15

What Role Does Equity Play in the International Distribution of Development Aid?

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Introduction

The international aid distributed to developing countries since the Second War has been substantial: for example, over $30 billion of concessional aid was distributed in 1980. In this essay we consider the role of equity in the division of foreign aid among various developing countries. This topic is examined through a model in which the aid donors trade off an increase in the equality of incomes of recipient countries for an increase in the total incomes of these countries. This model is then estimated to obtain indices of absolute-inequality aversion and of relative-inequality aversion, indices that are implicit in the distribution of aid.

There has been an increasing concern over the issue of equality in international development assistance during the past decade. It is now well recognized that developing countries form a continuum of material well-being and that any division of development assistance implies a welfare position. Moreover, a clear change can be noticed in the policy statements of such organizations of donor countries as the OECD and such multilateral organizations as the World Bank and the U.N. aid agencies. The official positions of these organizations show a marked increase in their awareness of equality.[1]

ECONOMIC STRUCTURE
AND PERFORMANCE

ISBN 0-12-680060-X

Reprinted from: Economic Structure and Performance
Editors: M. Syrquin, L. Taylor and
L. E. Westphal

Despite its importance, the role of equity in the allocation of aid has not yet been examined rigorously. Cline and Sargen (1975), Dudley and Montmarquette (1976), and Edelman and Chenery (1977), for example, relate aid to various economic characteristics of recipient countries. These relationships, however, do not have a theoretical basis to provide an explicit estimate of equity-efficiency trade-offs.[2]

In contrast, we develop here an explicit economic-choice model which is sensitive to the donors' preferences and to the constraints implied by the total aid budget and the income-generating functions in recipient countries.[3] This makes it possible to identify explicitly the trade-off between equality and total income gains. Concerns other than these two do not enter our basic model directly. We do not deny that other motives—such as geopolitics—might influence aid decisions. Instead, the approach in the basic model of this essay is to find out how all these considerations are reflected in influencing two central economic concerns: income distribution and income increases.

Our basic approach can be summarized as follows. Aid is considered to be a factor of production that, along with other factors, generates income in recipient countries. The donors have a welfare function defined over the incomes of individuals in various recipient countries (we abstract, however, from the intracountry distribution of income).[4] Conditions are obtained for the maximization of the donors' welfare function subject to the availability of total aid and income-generating functions for the recipient countries. Appropriate functional forms are then introduced, and the relevant parameters are estimated using recent data. In our empirical work we consider the donors to be the collective of the OECD's Development Assistance Committee (DAC). After presenting and discussing our basic estimates with their exclusive focus on the equity-efficiency trade-off, we give estimates in which parameters may differ for specific recipient countries because of additional considerations, like geopolitics.

The Model

Recipient countries are denoted by $i = 1, \ldots, I$. For country i, Y_i is income, A_i the aid received, N_i the population, and $y_i = Y_i/N_i$ the average per capita income. The income of country j is determined by an income-generating function that depends on the aid that country receives[5] and on other factors or endowments of that country, represented by the vector X_j:

$$Y_j = Y_j(A_j, X_j). \tag{1}$$

The donors' welfare function is[6]

$$W = W(y_1, \ldots, y_I, N_1, \ldots, N_I). \tag{2}$$

The donors maximize this welfare function, subject to the total availability of aid A and the income-generating functions:

$$\text{Max:} \quad W - \lambda \left[\sum_i A_i - A \right], \tag{3}$$

where λ is the Lagrangian multiplier for the total availability of aid in the time period under consideration. We assume that the population is given exogenously for each country, that a higher income in any country increases donors' welfare ($\partial W/\partial y_j > 0$), and that the average income of a country increases if more aid is given to this country ($\partial Y_j/\partial A_j > 0$). Therefore, the entire available aid is distributed. We further assume that the functions have the other necessary properties so that a maximum exists. The Kuhn–Tucker conditions are

$$\frac{\partial W}{\partial y_j} \frac{\partial y_j}{\partial A_j} - \lambda \leq 0, \text{ and } A_j \geq 0, \tag{4}$$

with complementary slackness. Complementary slackness here means that at least one of the two inequalities is an equality.

Note that there are no lagged effects in our model. The impact of aid is manifested fully in the period under consideration. We make this assumption for simplicity; in empirical applications it may be more justified if a period is defined to be several years. We explore below how sensitive our empirical estimates are to the length of the observation period.

The allocation mechanism of this model is illustrated by using an example of two recipient countries with identical populations. Denote the income of representative individuals in the two countries by y_1 and y_2. In Figure 15.1 the origin represents the per capita incomes $(y_1, y_2) = (0, 0)$. Given a total amount of aid transfers available, the income-possibility frontier is q_0q_3. The feasible set of incomes is convex under the standard assumptions that the income-generating functions have nonincreasing returns to scale and diminishing returns to the individual factors. The internal segment between q_1 and q_2 on the income-possibility frontier is the part of the frontier for which both countries receive positive aid. Note that it is possible that the curve q_1q_2 does not cross the 45° line because the available aid may be insufficient to equalize the incomes even if it were given entirely to the poorer country.[7] In Figure 15.1 there is an interior solution for maximizing donors' welfare at m, with both countries receiving positive aid and with $y_1 > y_2$.

