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EXPLANATORY STUDIES OF AID ALLOCATION AMONG DEVELOPING COUNTRIES: A CRITICAL SURVEY

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EXPLANATORY STUDIES OF AID ALLOCATION AMONG DEVELOPING COUNTRIES: A CRITICAL SURVEY

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I INTRODUCTION

Official aid transfers from developed to developing countries have remained an important feature of international economic and political relations since the late 1940s. This is emphasised by the level of net concessional aid provided by OECD Development Assistance Committee (DAC) member countries. Over the period 1982 to 1991 alone, the value of this aid in 1990 prices and exchange rates amounts to just under 500 billion US dollars (OECD, 1992). Not surprisingly, these transfers have attracted a degree of attention in the development literature. Since the 1960s, this literature has included quantitative investigation of the allocation of aid among developing countries, either from the viewpoint of subjectively evaluating or attempting to explain these allocations. The latter turns to identifying the determinants of inter-recipient aid allocation. We label these works as "descriptive studies" and "explanatory studies" respectively.

In this paper, we survey the explanatory studies. A critical survey of the descriptive studies may be found in White and McGillivray (1992). Our emphasis is on methodology and the robustness of results emanating from these studies. After providing an overview of this literature, we divide studies into six groups which may be labelled as recipient need/donor

interest, hybrid, bias, developmental, administrative/incremental and limited dependent variable studies of aid allocation. The basis for classification is the statistical models applied by these studies. We conclude with suggestions for further modelling of aid allocation, paying special attention to what we consider as the attributes of a "good" model of inter-recipient aid allocation.

II COMPETING MODELS OF AID ALLOCATION

(i) *An Overview*

The broad theoretical background of most explanatory studies of aid allocation can be traced to political economy theories of international relations. From the donor's point of view, aid is seen as an instrument of foreign policy, serving to: promote political and diplomatic relations with developing countries; enhance stability within countries of strategic importance; expand export markets; procure strategic imports, and; gain kudos in international fora by being seen to be a responsible, caring member of the international community helping countries in need and seeking to promote international development.[1] Indeed, there is reasonably wide acceptance that political, strategic, commercial and (albeit often begrudgingly) humanitarian motives offer a reasonable *a priori* basis for explaining patterns of aid allocation among developing countries. This assumption is a reflection of the tendency for donors to enthusiastically embrace these motives in aid policy statements, typically using them to justify the public funds allocated to official aid programs.

Motives cannot be directly observed, but the means by which

they are pursued can be. The explanatory studies develop empirically testable hypotheses relating observed aid flows to observable developing country characteristics. These characteristics relate, for example, to the extent of developing country political ties with donors, their commercial importance to donors and so on. The general assumption is that donors turn to these characteristics in allocating aid among countries in a manner consistent with the previously mentioned motives for aid *per se*. Empirical testing of these hypotheses turns to correlations between developing country characteristics and aid allocations, typically (although not exclusively) obtained from multiple regressions using cross-country data.

The multiple regression models used by the explanatory studies may, therefore, be described as follows:

$$A_i = \alpha_0 + \alpha_1 D_i + \alpha_2 P_i + \alpha_3 C_i + \mu_i, \qquad (1)$$

where A_i is a measure of the donor's aid to country i, D_i is a vector of variables representing i's developmental requirements (be it in terms of humanitarian need, absorptive capacity, ability to use aid and so on), P_i a vector of variables representing i's political and strategic importance to the donor, and C_i is a vector of variables representing that country's commercial or economic importance to the donor. α_1, α_2 and α_3 are vectors of parameters, α_0 is a constant and μ_i is an error term. Of course, the fundamental assumption of these models is the aid is allocated between countries, and not, for example, between regions (inter- or sub-national), projects or even people. Moreover, while most studies tend to implicitly accept the general form of equation (1) by accepting the relevance of the overall motives for aid *per se*, it is not necessarily the case that it is the form applied to the data. A

number of studies have sought to analyse aid using, for example, developmental variables only and thus imposing restrictions on (1). Nor is it necessarily the case that cross-country data are always used. Our classification of models, shown in Table 1, is based on the implicit restrictions imposed on equation (1).

(ii) *Hybrid Models*

Hybrid models are comprehensively specified models with variables for each of the three previously mentioned motives. The earliest published study of this type, and indeed of all explanatory studies, is Levitt (1968).[2] After an earlier paper considering subjective criteria for aid allocation (Levitt, 1967), Levitt sought to identify "those quantitative differences between developing countries which significantly explain the differences in the amounts of economic aid they receive" from the United Nations, the World Bank and the United States (Levitt, 1968, p.133). The general model proposed by Levitt was:

$$A_{ji} = \alpha_0 + \beta_1 POP_i + \beta_2 YCAP_i + \beta_3 ECAP_i + \beta_4 \Delta E_i + \beta_5 S_i + \beta_6 \Delta GFX_i + \beta_7 USX_i + \beta_8 USMA_i + \beta_9 UNVB_i + \mu_i, \quad (2)$$

where A_{ji} is a measure of various categories of donor j's aid to recipient i (1964 World Bank loans, 1964 World Bank grants, 1963 UN grants, 1963 United States loans and 1963 United States grants), POP_i is recipient i's population, $YCAP_i$ is per capita income, $ECAP_i$ is per capita electricity consumption, ΔE_i is electricity consumption growth, S_{it} is the percentage of the population attending school, ΔGFX_i is growth in gold and foreign exchange reserves, USX_i is US exports to i, $USMA_i$ is United States military aid to i and $UNVB_i$ is i's voting behaviour at the United Nations General Assembly when the United States and USSR where on opposite sides.[3]

Table 1
Listing of Explanatory Aid Allocation Studies

Study	Year	Classification
Strout[a]	1963	Unknown
Levitt	1968	Hybrid
Kato	1969	Hybrid
Davenport	1970	Developmental
Henderson	1971	Developmental
Wittkopf	1972	Hybrid
Wittkopf	1973	Donor Interest
OECD	1974	Bias
Kaplan	1975	Developmental
Isenman	1976	Bias
Dudley & Montmarquette	1976	LDV
Leohr, Price & Raichur	1976	Hybrid
Edelman & Chenery	1977	Developmental
McKinlay & Little	1977	RN/DI
Dudley & Montmarquette	1978	LDV
McKinlay	1978	RN/DI
McKinlay & Little	1978	RN/DI
McKinlay & Little	1978	RN/DI
McKinlay & Little	1979	RN/DI
Karunaratne	1980	Bias
Mosley	1981	RN/DI
Maizels & Nissanke	1984	RN/DI
Dowling & Hiemenz	1985	Bias
McGillivray	1986	Bureaucratic/Incremental
Bowles	1987	Hybrid
Eggleston	1987	LDV
Gulhati & Nallari	1988	Bureaucratic/Incremental
Bowles	1989	Hybrid
Gang & Khan	1990	Bureaucratic/Incremental
Gang & Lehman	1990	LDV
Gounder	1991	Bureaucratic/Incremental
McGillivray & Oczkowski	1991	LDV
Tsoutsoplides	1991	RN/DI
Anyadike-Danes & Anyadike-Danes	1992	Developmental
Grilli & Riess	1992	Hybrid
McGillivray & Oczkowski	1992	LDV
McGillivray	1992	LDV

Notes: (a) Year refers to presentation, not publication (see endnote 2). LDV is limited dependent variable and RN/DI recipient need/donor interest.

Levitt thought POP_i, $YCAP_i$, $ECAP_i$, ΔE_i, S_i and GFX_i to accord to developmental criteria, not only assisting those in greatest need but also those who have the capacity to efficiently absorb aid inflows. While not made clear by Levitt (in the sense that expected signs of the β coefficients were not stated), it was thought that donors could presumably give preference to countries with larger populations and smaller per capita incomes on the grounds that they need more aid. It was also postulated that donors could also favour countries with higher proportions of the population attending school and with higher electricity consumption on the grounds that they could better use aid. Levitt considered USX_i to represent commercial importance and $USMA_i$ and $UNMA_i$ to represent strategic and diplomatic importance. While also not made clear, one would *a priori* expect these variables to positively influence aid allocations.

Similar, yet more sophisticated hybrid models were proposed by Wittkopf (1972) and Kato (1969). Applied to 1961, 1964 and 1967 aid from France, Germany, the United Kingdom and the United States, Wittkopf proposed the following model:

$$\begin{aligned} A_{ji,t} = {} & \alpha_0 + \beta_1 YCAP_{i,t-1} + \beta_2 (X-M)_{i,t-1} + \beta_3 \Delta X_{i,t-1} + \beta_4 POP_{i,t-1} \\ & + \beta_5 LI_{i,t-1} + \beta_6 T_{ji,t-1} + \beta_7 CB_i + \beta_8 TS_{i,t-1} + \beta_9 AS_i \\ & + \beta_{10} OBA_{i,t-1} + \beta_{11} OMA_{i,t-1} + \mu_{i,t}, \end{aligned} \tag{3}$$

where it was expected that: β_1, β_2, β_5, β_{10}, $\beta_{11} < 0$, and β_3, β_4, β_6, β_7, β_8, $\beta_9 > 0$. The dependent variable, $A_{ji,t}$, is donor j's net total official flows to country i in year t. Ignoring subscripts, *YCAP* and *X-M* (per capita income and the trade balance respectively) measure developmental need for aid. ΔX (export growth) measures i's economic performance. A popular theme at the time, the notion of economic performance was considered important on the same grounds as absorptive capacity.

This related to the concern for donors to maximise the developmental "returns" from aid, which could be achieved by giving preference to countries with superior economic performance and/or greater absorptive capacity. Wittkopf treated *POP* (population) as an indicator of political importance, and not therefore as indicative of need. *LI*, *T*, *CB*, *TS* and *AS* (respectively, years of *i*'s independence, trade with donor *j*, a dummy variable taking the value of 2 if *i* borders on a communist state or 0 if otherwise, total trade with Soviet bloc states and a dummy variable with the value of 2 if *i* received economic assistance from the Soviet bloc or 1 if otherwise) also measure political and, in some cases cold war considerations. An innovation of Wittkopf's approach was its identification of other bilateral aid (*OBA*) and multilateral aid (*OMA*) as potential determinants of donor *j*'s aid to *i*. The underlying hypothesis was that there was a degree of co-ordination between donors, a "geographic division of labor" as Wittkopf (1972, p.20) describes it.

A further innovation of Wittkopf's study was incorporation of dynamics through the lagging of explanatory variables, as equation (3) shows. However, it was not made clear why lags were assigned. In reference to alternative lag structures of 0 to 3 years, it was simply stated that "none is necessarily preferable on *a priori* or theoretical grounds" (p.22). An explicit justification is, however, provided by Kato (1969). Kato argues that because of informational time lags aid allocation decisions can only be made on the basis of previous years' data. Citing Wildavsky (1958), Kato argues that a decision for an allocation for year *t* will be made in year *t-1*, based on data pertaining to either year *t-2* or *t-3*.[4] Applied to

1961-64 United States general, economic and military "final congressional (aid) appropriations", Kato's general model with the three year lag structure can be written as:

$$A_{i,t} = \alpha_0 + \beta_1 YCAP_{i,t-3} + \beta_2 BP_{t-3} + \beta_3 AR_{t-3} + \beta_4 CS_{i,t-3} + \beta_5 CB_{i,t-3} + \beta_6 MUS_{i,t-3} + \beta_7 TS_{i,t-3} + \beta_8 UN_{i,t-3} + \beta_9 AS_{i,t-3} + \beta_{10} UST_{i,t-3} + \mu_{i,t}, \quad (4)$$

where *YCAP* serves as an indicator of the "economic need" for aid; *BP* and *AR* (the US Balance of Payments deficit and aid to GNP ratio, respectively) indicate the state of the donor's domestic economy; *CS*, *CB* and *MUS* (indices of, respectively, the presence or otherwise of communist subversion or aggression, proximity to a communist border and existence of a military alliance) indicate strategic interests; *TS*, *UN* and *AS* (indices, respectively, of trade with the Soviet Union, political support given to United States' foreign policy stands in the United Nations, and the level of Soviet bloc aid) represent political (Cold War) interests, and; *UST* (*i*'s contribution to United States trade) represents commercial interests.

The inclusion of *BP* and *AR* is ambiguous on theoretical grounds and unambiguously problematic on econometric grounds. First, while it could be argued that aid to *i* would be likely to be greater, *ceteris paribus*, the healthier the state of United States economy, it is not clear the *AR* is a good indicator of this since this ratio could rise simply due to declines in GNP. Second, both these variables would be constant across all countries, and thus playing no role in the distribution of aid. An attempt to estimate the equation for a single year would result in perfect multicollinearity (since *BP* and *AR* are constant one must be a multiple of the other), so that the equation cannot be estimated. Although Kato is not clear on

this point we must therefore assume he pooled the data - a similar procedure to that adopted by Bowles (see below).

Other studies using hybrid models include Loehr, Price and Raichur (1976), Bowles (1987, 1989) and Grilli and Riess (1992). The specification of these hybrid models reflect the dominant aid and international relations issues of the time they were conducted. Humanitarian, commercial, political and strategic motives still form the basis for models proposed by these studies. Notwithstanding, more recent studies have tended to pay more attention to developmental variables and less, understandably, to Cold War considerations. This shift in emphasis is reflected in the models used in Bowles (1987, 1989). The model used in the former study is:

$$(A/POP)_{i,t} = \alpha_0 + \beta_1 POP_{i,t} + \beta_2 YCAP_{i,t-1} + \beta_3 SY_{i,t-1} + \beta_4 \Delta SY_{i,t} + \beta_5 TOT_{i,t-1} + \beta_6 GR_{i,t-1} + \beta_7 ECTWTS_{i,t-1} + \beta_8 SDFI_{i,t-1} + \beta_9 EECCOL_i + \beta_{10} TEECA_{i,t-1} + \beta_{11} AOD_{i,t-1} + \mu_{i,t}, \quad (4)$$

where it was expected that: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 < 0$ and $\beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11} > 0$.[5] The dependent variable, $(A/POP)_{i,t}$ is per capita 1975-81 EEC ODA,[6] for 60 recipients. *POP* and *YCAP* are as before, *SY* is the savings rate, ΔSY is the change in the savings rate, *GR* is the economic growth rate, *ECTWTS* is the share of EEC exports to *i*, *SDFI* is the stock of direct investment from DAC countries in *i*, *EECCOL* is a dummy variable taking the value of 1 if *i* is a "friendly" ex-colony of EEC states, *TEECA* is total aid disbursed in each year to all recipients and *AOD* is total other aid. No justification was provided for the lags assigned to the time dependent variables. Nor was there a justification for not lagging *POP*.