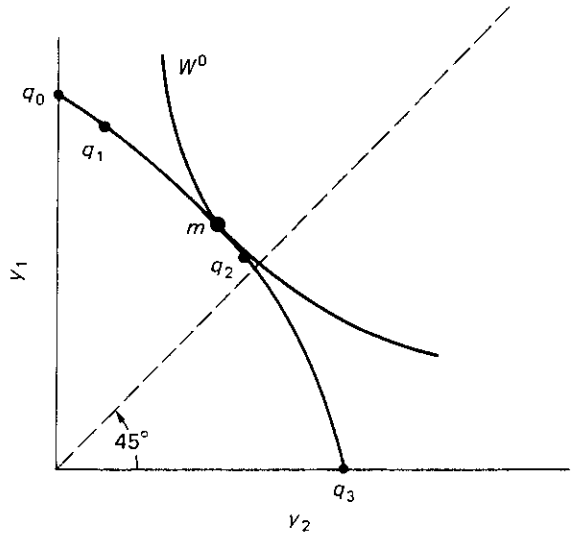

FIGURE 15.1 Tangency between income-possibility frontier with positive foreign aid and donors' isowelfare curve in a plane for two countries with equal populations.

This same example can be used to illustrate the circumstances under which a corner solution would occur, with no aid going to one country. For simplicity, assume that donors equally value equal per capita incomes in different recipient countries. That is, the isowelfare curve W^0 is symmetric with respect to the 45° ray. All aid goes to country 2 if the slope of the welfare curve at point q_2 is greater than or equal to the slope of the income-possibility frontier at q_2.[8] These conditions are more likely to be satisfied (given that country 2 is poorer) the sharper is the curvature of the welfare function and the smaller is the curvature of the income-possibility frontier. The welfare function has sharper curvature at q_2 the more inequality-averse are the donors' preferences. With extreme inequality aversion (i.e., the Rawlsian case in which donors value only the average income in the poorest country), the welfare function is L-shaped along the 45° ray. In this case, for all permissible shapes of the income-possibility frontier, the optimum is a corner solution with all aid going to the poorer country unless the incomes are equalized.[9] The income-possibility frontier is flatter the less substitution is possible between aid and other income-generating factors; in the extreme case of no substitution, the frontier is linear. Parallel considerations underlie the possibility of a corner solution with country 2 receiving no aid, or if there are more than two aid-recipient countries.

If there are no corner solutions, the extent of donors' inequality aversion can be easily estimated empirically. The method of estimation can be understood intuitively as follows. Income-possibility curve segments like q_1q_2 can be drawn for any pair of countries. These segments have different heights and slopes because of the differences among countries in their endowments and efficiencies. At the optimum, however, the same isowelfare surface touches each of these distinct segments. Therefore, a large number of points are observed on the same isowelfare surface, from which properties of the underlying welfare function can be estimated.

Functional Forms

To estimate from Equation (4) the extent of inequality aversion implicit in donors' distribution of aid, explicit functional forms are required for the donors' welfare function and the recipients' income-generating functions. We consider two different functional forms for the welfare function. Each has a single parameter which represents the donors' aversion to inequality.

The first is the Kolm–Pollak (K–P) welfare function, which is discussed extensively in Blackorby and Donaldson (1980):[10]

$$W = -\frac{1}{\gamma}\ln\left(\sum_i \frac{a_iN_i}{N}\, e^{-\gamma y_i}\right), \tag{5}$$

where $\gamma \geq 0$ is the index of absolute aversion to inequality, $N = \Sigma_i\, a_iN_i$, and a_i denotes a country-specific preference factor. For our extended model we generalize the K–P form by allowing donors to prefer the same average income level in some countries more than in others, perhaps due to some of the aid motives mentioned in the introduction. If there are no such preferences, but instead "equal concern" prevails as in our basic model, all the a_i's are equal to a common value, say a, and they cancel out. A higher γ implies higher absolute inequality aversion. For $\gamma \to 0$, (5) reduces to the utilitarian sum over individual incomes in which only total income counts, independent of distribution; for $\gamma \to \infty$, (5) takes the Rawlsian form in which only minimum income counts. From (5), the partial derivative with respect to per capita income in country j is

$$\partial W/\partial y_j = Ka_jN_je^{-\gamma y_j}, \tag{6}$$

where $K = 1/(\Sigma_i\, a_iN_ie^{-\gamma y_i})$ is a positive number that is constant for any cross section of recipient countries, though it may vary over time. The

second welfare function is the CES (constant elasticity of substitution) form

$$W = \begin{cases} \min\{y_i\}, & \varepsilon \to \infty, \\ -\sum_i a_i N_i y_i^{1-\varepsilon}, & \infty > \varepsilon > 1, \\ \sum_i a_i N_i \ln y_i, & \varepsilon = 1, \\ \sum_i a_i N_i y_i^{1-\varepsilon}, & 1 > \varepsilon \geq 0, \end{cases} \tag{7}$$

where $\varepsilon \geq 0$ is the index of relative inequality aversion. The a_i's have the same interpretation as with the K–P function. For the CES case, the donors' welfare function is Rawlsian if $\varepsilon \to \infty$ and is utilitarian if $\varepsilon = 0$. From (7), the partial derivative of donors' welfare with respect to average per capita income in the jth recipient country is:

$$\partial W/\partial y_j = C a_j N_j y_j^{-\varepsilon} \quad \text{if} \quad \varepsilon < \infty, \tag{8}$$

where C is a positive constant depending on ε alone.