Two further aspects of Bowles' hybrid model are worthy of

comment: the use of per capita aid receipts as the dependent variable and total EEC aid (*TEECA*) as an explanatory variable.[7] The justification for using per capita aid rests on a perceived, yet not entirely unambiguous, problem with absolute (total) aid: "if total aid is used as the dependent variable then the interpretation of population as an independent variable is problematic since population is clearly an indicator of a country's need for aid, but it may also be an indicator of its political importance" (Bowles, 1989, p.12).[8] Per capita aid was thought to avoid this "problem", somehow allowing population to be interpreted solely as an indicator of need. The use of total EEC aid as a dependent variable was justified on the grounds that the amount of aid a country receives in any given year will depend on the total amount of aid available for distribution in that year. Since Bowles pools cross section and time series data (another departure from previous hybrid studies), the singularity problem referred to above in Kato's specification is avoided, with *TEECA* picking-up year-on-year changes in aid to which are independent of the other explanatory variables. To this extent, *TEECA* acts as an intercept dummy, shifting the regression line upward or downward according to the level of total aid. This interpretation does, however, give rise to the issue of simultaneity bias, with the possibility that A_{it} (and hence $(A/POP)_{it}$) affecting and being affected by $TEECA_{it}$. Bowles has implicitly assumed that $TEECA_{it}$ is exogenous with respect to A_{it}. The implications of this assumption being incorrect, along with the general issue of simultaneity, is considered below.

(iii) *Recipient Need/Donor Interest Models*

In the late 1970s it became fashionable to estimate two alternative models of aid allocation - 'recipient need' (RN) and

'donor interest' (DI). This paradigm has since come to dominate the aid allocation literature. The recipient need model contained only economic and social characteristics of recipient countries. Its construction was premised on the assumption that donors, motivated purely by humanitarian considerations, endeavour to ensure that aid is equitably distributed among poor countries. Therefore, the amount of aid allocated to any given country will be in proportion to its need, and the distribution of aid will reflect the relative needs of recipient countries. The donor interest model differentiates recipients on the basis of their economic, security, political and strategic importance to a given donor. It assumes that donors seek to take advantage of the foreign policy implications of aid and uses it to pursue their own self-interests. Thus, the distribution of aid among recipients will reflect these interests.

The RN/DI paradigm was initiated in McKinlay and Little (1977, 1978, 1978a and 1979), McKinlay (1978) with more recent contributions including Maizels and Nissanke (1984) and Tsoutsoplides (1991). These studies were preceded by Wittkopf (1973), which looked solely at donor interests. Wittkopf was concerned purely with the relationship between United Nations General Assembly voting behaviour and aid.

Maizels and Nissanke's paper is the most widely cited and influential of the RN/DI studies. Their recipient need model is:

$$(A/POP)_i = \alpha_0 + \beta_1 POP_i + \beta_2 YCAP_i + \beta_3 PQLI_i + \beta_4 \Delta Y_i + \beta_5 (BP/Y)_i + \mu_i \quad (5)$$

where (A/POP) is country i's per capita net ODA receipts, POP is population, $YCAP$ is per capita GNP, $PQLI$ is the Physical Quality of Life Index (PQLI, a composite index comprising i's life

expectancy, adult literacy and infant mortality)[9], ΔY is the GNP growth rate and BP/Y is Balance of Payment's current account balance expressed as a percentage of GDP.

Maizels and Nissanke's donor interest model, applied to 1978-80 aid data, is:

$$(A/POP)_i = \alpha'_0 + \beta_6 ARMCAP_i + \beta_7 PDUM_i + \beta_8 TNC_i + \beta_9 M_i + \beta_{10} X_i + \beta_{11} SMDUM_i + \mu'_i, \quad (6)$$

where *ARMCAP* denotes donor arms transfers to recipient *i*, *PDUM* is a dummy taking the value of 1 if *i* is a former colony and/or located in a regional of political and strategic importance or 0 if otherwise, *TNC* denotes the number of affiliates and subsidiaries of the donor's transnational corporations in *i*, *M* is the value of *i*'s imports from the donor expressed as a ratio of world imports to *i*, *X* is *i*'s exports to the donor expressed as ratio of world exports to the donor, and *SMDUM* is a dummy variable taking the value of 1 if *i* supplies more than 1 percent of world exports of selected strategic materials or zero if otherwise.

Tsoutsoplides (1991) estimated the following recipient need model:

$$(A/POP)_i = \alpha_0 + \beta_1 POP_i + \beta_2 YCAP_i + \beta_3 PQLI_i + \beta_4 \Delta Y_i + \beta_5 (BP/Y)_i + \mu_i \quad (7)$$

where $(A/POP)_i$ is the average 1975-80 net per capita ODA disbursement to country *i* from EC donors, *POP* is 1978 population, *YCAP* is 1978 GDP per capita, *PQLI* is the Physical Quantity of Life Index relating to 1970-80, ΔY is the GDP growth rate and (BP/Y) is the Balance of Payments to GDP ratio. Time periods and donors aside, Tsoutsoplides' recipient need model differs from that of Maizels and Nissanke in one respect only,

the use of GDP as opposed to GNP in *YCAP* and ΔY. Also similar to Maizels and Nissanke's, Tsoutsoplides' donor interest model is:

$$(A/POP)_i = \alpha'_0 + \beta_6 MIL_i + \beta_7 PDUM_{1i} + \beta_8 PDUM_{2i} + \beta_9 TNC_i + \beta_{10} M_i + \beta_{12} SM_i + \mu'_i, \quad (8)$$

where *MIL* is a dummy variable taking the value of 1 if EC countries have a military interest or border with *i* or 0 if otherwise, $PDUM_1$ and $PDUM_2$ are political dummies (the former taking the value of 1 if *i* had a previous post-WWII colonial affiliation with any one of the original six EC members, the latter taking the value of 1 if *i* has a post-WWII colonial affiliation with the United Kingdom), *TNC* is the number of donor transnational corporation affiliates and subsidiaries in *i*, *M* is the EC share of total imports into *i*, and *SM* is a dummy variable taking the value of 1 if *i* supplies a "high" proportion of strategic materials to the EC.

An important distinction between the Maizels and Nissanke and Tsoutsoplides models and those of McKinlay and Little is the dependent variable. As mentioned, Maizels and Nissanke (1984) and Tsoutsoplides (1991) used per capita aid as the dependent variables in both recipient need and donor interest models. The McKinlay and Little studies, however, proposed a number of alternative dependent variables: absolute aid, which was intended to reflect the gross importance attached to a recipient; absolute aid multiplied by the ratio of per capita GDP to population, indicating the donor's commitment to relative need, and; gross aid as a percentage of GDP, indicating the degree of dependency of the recipient to the donor. In their analysis of United States aid, McKinlay and Little (1979) replaced the second of these variables in their recipient need model with per capita aid, while retaining absolute aid the

donor interest model.

The main conclusions of Maizels and Nissanke (1984) and McKinlay and Little (1979) relate to the estimation of the recipient need model. Based on corrected functional fits ($\bar{R}^2$s), Maizels and Nissanke concluded that "the recipient need model is not generally applicable as an explanation of the allocation of aid from DAC Member countries" (p.883). This conclusion was drawn for both average 1969-70 and 1978-80 average per capita net ODA disbursements. Results for the latter year are shown in Table 2. As can be seen, the recipient need model at best explains 15 percent of the variation of French aid and at worst 8 percent of Japanese aid. It explains 12 percent of total DAC bilateral aid. In contrast, the RN model was thought to offer a reasonable explanation of multilateral aid. In contrast, the donor interest model performed well, accounting for 81 percent of the variation in total DAC bilateral aid for 1978-80 and, at best, 97 percent of United States aid for the same period. Indeed, on the basis of both sets of results, Maizels and Nissanke actually rejected recipient need as a determinant of aid allocation *per se* (which is more profound than rejecting the recipient need model) in the conclusion to their paper, observing that for some donors "bilateral aid allocations are made ... solely ... in support of donor's perceived foreign economic, political and security interests" (p.891).

McKinlay and Little (1979) were even more candid in interpreting the results obtained from estimating their recipient need model. On the basis of United States aid data for each of the years 1960 to 1970, they "found no support for the hypothesis derived from the recipient need model" (p.243).

Table 2
Maizels and Nissanke Recipient Need Model Estimates, 1978-80

		France	Japan	U.K.	U.S.	Total Bilateral	Total Multilateral
Constant	(α_0)	10.79* (4.55)	1.49* (5.40)	0.47 (0.74)	-12.19 (-1.24)	3.81 (0.36)	5.92* (2.64)
Population	(α_1)	-0.01 (-1.26)	-0.00 (-1.17)	-0.00 (-0.52)	0.01 (0.34)	0.01* (3.06)	-0.00 (-0.02)
GNP per capita	(α_2)	——	-0.00* (-2.89)	-0.00 (-1.27)	0.01* (3.84)	-0.15 (-0.76)	-0.03 (-0.75)
PQLI	(α_3)	-0.13* (-3.71)	——	——	——	-0.76 (-0.62)	-0.06 (-0.24)
GNP Growth Rate	(α_4)	-0.06 (-0.21)	0.10* (2.04)	0.21* (1.93)	-1.27 (-1.19)	-0.89* (-2.73)	-0.44* (-6.39)
Balance of Payments	(α_5)	0.04 (0.06)	0.02* (1.72)	-0.07* (2.32)	-0.58* (-2.09)	-0.01 (-0.20)	-0.01 (-1.34)
$\bar{R}^2$		0.15	0.08	0.10	0.13	0.12	0.43

*: significant at the 90 percent level or greater.

Indeed, they went so far as to say that there are "no grounds for asserting that humanitarian criteria have any significant direct influence on the pattern of US aid" (*ibid.*) and concluded that the "findings for all years provide strong confirmation for the donor interest model" (*ibid.*).

Tsoutsoplides (1991) provides rather different conclusions. The recipient need model was thought to offer a better explanation of total EC aid than the donor interest model, with $\bar{R}^2$s of 0.461 and 0.298 respectively. In the case of EC bilateral aid, however, the donor interest model provided a $\bar{R}^2$ of 0.412 and the recipient need model a $\bar{R}^2$ of 0.383.

(iv) *Bias Models*

In its 1969 *Review*, the DAC noted a tendency for small countries to receive more aid per capita than their larger

counterparts: this tendency is the "small country" effect or bias. Another possible bias is the "middle income" effect, which is a tendency for aid to rise with per capita income, only falling after some relatively high threshold. These biases may arise for a variety of reasons, including a policy among aid donors to maximise the observed effectiveness of aid (which may be a decreasing function of population and an increasing function of income) and the ability of richer countries to make a better case for aid.[10]

A relatively recent "biases" study is Dowling and Hiemenz (1985). They proposed the following equation:

$$ln(A/POP)_i = \alpha_0 + \beta_1 lnPOP_i + \beta_2 lnYCAP_i + \beta_3 lnYCAP_i^2 + \mu_i \qquad (9)$$

where it is hypothesised that $\beta_1 < 0$, $\beta_2 > 0$ and $\beta_3 < 0$. $ln(A/POP)_{it}$ is the logarithm of per capita aid in one of four categories for the periods 1970-72 and 1976-78: bilateral ODA, multilateral ODA, total ODA and total other official flows (OOF, which includes non-concessional flows). Presumably in response to their narrowly specified model, which cannot directly account for political (and commercial) influences on aid allocation, Dowling and Hiemenz excluded from their recipient sample countries "where political considerations in aid allocation might overwhelm economic factors" (Dowling and Hiemenz, 1985, p.536). Retaining these countries in the sample would "distort the analysis" (*ibid.*). Countries excluded were those situated in the Middle East and thought to be "Socialist". An alternative course of action would have been to add Middle Eastern and Socialist country dummies in equation (9). Another, seemingly better option, especially if one is of the view that almost all aid allocations have some non-economic basis, would have been to comprehensively specify the estimating equation with the

inclusion of commercial and political interest variables: that is to test for population and middle income country biases in a hybrid model.

This latter approach was used by Isenman (1976) and Karunaratne (1980), both of whom used absolute aid as the dependent variable. Isenman, for example, proposed the following aid allocation model:

$$A_i = \alpha_0 + \beta_1 POP_i + \beta_2 POP_i^2 + \beta_3 YCAP_i + \beta_4 YCAP_i^2 + \beta_5 B_i + \beta_6 P_i + \beta_7 Z_i + \mu_i \quad (10)$$

where B, P, and Z are vectors of Balance of Payments, political and "other appropriate" variables respectively. Isenman's model was applied to various categories of DAC, United States, World Bank and United Nations Development Program aid allocations for the late 1960s and early 1970s.

Isenman (1976: 622) argued that there will be small country bias if β_2 in equation (10) is significantly less than zero. This statement is incorrect. If, as assumed, $\beta_1>0$ and $\beta_2<0$ (or is equal to 0) then there is small country bias if the intercept (α_0) is positive. Even if β_2 is positive then, with a positive intercept, aid per capita will initially fall with population (that is, there is small country bias). If the intercept is negative then when $\beta_1>0$ and $\beta_2<0$ income per capita will initially rise with population (a large country bias). The test for small country bias therefore rests crucially with the intercept, although the behaviour of aid per capita as a function of population depends on the estimated values of all three coefficients (α_0, β_1 and β_2).