For the income-generating function, we use a generalized partial Cobb–Douglas function:

$$Y_j = B_j A_j^{\beta_j} g_j(X_j), \tag{9}$$

where B_j is a country-specific technical efficiency parameter, β_j a country-specific exponent for aid, and g_j a country-specific (general) function of the vector of all other income-generating factors. With this function, in our extended model the marginal productivity of aid may vary considerably across countries because of differences in technological efficiency (B_j), the availability of other inputs (X_j), the production relation of output for inputs other than aid (g_j), and the elasticity of income with respect to aid (β_j). In our basic model, the marginal productivity of aid also may vary substantially, though we assume a constant elasticity of income with respect to aid ($\beta_j = \beta$, for all countries j). In both models there is a maintained hypothesis of separability between A_j and other factors with an elasticity of substitution of one.[11] This production function is much more general than the standard Cobb–Douglas function. From (9), the partial derivative of national income in country j with respect to the aid it receives is

$$\partial Y_j/\partial A_j = \beta_j Y_j/A_j. \tag{10}$$

Now we restrict ourselves to countries receiving positive aid, which implies that the equality holds in (4). Substitution of (6) and (10) in (4)

gives the allocation rule for the K–P welfare function:

$$\ln(A_j/Y_j) = k_j - \gamma y_j, \tag{11}$$

where

$$k_j = \ln K - \ln \lambda + \ln \beta_j + \ln a_j. \tag{11a}$$

The allocation rule for the CES welfare function is similarly obtained by substituting (8) and (10) in (4):

$$\ln(A_j/Y_j) = c_j - \varepsilon \ln y_j, \tag{12}$$

where

$$c_j = \ln C - \ln \lambda + \ln \beta_j + \ln a_j. \tag{12a}$$

The allocation rule for the CES case in (12) has some interesting implications for the per capita distribution of aid. Assume that the donors have equal concern ($a_j = a$, for all j) and that the elasticity of income with respect to aid is identical across countries ($\beta_j = \beta$, for all j) so that c_j is a constant (say c) across countries for a given period, as in our basic model. Under these assumptions, (12) can be rewritten as:

$$A_j/N_j = y_j^{(1-\varepsilon)}e^c. \tag{13}$$

The elasticity of optimal per capita aid with respect to per capita income in this case is $1 - \varepsilon$. Therefore per capita aid increases with average income per capita if $1 > \varepsilon$, decreases with average income per capita if $\varepsilon > 1$, and is independent of average income per capita if $\varepsilon = 1$.[12] For the utilitarian welfare function with $\varepsilon = 0$, optimal aid per capita is simply a fixed proportion of average income per capita.

For the K–P case (again with $a_j = a$ and $\beta_j = \beta$ for all j, so that $k_j = k$), per capita aid can be expressed as

$$A_j/N_j = y_j e^{k-\gamma y_j}. \tag{14}$$

This implies that the elasticity of per capita aid with respect to per capita income is $1 - \gamma y_j$. If the welfare function is utilitarian (i.e., $\gamma = 0$), this is the same as for the CES welfare function. Aside from the utilitarian extreme, however, with the K–P welfare function, this elasticity depends on the per capita income level—in contrast to the result for the CES case—and it declines as per capita income increases. With the K–P function, therefore, per capita aid decreases with per capita income if the per capita income is above a critical level, $1/\gamma$, and the reverse holds below this critical level of per capita income. The impact of a higher aversion to absolute inequality is to decrease the critical level of per capita income at which this switch occurs.

Another important difference between the K–P and the CES welfare functions is that the former incorporates absolute and the latter relative inequality aversion. A brief comment is useful here to illustrate the difference between absolute and relative inequality aversion in the present context (for details, see Blackorby and Donaldson, 1980). Take the case of two countries with equal populations and assume equal concern and that the first country is richer. From (6) and (8), the slopes along iso-welfare curves are

$$\left.\frac{dy_1}{dy_2}\right|_W = -e^{-\gamma(y_2-y_1)} \qquad \text{for the K–P function}$$

and

$$\left.\frac{dy_1}{dy_2}\right|_W = -\left\{\frac{y_2}{y_1}\right\}^{-\varepsilon} \qquad \text{for the CES function.}$$

The donors' trade-off between the per capita incomes of the two recipients, while staying at the same welfare level, thus depends on the absolute per capita income difference in the first case and on the relative per capita income difference in the second case. Now suppose that the per capita incomes of both countries are doubled. The trade-off increases if the K–P function is used and $\gamma > 0$; it remains unchanged for the CES function.

Absolute-inequality aversion has implications different from those of relative-inequality aversion. Which, then, is more relevant empirically? Because the two alternatives lead to estimating relations with the same independent variables (see [11] and [12]), a direct test is provided by comparing their relative consistency with the data. In addition a test of each against a more general hypothesis is provided by estimating:

$$\ln(A_j/N_j) = b_0 + b_1 \ln y_j + b_2 y_j. \tag{15}$$

If b_1 is not significantly greater than one[13] and b_2 is not significantly different from zero, this implies the CES form in (12). If b_1 is not significantly different from one and b_2 is not significantly positive,[14] this implies the K–P form in (13). Other values of b_1 and b_2 imply some welfare function other than either the CES or the K–P form.

Data

Our model of inequality aversion in international aid distribution requires only limited data: that on aid distribution and that on per capita incomes in recipient countries. Under the maintained hypothesis regard-

ing the income-generating function, the many other factors that affect income do not enter directly into our estimating relations.

For foreign aid (A_j) we use data for the total commitments of official development assistance from all major sources of funding.[15] A transaction is defined as *official development assistance* by DAC if it is not an explicit military transfer and if it has a grant element of 25% or more. We have used the data on the commitments of aid rather than on the disbursements because, following Edelman and Chenery (1977), we believe that the former data better reflect the intentions of donors.[16]

Other than foreign aid, the required data include the expected per capita income in each recipient country (y_j) and each recipient country's population (N_j). To represent the expected per capita income, we use average actual income as a proxy. This introduces measurement error, which we assume is incorporated into additive disturbance terms in the estimated relations. Such measurement error, if random, causes a bias in the estimated inequality aversion toward zero—that is, toward the utilitarian welfare function.