Karunaratne's estimating equation, applied to Australian

bilateral aid, is:

$$A_i = \alpha_0 + \beta_1 POP_i + \beta_2 POP_i^2 + \beta_3 YCAP_i + \beta_4 YCAP_i^2 + \beta_5 AX_i + \beta_6 PQLI_i + \beta_7 LEV_i + \mu_i \quad (11)$$

where AX_i is Australian exports, *LEV* is a dummy variable representing political leverage (equalling 1 if Australian aid constitutes one percent or greater of total DAC aid to *i*) and the remaining variables are as before.

(v) *Bureaucratic/Incremental Models*

Some aid allocation studies have explicitly taken into account overtly bureaucratic influences in the formulation of models and interpretation of results. A commonly identified influence is the tendency for aid bureaucracies, like other spending agencies, is to use the preceding year's aid allocation as a benchmark for the current year's allocation in a process of "marginal incrementalism" or "bureaucratic inertia". A number of reasons for this process are identified. One is the influence of project aid. Many projects extend over a number of years, with an ongoing year-on-year flow of aid funds the consequence. Any cessation of this flow is less than conducive to cordial relations between donor and recipient.[11] Indeed, irrespective of whether project aid is involved, reducing aid funds to a recipient country can often be interpreted as a sanction for some course of action to which the donor objects. From the donor aid bureaucracy's perspective, this can further complicate an already onerous task of allocating aid among an often large sample of developing countries, identifying and weighing up the relative importance a range of often competing factors in a manner (presumably) consistent with policy directives, deciding which form the aid should take, engaging in consultations with other government departments and aid lobby groups and so on.

Turning to the previous year's allocations, and marginally adjusting (presumably upward) is an expedient way of coping with this task.

Gulhati and Nallari (1988) pursued the bureaucratic theme further. In formulating their model, a stated concern was "not with the elegance of theory" but with the "crude rules of thumb used by those who make aid allocation decisions". Notwithstanding, Gulhati and Nallari, like McGillivray (1986), specified a somewhat similar model to those described above as hybrid. The only difference was in the specification of a lagged dependent variable to pick up inertia. Another innovation was the use of time series data in addition to cross section data. The data related to selected DAC member bilateral ODA commitments to 18 recipients in Eastern and Southern during the period 1970 to 1984. The model applied to time series is:

$$A_{i,t} = \alpha_0 + \beta_1 PR_{i,t} + \beta_2 D_{i,t} + \beta_3 POL_{i,t} + \beta_4 X_{i,t} + \beta_5 A_{i,t-1} + \mu_{i,t}, \quad (12)$$

where PR is a subjective performance rating for recipient i, D is a drought, famine and crop damage dummy, POL is a subjective rating of donor political relations with i which ranges from -1 to +1 and is based on such factors as arms sales and colonial ties, X is donor exports net of aid to i and $A_{i,t-1}$ is the lagged dependent variable. The subtraction of aid from exports is to avoid overstating the commercial importance of i since some exports are aid financed. McGillivray (1986) did likewise on the same grounds. While it is correct that exports are often aid financed, however, not all exports fall into this category. As a consequence, the subtraction of total exports from aid is, however, likely to understate commercial importance. We return to the general selection of variables later in this paper.

Gulhati and Nallari applied equation (12) to time series data only. The model applied to cross section data, drawn from period to which the time series data relate, specified per capita aid as the dependent variable and a rather different set of explanatory variables. Lagged aid was excluded. This approach is rather curious on a number of grounds, especially given that none of equation (12)'s regressors would appear to be constant over time. Moreover, if the decision variable is absolute aid, then it cannot simultaneously be per capita aid. Perhaps Gulhati and Nallari's concern should not have been with theory *per se*, but with the distinction between good theory and bad theory.

Another study falling within this category is Gang and Khan (1990), who looked at time series data for aid to India over the period 1960-85. Unlike Gulhati and Nallari (1988) and McGillivray (1986), whose approach to the specification of the lagged dependent variable was rather *ad hoc*, Gang and Khan adopted a more formal partial adjustment framework. It was postulated that there is some "targeted" aid allocation for the current period, A_t^*. The process by which this allocation is determined can be described as follows:

$$A_t^* = b_0 + b_1 f_{1t} + b_2 f_{2t} + b_3 f_{3t} + b_4 f_{4t} + b_5 \Delta Y_t + b_6 E_t + \mu_t, \qquad (13)$$

where f_1, f_2, f_3 and f_4 represent latent, unobservable variables derived from a factor analysis of aid to India, ΔY is the GDP growth rate and E the trade balance.

Since the targeted variable is unobservable, it is further postulated that:

$$A_t - A_{t-1} = \delta (A_t^* - A_{t-1}) + \nu_t, \qquad 0 < \delta < 1 \qquad (14)$$

where A_t and A_{t-1} are current actual and lagged actual aid to

India respectively, δ is an coefficient of adjustment and v_t an error term. Equation (14) implies an adjustment process in which the actual change in aid to India between t-1 and t is some constant fraction δ of the desired change. Since δ lies between 0 and 1, the adjustment is thought to be partial due to the presence of bureaucratic inertia. Substituting for A_t^* and re-arranging provides Gang and Khan's estimating equation, which may be written as:

$$A_t = \delta b_0 + \delta b_1 f_{1t} + \delta b_2 f_{2t} + \delta b_3 f_{3t} + \delta b_4 f_{4t} + b_5 \Delta Y_t + \delta b_6 E_t + (1-\delta) A_{t-1} + u_t, \quad (15)$$

where $u_t = \delta \mu_t + v_t$. Equation (15) was separately applied to total aid, total grants and total loans to India.

A novel study was that undertaken by Gounder (1991), who tested whether an aid administration had implemented the recommendations of the 1984 *Report of the Committee to Review the Australia's Overseas Aid Program* to shift the regional focus of Australian aid. Using time series data, Gounder estimated the following equations:

$$Y_{k,t} = \alpha_k + \beta_{1k} T + \mu_{k,t}, \quad (16)$$

$$Y_{k,t} = \alpha_k + \beta_{1k} T + \beta_{2k} DV + \mu'_{k,t}, \text{ and} \quad (17)$$

$$Y_{k,t} = \alpha_k + \beta_{1k} T + \beta_{2k} DV + \beta_{3k} (DV.T) + \mu'_{k,t}, \quad (18)$$

where $Y_{k,t}$ is the share of Australian aid to region k in year t, T is a linear time trend, DV is a dummy variable taking the value of 1 in the post-review years and 0 in the pre-review years and $DV.T$ is a multiplicative dummy. The variable DV is used to test for a discontinuity in the intercept term between the two periods, while $DV.T$ is used to test for differences in both intercept term and slope coefficients. Should β_{2k} and β_{3k} be significantly different from zero, and display a sign consistent with the recommendations of the review, then these

recommendations have been implemented with respect to region k.

(vi) *Developmental Models*

Developmental models are those which explain aid allocation on the basis of developmental variables only. As such they are the same or similar to recipient need models. All that separates the studies falling under this category is that they do not also propose donor interest models. An early study of this type is Davenport (1970), who looked at various categories of 1962-64 United States aid, total multilateral and total bilateral aid. The model estimated was:

$$(A/POP)_i = \alpha_0 + \beta_1 YCAP_i + \beta_2 FR_i + \beta_3 AC_i + \mu_i, \qquad (19)$$

where FR is the foreign reserve position of i, measured by the value of its gold, foreign exchange and gold tranche with the IMF and AC is its absorptive capacity as measured by the value of private foreign capital inflows to i. Similar approaches were used by Henderson (1971), OECD (1974), Kaplan (1975), Edelman and Chenery (1977) and, more recently, Anyadike-Danes and Anyadike-Danes (1992).[12] For example, the following equation was applied to OECD aid commitments during the later 1960s and early 1970s by Edelman and Chenery:

$$ln(A/POP)_i = \alpha + \beta_1 lnPOP_i + \beta_2 lnYCAP_i + \beta_3 YCAP_i^2 + \beta_4 (X/Y)_i + \mu_i \qquad (20)$$

where X/Y is i's exports as a ratio of GDP and the other variables are as above.

Anyadike-Danes and Anyadike-Danes (1992) applied the following equation to 1975 European Development Fund (EDF) aid (and variants to 1980 and 1985) to 45 African, Caribbean and Pacific (ACP) member countries:

$$lnA_i = \alpha_0 + \beta_1 lnPOP_i + \beta_3 lnYCAP_i + \beta_4 DNIE_i + \beta_5 LD_i + \mu_i \qquad (21)$$

where $DNIE$ is a Nigeria dummy (this country was considered an

outlier due to its very large population and small aid receipt) and *LD* is a dummy variable taking the value of 1 if *i* belongs to the United Nation's Least Developed Country classification or 0 if otherwise.

(vii) *Limited Dependent Variable Models*

An issue overlooked by all the above-mentioned studies has been developing country *eligibility* for aid. Clearly, donors must at some stage consider which countries shall receive aid and which shall not. Those which actually receive aid are deemed eligible, those which do not receive are deemed ineligible. While the studies discussed above purport explain the distribution of aid among those countries deemed eligible, they say nothing of why some countries receive no aid at all. Sample selection models (which fall within the broad gamut of limited dependent variable models) fill this gap. A sample selection model envisages a two-stage "yes/no and if yes, how much?" decision making process to aid allocation. The "yes/no" stage of the process involves eligibility for aid, while the "how much?" involves the amounts of aid to allocated to each country deemed eligible. While the decisions are treated as separate, they do not necessarily have to be treated as independent.

Four sample selection studies of aid allocation have appeared in the literature. The first were those of Dudley and Montmarquette (1976, 1978). Dudley and Montmarquette (1976) analyse 1970 ODA from each DAC member, while the 1978 study looked specifically at Canadian ODA. Their relatively sophisticated studies treated the aid allocation process as a utility maximising problem. Decision makers were assumed to maximise the perceived "impact" of aid subject to a budgetary

constraint. Unconstrained, the impact of aid was viewed as its affect on the recipient country and was primarily thought to be and increasing function of per capita aid, an increasing function of recipient population and a decreasing function of recipient per capita GNP. A number of auxiliary variables were also specified to represent political and economic self-interest impacts. Like the hybrid models, these included former colony and geopolitical dummies, the donor exports and other donors' aid. Rather than reflecting a needs consideration, other aid was intended to reflect a possible "bandwagon effect" in the allocation of aid among countries. Thus, any given donor's aid allocation to a recipient country was thought to be an increasing function of other donors' aid to that recipient.

The econometric model estimated by Dudley and Montmarquette is:[13]

$$\begin{aligned} y^*_{1i} &= x'_{1i}\beta_1 + u_{1i} \\ y^*_{2i} &= x'_{2i}\beta_2 + u_{2i} \end{aligned} \tag{22}$$

where x'_{1i} and x'_{2i} are vectors of the previously mentioned explanatory variables pertaining to recipient country i, β_1 and β_2 are vectors of parameters, u_{1i} and u_{2i} are independently distributed error terms with mean zero and variances unity and σ_1^2 respectively and $i = 1, \ldots, n$. y^*_{1i} and y^*_{2i} are latent variables representing eligibility for aid and potential amounts of aid respectively. The observed variables are a binary dummy and a truncated amount variable defined as follows:

$$\begin{aligned} y_{1i} &= 1 && \text{if} \quad y^*_{1i} > 0 \quad \text{and} \quad y_{2i} > 0 \\ y_{1i} &= 0 && \text{if} \quad y^*_{1i} \leq 0 \quad \text{and} \quad y_{2i} \leq 0 \\ y_{2i} &= x'_{2i}\beta + u_{2i} && \text{if} \quad y_{1i} = 1 \end{aligned} \tag{23}$$

That is, if eligible ($y_{1i} = 1$) the observed amount equals the

potential amount of aid.

Two more recent sample selection studies are those of McGillivray and Oczkowski (1991, 1992). Like Amemiya (1984), they question Dudley and Montmarquette's implicit assumption that eligibility and amount decisions are independent (and thus, that the error terms u_{1i} and u_{2i} in equations (24) are uncorrelated). McGillivray and Oczkowski further argue, that in the context of absolute allocations, aid flows tend to be scattered among many countries and that the resultant fragmentation results in numerous relatively very small, inconsequential allocations. This, it is thought, poses problems for modelling aid allocation as it is reasonable to assume that aid decision-makers do not fully and seriously consider these allocations. Moreover, these allocations are likely to be independent of those criteria normally held to determine aid allocation.

To overcome this problem, McGillivray and Oczkowski propose a positive cut-off allocation which partitions eligible from ineligible countries. In this context, an 'eligible' country is treated as one eligible for a "significant" (that is, greater than the cut-off) aid allocation. The truncation of potential amounts is therefore made with respect to this cut-off, denoted C, and not zero. Letting i denote the potential aid recipient, McGillivray and Oczkowski's general econometric model is given as:

$$\begin{aligned} E_i^* &= Z_i'\alpha + \varepsilon_i & \varepsilon_i &\sim N(0, 1) \\ A_i^* &= X_i'\beta + \mu_i^* & A_i^* &> C \end{aligned} \qquad (24)$$

where E_i^* is the difference in the indirect utilities between allocating aid greater than C and allocating less than or equal

to C in aid to country i, A_i^* represents the significant potential aid allocation, Z_i' and X_i' are vectors of exogenous regressors, α and β are vectors of parameters, $\mu_i^* \sim N(0, \sigma^2)$ but truncated at $(C - X_i'\beta)$ and $i = 1, \ldots, n$. To capture possible dependence of the eligibility and amount decisions, it was assumed that $\rho = \text{cor}(\varepsilon_i, \mu_i^*/\sigma)$ is non-zero. Unlike Dudley and Montmarquette's approach, equations (24) are estimated simultaneously. The observed variables under consideration were the eligibility or otherwise of a country I_i and the actual aid amount given in excess of the cut-off A_i. The relationship between the latent and the observed variables was:

$$\begin{aligned} I_i &= 1 && \text{if} \quad E_i^* > 0 \quad \text{and} \quad A_i > C \\ I_i &= 0 && \text{if} \quad E_i^* \leq 0 \quad \text{and} \quad A_i \leq C \\ A_i &= X_i'\beta + \mu_i^* && \text{if} \quad I_i = 1 \\ A_i &= 0 && \text{if} \quad I_i = 0 \end{aligned} \tag{25}$$

That is, if eligible ($I_i = 1$) the observed amount is assumed to equal the potential amount of aid. Conversely, if ineligible ($I_i = 0$), then less than C is allocated and the potential aid allocation is not observed.