The conversion of average domestic income to common units raises the usual question of the appropriate exchange rates. Because of this question, we estimate our equations for two methods of conversion. By doing so, we also are able to find out whether our results are sensitive to the conversion method the donors might be using. The first method uses official exchange rates. The second is the GNP calculated for the World Bank Atlas, which takes the average exchange rate over a few years and thereby reduces fluctuations in GNP due primarily to transitory exchange-rate fluctuations. The GNP data for both versions are taken from OECD (1980b); this publication also provides further details on these two versions.[17] The population data also are taken from OECD (1980b). This publication provides annual data for 4 years, 1976–1979. We limit ourselves to these years because the aid data for the earlier years are based on somewhat different concepts and because we wish to focus on recent experience. For convenience, we refer to the two concepts of GNP as *(Official) GNP* and *(Atlas) GNP*. The unit for GNP and aid is in millions of US dollars, and the population is in millions.

Our sample has 83 of the 90 countries defined as lower- and middle-income countries in the World Development Report (World Bank, 1980, pp. 110–111). This group excludes industrial countries, capital-surplus oil exporters, and centrally planned economies. Within this group, however, seven countries—Kampuchea, Lao PDR, Bhutan, Viet Nam, Lebanon, South Africa, and Venezuela—had to be excluded because of the unavailability of data. All 83 countries in the sample receive aid, and therefore warrant our assumption about interior solutions.

Basic Estimates with Neither Country-Specific Nor Period Effects

We begin by exploring how sensitive our estimates are to the length of a unit of observation. This question is relevant because the models presented above are one-period models: all the impact of aid on income occurs within that period. Such an assumption may be warranted if a period is defined as 4 or 5 years so that there is enough time for the gestation period of most aid projects to pass. But is a distortion introduced if a shorter period—say, a year—is used as the unit of observation?

To explore this question, we compare ordinary-least-squares estimates of the two models (with the different definitions for income) with a period of 4 years and a period of 1 year.[18] To avoid other complications, we use the basic model in which we assume that there are neither country-specific nor period effects in the constants. (These assumptions are relaxed below.)

Table 15.1 summarizes the relevant estimates. The basic result is that in no case do the estimates change significantly if the period is 4 years or 1. Since aid often has gestation periods longer than 1 year, this result may be somewhat surprising. Nevertheless, annual data apparently are good proxies for longer periods of observation because there are substantial regularities from year to year in the intercountry aid commitment patterns. This result facilitates estimation of the country-specific and annual effects in the extended model of the next section.

What are the other implications of the estimates in Table 15.1? First, they suggest that the Atlas definition of income is at least as good in explaining international aid allocation patterns as is the official definition. In every case the former leads to a smaller standard error of estimate, though often the differences are not very large. This means that donors act as if they have a longer-run measure of the recipients' incomes in mind and do not adjust aid patterns substantially in response to short-run exchange rate fluctuations. Since aid is directed ostensibly toward longer-run concerns, the implied longer-run perspective of donors has some merit because it suggests that donors are not sensitive in their aid allocations to short-run foreign exchange shortages of recipients.

Second, for the CES case, the estimates of inequality aversion are not sensitive to the choice of dependent variable (i.e., $\ln(A_j/Y_j)$ in [12] versus $\ln(A_j/N_j)$ in [13]). That is, there is no evidence of a bias due to the appearance in the denominator of the left side of relation (12) of total income, which also is used to define the right-side per capita income variable.

Third, and most important from a substantive point of view, the basic model estimates suggest that donors have significant inequality aversion,

TABLE 15.1

Estimates of Aid Donors' Inequality Aversion Under Assumption of No Country-Specific or Year-Specific Effects, Annual and 4-Year Periods, 1976–1979[a]

Relation	Parameters and statistics	Official data		Atlas data	
		Annual period	4-Year period	Annual period	4-Year period
1(KP)	γ	.0014 (16.3)	.0015 (8.6)	.0015 (16.5)	.0015 (8.7)
	k	−2.5 (22.8)	−2.4 (11.7)	−2.4 (22.4)	−2.4 (11.5)
	$\bar{R}^2$	.443	.469	.541	.477
	SE	1.461	1.372	1.443	1.363
2(CES)	ε	1.42 (18.3)	1.40 (9.4)	1.45 (18.4)	1.45 (9.6)
	c	5.2 (10.6)	5.1 (5.5)	5.4 (10.8)	5.5 (5.7)
	$\bar{R}^2$	.503	.518	.504	.529
	SE	1.380	1.307	1.373	1.294
3(CES)	$1 - \varepsilon$	−.41 (5.4)	−.40 (2.7)	−.45 (5.7)	−.45 (3.0)
	c	5.2 (10.6)	5.1 (5.5)	5.4 (10.9)	5.5 (5.7)
	$\bar{R}^2$	.078	.071	.088	.089
	SE	1.369	1.307	1.362	1.294
5(composite)	b_1	−.0004 (0.2)	−.0005 (1.4)	−.0005 (2.5)	−.0005 (1.3)
	b_2	−.074 (0.5)	−.0088 (0.0)	−.085 (0.5)	−.0699 (0.2)
	b_0	3.4 (3.9)	3.1 (1.8)	3.5 (3.8)	3.5 (1.9)
	$\bar{R}^2$	.092	.082	.102	.097
	SE	1.380	1.299	1.373	1.289

[a] Figures in parentheses are the absolute values of the t statistics.

probably of a relative kind. Relative-inequality aversion is at least as consistent with experience as is absolute-inequality aversion. This is suggested by the fact that the standard errors for the former in (12) are in each case smaller than are those for the latter in (11). The estimate of the composite relation (15) provides some additional weak evidence against absolute-inequality aversion. In this case multicollinearity is sufficiently strong (and therefore the standard errors of the point estimates sufficiently large) that only one of the eight coefficient estimates in the four relations is significantly nonzero at the 5% level by standard t tests. Despite the large standard errors, however, the coefficient estimates of y_j are significantly less than one in all four regressions, contrary to the prediction of the absolute-inequality aversion formulation.

The CES relative-inequality-aversion parameter in (11) and (12) is estimated to be about 1.4, which is significantly greater than the utilitarian value of zero. Thus donors do not distribute aid among recipient developing countries only to maximize income in that group of countries. The estimated value of ε also is significantly greater than one, which implies

that the aid distribution partially offsets the inequalities among recipient countries in other income-generating factors (i.e., in B_j, g_j, and X_j [8]) and is inversely associated with per capita income. Thus, the basic model estimates imply that the donors' preferences reflect an equity-productivity trade-off, with a heavy weight on equity.

Extended Model Estimates with Country-Specific and Year-Specific Effects

To explore the country-specific and year-specific effects, we use the 332 observations in the pooled cross-section over 1976–1979, with a year as the period of observation. In (11), and implicitly in (15), K and λ are specific to a year, whereas β_j and a_j are specific to a country. Similarly, in (12) and (13) λ is specific to a year and β_j and a_j are specific to a country. To incorporate these differences, we introduce two sets of dummy variables. d_1, d_2, and d_3 are the dummy variables to capture the annual differences, which assume a value of one for the years 1977, 1978, and 1979, respectively, and a value of zero otherwise (so that 1976 is the base year). $D_1, \ldots D_{82}$ are 82 dummy variables for country differences, which take a value of one for a country and zero otherwise. Bangladesh is the base country for which all country dummy variables are zero.

With these sets of dummy variables, (11) and (12) can be rewritten as

$$\ln(A_{jt}/Y_{jt}) = k_0 + \sum_{t=1}^{3} k_t d_t + \sum_{j=1}^{82} b_j D_j - \gamma y_{jt} \qquad (11')$$

$$\ln(A_{jt}/Y_{jt}) = c_0 + \sum_{t=1}^{3} c_t d_t + \sum_{j=1}^{82} b_j D_j - \varepsilon \ln y_{jt}. \qquad (12')$$

Once again we assume an additive disturbance term in each relation. Table 15.2 gives the ordinary-least-squares estimates of these two relations, with alternatives for the official and Atlas data sets.[19] Table 15.3 summarizes the distribution of the country-specific effects.

Before examining the annual and country-specific effects, we briefly summarize the other characteristics of the estimates in Table 15.2. These estimates, like those in Table 15.1, suggest significant inequality aversion (except for the K–P form with Atlas data). This robustness of significant inequality aversion is striking, particularly given that the 82 country dummies might pick up any curvature in the welfare surface and mask true inequality aversion. And as in the Table 15.1 estimates, those in Table

TABLE 15.2

Estimates of Aid Donors' Inequality Aversion with Country-Specific and Year-Specific Effects, Pooled Annual Data, 1976–1979[a]

Relation	Parameters and statistics	Official data	Atlas data
11′(K-P)	γ	.0003 (2.0)	.00002 (0.1)
	k_0	−1.8 (6.2)	−1.8 (6.2)
	k_1 (1977)	0.01 (0.1)	0.05 (0.6)
	k_2 (1978)	0.06 (0.7)	0.10 (1.0)
	k_3 (1979)	0.14 (1.3)	0.16 (1.4)
	$\bar{R}^2$	0.915	0.911
	SE	0.573	0.582
	Number of significant country dummies[b]	53	53
12′(CES)	ε	0.50 (2.5)	1.1 (2.0)
	c_0	0.31 (0.4)	2.9 (1.2)
	c_1 (1977)	0.05 (0.5)	0.14 (1.4)
	c_2 (1978)	0.13 (1.3)	0.29 (2.2)
	c_3 (1979)	0.22 (1.8)	0.45 (2.6)
	$\bar{R}^2$	0.915	0.912
	SE	0.570	0.577
	Number of significant country dummies[b]	34	8

[a] To the right of the point estimates in parentheses are the absolute values of the t statistics. Each regression is for the pooled 1976–1979 data and has 332 observations.

[b] A 5% significance level is used. The implications of the results do not change substantially if a 2% level is used. Table 15.3 summarizes the distribution of the point estimates for individual countries.

15.2 suggest that the CES form is at least as consistent with historical experience as is the K–P absolute-inequality aversion form.