The explanatory variables used in McGillivray and Oczkowski (1992) (that is, the elements in Z_i and X_i) were: per capita GNP, population, and LLDC dummy, British exports, a British Commonwealth country dummy, arms transfers and total DAC gross ODA (net of British ODA).[14] Each were expressed as logarithms and lagged one period to allow for informational time lags. Applying their model to British absolute ODA commitments in each of the years 1980 to 1987, McGillivray and Oczkowski found a consistent bias favouring Commonwealth countries in both eligibility and amount decisions. They found that countries with lower per capita GNPs and larger populations were often given

preference in these decisions. So too did larger beneficiaries of other DAC aid in determining aid amounts, but not eligibility for aid *per se*.

Three other studies employing limited dependent variable techniques have appeared in the literature. They are Gang and Lehman (1990), who looked at 1960, 1965, 1970, 1975 and 1980 United States "economic" aid to Latin America, Eggelston, who looked at 1955-79 United States PL480 food aid and McGillivray (1992) who looked at 1978-85 Australian bilateral food grain aid. What separates these studies from the others is the econometric estimator used. Since observed aid to a number of countries was zero, these studies used the Tobit estimator, which may be described as follows:

$$y_i^* = z_i'\beta + u_i \tag{26}$$

where z_i is a vector of explanatory variables, u_i is an error term with mean zero and variance σ^2 and $i = 1, \ldots, n$. y_i^* is a latent amount of aid variable. The observed variable is the actual amount of aid y_i. The relationship between y_i^* and y_i is as follows:

$$\begin{aligned} y_i &= y_i^* \qquad if \quad y_i^* > 0 \\ y_i &= 0 \qquad if \quad y_i^* \leq 0 \end{aligned} \tag{27}$$

Eligibility and amount decisions aside, it is well established in the econometric literature that Tobit is an appropriate estimator when observations of the dependent variable take the value of zero.

The interest in the Tobit estimator, in the context of aid allocation, is more than purely econometric. It is of analytic appeal in that it, like the sample selection models, allows investigation of how aid is allocated among developing countries

generally, rather restricting the focus to those countries who finally received aid. But, unlike the sample selection models, the Tobit model treats eligibility decisions as being implicit to those concerning amounts of aid. In other words, it assumes that decision makers adopt a one part approach in which they simultaneously decide between zero and positive aid only, without first separately determining eligibility.[15]

Gang and Lehman (1990) used the following set of explanatory variables: child mortality, the frequency of riots and protest demonstrations (an indicator of stability), the share of total Latin American imports from the United States and GDP per capita. When using first differences of both the regressor and regressands, Gang and Lehman found the import share and stability variables to be significant determinants. GDP per capita (with the exception and 1965-70) and child mortality appeared to play an insignificant role in determining US aid to Latin America. Eggleston's (1987) explanatory variables included many which were specific to food aid. These included per capita agricultural output (an indicator of need), the current agricultural production as a proportion of previous years' production and commercial United States commercial agricultural commodity sales to the recipient. Other variables included foreign exchange reserves, net exports of the recipient as a percentage of GNP, population and the share of US military and educational training grants to the recipient (an indicator of political and military ties). Eggleston's model performed satisfactorily, accounting for up to 60 percent of the variation in PL480 food aid for 1955-79. The most important variables included US agricultural sales, domestic agricultural production and US military and training grants. McGillivray's model, which

contained a similar set of explanatory variables to that used by Eggleston, also explained up to 60 percent of the variation Australian food grain aid.

III A CRITIQUE

Our critique of the literature is based on:

(i) the *a priori* validity of the hypotheses on which the aid allocation models are based; and,

(ii) the statistical methodology employed in testing these hypotheses and hence the robustness of the results obtained.

The conclusions from the literature will be misleading if it is found to be wanting on either of the above. In particular, if the hypotheses tested are unlikely to be good representation of the actual decision-making process, are internally inconsistent or, in the absence of prior information, describe a decision-making process which is operationally unfeasible, then the results obtained will be misleading irrespective of the validity of the statistical methodology used to test these hypotheses. These criteria are of course largely mutually inclusive. For example, incorrect hypotheses lead to an incorrectly specified model, which in turn leads to biased regression coefficients.

III(a) CHOICE OF AID VARIABLE

One of the central issues in the aid allocation literature is the choice of the aid variable. The key question ought to be rather obvious: whether or not the choice corresponds to the decision variable likely to be used by donors. In statistical terms, using the wrong variable is analogous to the problem of

errors in the measurement of the dependent variable. The result is larger regression coefficient standard errors, and hence smaller *t* ratios, than would otherwise be the case.[16]

(i) *Definitional Issues*

Since 1969, all members of the OECD's DAC have published data in terms of its definition of aid: Official Development Assistance (ODA). ODA is defined as those flows to developing countries and multilateral institutions provided by official agencies, including state and local governments, or by their executive agencies, each transaction of which satisfies the following criteria:

> (i) is provided with the promotion of the economic development and welfare of developing countries as its main objective; and
> (ii) is concessional in character and contains a grant element of at least 25 percent. (OECD, 1990)

Almost all studies using data from 1969 onward have opted to use some measure of ODA as the dependent variable. It is the logical choice on a number of grounds. Most importantly, it is, broadly speaking, the decision variable of donors.[17] At around the time of the introduction of the ODA reporting concept, most donors had either established or were in the process of bringing responsibility for aid policy and allocation under the auspices of a single agency. Transfers not especially well described by the regression models outlined above and not included in ODA (military aid, loans provided on purely commercial terms, export credits and so on) are typically administered by other agencies or are allocated from a separate pool of funds. Moreover, given uniformity in reporting, using ODA increases the degree of homogeneity of the aid variable across donors, thus enhancing the application of a single model across a sample of donors. It

also increases homogeneity within aid programs, enhancing the application of a single equation across a sample of recipients. Also enhanced is the comparability of data over time - an obviously important consideration for time series analyses.