But in some respects these estimates differ somewhat from those in Table 15.1: (1) If judged by the standard errors in Table 15.2, the official data, if anything, are preferable to the Atlas data. (2) The extent of inequality aversion is significantly less in Table 15.2 than in Table 15.1 in three of the four cases (the exception being the CES form with Atlas data). (3) The estimates of inequality aversion differ significantly depending on which data are used for income, with higher relative-inequality aversion implied by the Atlas data and higher absolute-inequality aversion implied by the official data. (4) If judged by the standard errors, the preference for the CES form with relative-inequality aversion to the K–P

TABLE 15.3

Distribution of Estimated Country-Specific Effects in Aid Allocation Relations[a]

Significantly positive				
4 Somalia	61 Jordan			
Insignificantly different from Bangladesh				
2 Mali	13 Sri Lanka	23 Madagascar[b]	38 Liberia	52 Ivory Coast[b]
3 Nepal	14 Guinea[b]	24 Haiti	39 Honduras	53 Nicaragua[b]
5 Burundi	15 Sierra Leone[b]	26 Lesotho	40 Zambia	55 Paraguay[b]
6 Chad	16 Zaire[b]	29 Sudan	43 Bolivia[b]	57 Dominican Rep.[b]
7 Mozambique	17 Niger	30 Togo	45 Yemen Arab Rep.	59 Syrian Arab Rep.
8 Burma[b]	18 Benin	31 Kenya	46 Congo, People's Rep.	63 Jamaica[b]
9 Upper Volta	19 Pakistan[b]	32 Senegal	48 Papua New Guinea	68 Panama[b]
11 Malawi	20 Tanzania	34 Egypt	49 El Salvador[b]	71 Costa Rica[b]
12 Rwanda	21 Afghanistan[b]	35 Ghana[b]	50 Morocco[b]	82 Israel
	22 Central African Republic	36 Yemen, PDR		
		37 Cameroon[b]		

Significantly negative in −0.8 to −3.0 range

1 Ethiopia
8 Burma[b]
10 India
14 Guinea[b]
15 Sierra Leone[b]
16 Zaire[b]
19 Pakistan[b]
21 Afganistan[b]
23 Madagascar[b]
25 Mauritania
27 Uganda[b]
28 Angola
33 Indonesia
35 Ghana[b]
37 Cameroon[b]
42 Thailand
43 Bolivia[b]
44 Philippines
49 El Salvador[b]
50 Morocco[b]
51 Peru
52 Ivory Coast[b]
53 Nicaragua[b]
54 Colombia
55 Paraguay[b]
56 Ecuador
57 Dominican Republic[b]
58 Guatemala
60 Tunisia
62 Malaysia
63 Jamaica[b]
66 Algeria[b]
68 Panama[b]
71 Costa Rica[b]
75 Portugal

Significantly negative in −3.1 to −7.0 range

41 Zimbabwe
47 Nigeria
64 Korea, Republic of
65 Turkey
67 Mexico
69 Taiwan
70 Chile
72 Brazil
73 Uruguay
74 Argentina
76 Yugoslavia
77 Trinidad and Tobago[b]
78 Hong Kong
79 Greece[b]
80 Singapore
81 Spain

[a] These are from regressions that are summarized in Table 15.2. A significance level of 5% is used. A country is placed in a category without a note if three or four of the four point estimates in the four regressions in Table 15.2 fall in that category. The country of reference is Bangladesh. The numbers in front of the countries refer to the 1978 rank order of official average per capita incomes (with a higher number implying a higher income) for the 83 countries in the sample (with Bangladesh being 0) according to the World Bank (1980, pp. 110–111).

[b] Two estimates for this country fall into this category, two fall elsewhere.

form with absolute inequality aversion is less in Table 15.2 than in Table 15.1.

We now turn to the estimated annual and country-specific effects. There is little evidence of significant annual effects. Only in the regression for the CES formulation using Atlas data are there any significant effects of the annual dummies at the 5% level. In this case, the dichotomous year variables indicate that the Lagrangian from the budget constraint was significantly less in 1978 and 1979 than in 1976. But there is no evidence of such a change in the other three regressions.

The country-specific effects are much more important. At the 5% level there are 53 significant country-specific coefficients in each of the K–P regressions, though many fewer for the CES estimates (i.e., 34 with the official data and only 8 with the Atlas data).

This dichotomy regarding the significance of country-specific effects between the K–P and the CES estimates may explain the relative improvement in the first relative to the second noted above when the country-specific effects are added. The large number of country-specific variables in the K–P case may make the K–P formulation appear about as satisfactory as the CES one because they effectively modify a relative-inequality aversion welfare surface so it can be approximated by absolute-inequality aversion.[20] If so, despite the smaller differences in standard errors of estimates between relative and absolute inequality aversion once the country-specific effects are included, the relative-inequality aversion formulation still is preferable.

Another interesting dimension of the country-specific effects is how they differ across recipient countries. As noted above, our modeling suggests that this distribution represents the impact of different elasticities of income with respect to aid in different recipient countries (β_j) and different weights placed on equal incomes in different recipient countries by the donors (a_j). Our country-specific estimates are all relative to Bangladesh, the lowest per capita income country in our sample. Positive values of country-specific estimates for the jth country imply that $\ln a_j + \ln \beta_j$ for the jth country is greater than it is for Bangladesh.

The distribution of country-specific effects across countries suggests some noteworthy patterns. Only for Jordan and Somalia are the country effects significantly positive relative to those for Bangladesh. This suggests strong donor preference (perhaps due to geopolitical factors), high income elasticities with respect to aid for these two countries, or both.

At the other extreme are 16 countries with significant point estimates for the country-specific dummy variables from -3.1 to -7.0 below that for Bangladesh. For this group donors give relatively little weight to the recipient countries' income levels and/or income elasticities with respect

to aid are low relative to that of Bangladesh. This group includes 14 of the highest per capita income countries in our sample. Therefore, to the extent that these estimated negative country-specific effects reflect donors' preferences, they are consistent with concern about equality—and, in fact, probably "rob" the direct inequality-aversion estimates of some of their explanatory power, as suggested above. The other two countries in this group of 16 countries, Zimbabwe and Nigeria, are near the middle of the sample distribution of per capita incomes across countries. For Zimbabwe, the strong estimated negative effect almost surely reflects donors' discrimination against this country (or, rather, against Rhodesia) before independence. For Nigeria the large foreign exchange revenues from oil in the late 1970s probably reduced both the donors' concern and the income elasticity with respect to aid.

Most of the countries fall into two intermediate groups: those with no significant differences from Bangladesh and those with a small (smaller than that discussed in the preceding paragraph) significant negative difference from Bangladesh (in the -0.8 to -3.0 range). The distribution between these two intermediate groups also tends to reflect relative average per capita income levels, with more countries with lower levels in the former group and more countries with higher levels in the latter.[21] To the extent that there is an association with per capita income levels, once again, the estimated country-specific effects are consistent with inequality aversion and may rob the direct inequality-aversion estimates of some of their true power.

But for several countries in these two intermediate groups, the estimates do not follow the general tendency of an inverse association with per capita income. In the group with estimates significantly below Bangladesh in the -0.8 to -3.0 range, for example, are 2 of the 10 lowest per capita income countries in our sample (Burma and Ethiopia) and the eleventh lowest (India). The estimates suggest that OECD aid was distributed in unusually small amounts to these countries relative to the overall sample, probably in part due to political preferences of donors. In the group with estimates not significantly different from Bangladesh, on the other hand, is included Israel, the highest per capita income country in the sample.[22] There apparently has been strong preference of donors toward Israel despite its relatively high per capita income level and/or Israel has a relatively high elasticity of income with respect to aid for a country with its per capita income level. Burma, India, Israel, and Ethiopia cause the estimated inequality aversion to be much less in the estimates of Table 15.1 than it could be without such examples of strong positive association between per capita income and per capita aid in the sample.

Summary

In this essay we have developed models to explore the donors' absolute and relative inequality aversion—and therefore the equity-productivity trade-off—implicit in the international distribution of aid. The approach has three strengths: we explicitly proceed with an economic model that can distinguish between equity and efficiency; we estimate relations based explicitly on the theoretical modeling; and our estimating forms are parsimonious in their data requirements.

These estimates suggest there is significant donors' inequality aversion implicit in the international distribution of aid and that relative inequality aversion is more consistent with this experience than is absolute inequality aversion. If we allow country-specific effects, as in our extended model, in substantial part they seem to represent inequality aversion, but there are some important exceptions, such as the relatively high aid level for Israel and the relatively low ones for Burma, India, and Ethiopia. Because the country-specific effects seem to pick up inequality aversion in part, we prefer the estimate based on the model of relative-inequality aversion in which the country-specific effects are surpressed. This estimate is not only significant but also large enough that international aid per capita is inversely associated with per capita incomes.

Acknowledgments

We thank Alan Manne and Robert Pollak for useful suggestions and the Center for Analysis of Developing Economies (CADE) of the University of Pennsylvania for support. The responsibility for the contents of this paper is entirely ours.

Notes

[1] While there has been increased concern about distribution in the developing world, somewhat paradoxically there has been less concern about inequalities of distribution between the developed and developing countries (at least as measured by indices such as the percentage of total OECD national product going to development aid). In this essay we focus exclusively on the question of distribution in the developing world of a given amount of OECD aid.

[2] Cline and Sargen (1975) discuss a donors' maximand which, surprisingly, depends on the marginal changes in the recipients' income in response to aid, rather than on the levels of recipients' income. Dudley and Montmarquette (1976) explain the patterns of aid on the basis of a donors' maximand, but the economic variables enter this maximand quite arbitrar-

ily: among other things, the recipients' incomes are insensitive to the aid received. Note 12 describes the normative position advocated by Cline and Sargen and by Edelman and Chenery (1977) in terms of the model developed here.

[3] This essay can therefore be seen as a contribution to a new field in economics: the revelation of implicit preferences based on economically motivated choice models. Previous examples include Christianson and Jansen (1978) and Behrman, Pollak, and Taubman (1982). These studies estimate the relative-inequality aversion. The present study is the first to estimate the absolute-inequality aversion. Behrman and Birdsall (1983) also use a similar approach to estimate the equity-productivity considerations in the distribution of public school resources across regions in Brazil.

[4] We focus on intercountry income distribution due to limitations in the available data. Some recent studies suggest that on a global level intercountry income inequalities are significantly greater than intracountry inequalities, though there is considerable uncertainty on this issue (see Summers, Kravis, and Heston, 1980).

[5] The consideration of aid as a separate factor of production has a long tradition, dating at least back to the study by Chenery and Strout (1966), in which they say: "Thus the inflow of external resources—which can loosely be called 'foreign assistance'—has become virtually a separate factor of production, whose productivity and allocation provide one of the central problems for a modern theory of development" (p. 383).

[6] Note that the donors' welfare function is defined over recipients' incomes rather than over their utilities. We make this assumption for simplicity in our empirical estimates below.

[7] Note that q_1q_2 does not touch the axes because we do not expect y_i to approach zero if A_i approaches zero.

[8] There is one borderline exception if a strict equality holds: if the q_1q_2 segment of the income-possibility frontier is linear (i.e., within each country the production technology is Leontieff so there is no substitution between aid and other factors and aid effectively constraints income) and the welfare function is a straight line (as in the utilitarian case discussed below), then the donors' welfare is equally high for any allocation of aid for which the income-possibility frontier and the welfare function are coincident. That these conditions all would be satisfied, however, is very unlikely.

[9] For incomes to be equalized, q_1q_2 must cross the 45° ray. This is more likely, ceteris paribus, the more similar are the income-generating functions and the non-aid endowment levels of the two countries, the larger is the total aid, and the greater the impact of a unit of aid on income.

[10] There is a typographical error in this paper: the minus sign in (5) is missing.

[11] An elasticity of substitution of one is a common maintained hypothesis. In the present case we consider it a convenient compromise between probably much higher elasticities of substitution between aid and some factors (e.g., other sources of foreign exchange) and probably much lower ones between aid and other factors (e.g., national entrepreneurial and managerial skills and other inputs which limit "absorptive capacity" of foreign exchange). We also consider it an approximation to the true income-possibility frontier over the range relevant for our sample. But we do not think that it could be used to extrapolate far outside of the sample since it is implausible that y_i goes to zero as A_i goes to zero.

[12] In their prescriptions on aid policy, Edelman and Chenery (1977) implicitly propose that a value of ε equal to one should be used: "a one percent increase in an income of $100 is weighed equally with a one percent increase in an income of $1000" (p. 28). Cline and Sargen (1975) suggest the same normative position by proposing "a logarithmic utility function" (p. 391).

[13] Remember that ε cannot be less than zero (and therefore $1 - \varepsilon$ can not be greater than one) if the CES welfare function is concave.

[14] A comment parallel to the previous note applies here: γ cannot be less than zero if the K–P function is concave.

[15] It may be of additional interest to examine the data for disaggregated donor groups for several types of aid (i.e., aid with different conditions), but we leave this for future research.

[16] There is substantial stability between cross-country patterns of aid commitments and of disbursements over time in our sample. The use of disbursements rather than commitments therefore would not substantially change our empirical results.

[17] A third alternative would be to use the International Comparison Project (ICP) data (see Kravis, Heston, and Summers, 1982) based on direct price comparisons among countries. These data suggest that official and Atlas data overstate substantially international per capita income differences. But at the time of this study ICP data were not available for most recipient countries for the later years of our sample.

[18] We present pooled estimates for 1976–1979 in the latter case. Covariance analysis does not reject pooling these individual years. The annual estimates have 332 observations (i.e., 4 years × 83 recipient countries) and the 4-year estimates have 83 observations.

[19] We also have estimated relations parallel to (13) and (15) with annual and country-specific effects. As in Table 15.1, the former imply the same parameter values as in (12′) and the latter adds weak evidence favoring the CES formulation. For economy of presentation, therefore, we do not report the details of these estimates.

[20] Or, to make the same point in a slightly different manner, the first two terms in the Taylor expansion of $\ln y$ around $y = 1$ in the CES relation (11′) lead to an expression similar to the K–P relation (12′).

[21] Some countries are in both groups because half of the effects fall into one category and the other half into the other.

[22] Moreover, among the first 20 countries ranked by per capita income in the sample, Israel is the only one for which all four regressions indicate country-specific effects not different from Bangladesh.

References

Behrman, J. R., and N. Birdsall. (1983). "Implicit Equity-Productivity Tradeoffs in the Distribution of Public School Resources in Brazil," *mimeo*. Washington: World Bank.

Behrman, J. R., R. A. Pollak, and P. Taubman. (1982). "Parental Preferences and Provision for Progeny," *Journal of Political Economy*, Vol. 90, No. 1 (February), pp. 52–73.

Bhagwati, J. N. (1970). "Amount and Sharing of Aid." Washington, DC: Overseas Development Council.

Blackorby, C., and D. Donaldson. (1980). "A Theoretical Treatment of Indices of Absolute Inequality," *International Economic Review*, Vol. 21, No. 1 (February), pp. 107–136.

Chenery, H., and A. Strout. (1966). "Foreign Assistance and Economic Development," *American Economic Review* 56. (Reprinted in *Structural Change and Development Policy*," H. Chenery (ed.), pp. 382–455. New York: Oxford University Press.

Christianson, V., and E. S. Jansen. (1978). "Implicit Social Preferences in the Norwegian System of Indirect Taxation," *Journal of Public Economics*, Vol. 10, No. 2 (October), pp. 217–245.

Cline, W. R., and N. P. Sargen. (1975). "Performance Criteria and Multilateral Aid Allocation." *World Development*, Vol. 3, No. 6 (June), pp. 383–391.

Dudley, L. (1979). "Foreign Aid and the Theory of Alliances," *Review of Economics and Statistics*, Vol. 61, No. 4 (November), pp. 564–571.

Dudley, L., and C. Montmarquette. (1976). "A Model of the Supply of Bilateral Foreign Aid," *American Economic Review*, Vol. 66, No. 1 (March), pp. 132–142.

Edelman, J., and H. Chenery. (1977). "Aid and Income Distribution." In *The New International Economic Order*, J. N. Bhagwati (ed.), pp. 27–49. Cambridge: M.I.T. Press.

Kravis, I. B., A. Heston, and R. Summers. (1982). *World Product and Income*. Baltimore: Johns Hopkins Press.

OECD. (1980a). *Development Cooperation*. Paris: Organization for Economic Cooperation and Development.

OECD. (1980b). *Geographical Distribution of Financial Flows to Developing Countries*. Paris: Organization for Economic Cooperation and Development.

Summers, R., I. Kravis, and A. W. Heston. (1980). "Changes in the World Income Distribution," *mimeo*. Philadelphia: University of Pennsylvania.

World Bank. (1980). *World Development Report*. New York: Oxford University Press.