Prior to 1969, however, there was little uniformity between donors in the reporting of aid flows. Indeed, there was considerable debate in the 1960s over aid definition.[18] Essentially, whatever donors happened to call "aid" was reported as such, with non-concessional official finance and a range of other transfers which would not qualify as ODA being included. This has obvious implications for aid allocation studies using pre-1969 aid data on the grounds just identified. It has potentially more serious implications for those studies which have used pre- and post-1969 aid data, such as McKinlay and Little (1979) and Gang and Lehman (1990). In short, results for these periods are simply not comparable.[19]

A special case regarding aid definition and measurement is Gang and Khan (1991), who used aid data recorded by the Indian government. The usual practice in recipient countries is to record all development-oriented official transfers as aid. Non-concessional official finance, in particular, are included in aid. Unless it can be shown that the Indian government reports aid data in accordance with the ODA concept, then Gang and Khan did not model the decision variable of donors.

(ii) *Aid Measurement*

Having decided on ODA, there still remains a myriad of options for expressing the aid variable. Given DAC reporting practices, there are essentially four options of the measurement

of ODA. The first is gross disbursements. Disbursements represent the actual international transfer of financial resources from donor to recipient. The second is net disbursements, that is, actual amounts disbursed less repayments of principal in respect of earlier loans. If interest payments are also deducted the resulting series are the third option of net aid transfers.
The fourth option is ODA commitments. ODA commitments are obligations expressed in an agreement concerning the availability of funds to be intended for transfer from donor to recipient. As such, they are recorded in gross terms only. It follows that disbursements are the outcome of commitments.

As noted above, studies have tended to use either net disbursements or commitments, with most opting for the former. While not explained, this is presumably because net disbursements represent the extent of additional resources transferred to the recipient. One can, however, question the merit of this choice. The models outlined above essentially describe a donor decision making process; that is, the supply side. And yet disbursements are directly affected by the actions of the recipient. Once a commitment is determined, it is up to the recipient to draw upon the committed amount. That amount is of course the disbursement. It follows from this line of reasoning that the more appropriate variable is the donor's decision variable - the ODA commitment. As Dudley and Montmarquette (1976) assert, disbursements are "more likely to represent the results of a compromise between the aid demand of recipient countries and the aid supply of donor countries" (p.138).

There is another reason for using ODA commitments over disbursements as the measure of the aid variable. Commitments, determined on an annual basis, are not usually affected by sudden emergencies (such as natural disasters, political upheaval and the like), whereas disbursements are. It can often be the case that a donor may extend more aid than the original amount committed (in which case the disbursement may exceed the annual commitment), or may even renege on a commitment in an attempt to punish a recipient for some unexpected course of action. However, these events are simply not captured by the studies outlined above, nor often can they by a statistical model (without recourse to the use of dummy variables).

Of course, the question remains as to whether using ODA commitments as the dependent variable as opposed to disbursements makes any effective difference. The ultimate test of this is to estimate an aid allocation model using each ODA measure and compare results. We turn to this below. For the moment we consider another test. Table 3 reports slope coefficients from a simple regression of net ODA disbursements on commitments. The data employed are total ODA (DAC bilateral and multilateral combined) and total DAC bilateral ODA allocations, together with the bilateral allocation of France, Japan, the United Kingdom and the United States. The hypothesis tested, using simple *t* ratios, was whether the slope (regression) coefficient was significantly different from one. As can be seen, this hypothesis was rejected at the 95 level of confidence (using a two-tailed test) in the overwhelming majority of instances. The choice between the two measures would, therefore, seem to be of consequence. Whether this conclusion holds under more rigorous testing is considered

below. The main point of our discussion however remains. In principle, the more appropriate choice, given the nature of the models used in explaining aid allocations, is not ODA disbursements; it is ODA commitments.

Table 3
Regression Coefficients Between ODA Disbursements and Commitments

Year	Total (n=94)	DAC (n=94)	France (n=85)	Japan (n=85)	UK (n=85)	USA (n=85)
1978	0.71**	1.11				
1979	0.80**	1.18*	0.09**	1.49**	1.72**	0.96
1980	0.67**	1.04	0.03**	1.39**	1.32**	0.92
1981	0.71**	1.12	0.16**	1.26**	0.45**	1.15**
1982	0.73**	1.05	0.07**	1.44**	0.97	1.10**
1983	1.18**	1.13**	-0.02**	1.36**	1.29**	0.99
1984	1.26**	1.19**	0.09**	1.42**	1.78**	1.03
1985	1.15**	1.09**				
1986	1.08**	1.09**				
1987	1.36**	1.27**				
1988	1.46**	1.56**				
1989	1.30**	1.27**				

*: significantly different from 1 at the 95% confidence level.
**: significantly different from 1 at the 99% confidence level.

(iii) *Relative or Absolute Aid?*

Choice between aid variables is further complicated by the options of expressing aid in per capita or absolute terms. A large proportion of the studies cited above have used per capita aid. This is, however, a dubious choice. The process of inter-country aid allocation typically involves distributing aid among countries from a predetermined total pool of funds.[20] Aid decision-makers, like most others in spending agencies, must ensure that these funds are fully allocated. Distributing aid in per capita terms in this context is both a difficult and cumbersome task. It would involve determining per capita aid

allocations for each recipient which are not only consistent with the previously mentioned objectives, but also with a fully committed total pool of absolute bilateral aid funds. A more likely and less cumbersome process would simply be to determine aid amounts in absolute terms, after taking in account country size as one determinant of allocation. Aid decision-makers may well be aware of the corresponding per capita amounts, and may well adjust absolute amounts on this basis, but this is a response to country size. In this context, per capita aid allocations are viewed as the outcome of this process rather than the prime consideration. This line of reasoning is consistent with the assertions of Levitt (1968), Isenman (1976), Gulhati and Nullari (1988) and McGillivray and Oczkowski (1992) that the use of absolute ODA is a closer approximation to aid allocation in practice.[21]

Isenman (1976, p.637) further argues that the use of per capita aid gives "too much weight" to small countries. This becomes very evident if one examines, for example, 1987 British ODA allocations. Per capita bilateral ODA commitments to Vanuatu and the Seychelles were US$ 44.44 and 27.69 respectively. Those to India, Bangladesh and Pakistan were US$ 0.34, 0.68 and 0.16 respectively (OECD, 1989b). Clearly, it would seem somewhat tenuous to argue that the humanitarian, commercial and political importance Vanuatu and the Seychelles would be of such relative magnitudes to justify the differentials between their ODA receipts and those of the India, Bangladesh and Pakistan. Furthermore, given the often very small sums involved, allocating aid on a per capita basis requires very fine differentiation between aid amounts. It would also seem tenuous to argue that British aid decision makers so finely

differentiate between amounts as to consciously decide to allocate the equivalent of 0.007, 0.009 and 0.010 US dollars in ODA per capita in 1987 to the Philippines, Brazil and Algeria respectively, or, for that matter, to consciously deliberate between allocating 2.235 US dollars per capita to Papua New Guinea and 2.268 dollars per capita to Zimbabwe (*Ibid.*) As already stated, these amounts would appear to be outcomes of a decision-making process primarily concerned with absolute amounts.

III(b) FURTHER ASPECTS OF MODEL SPECIFICATION: CHOICE OF EXPLANATORY VARIABLES

(i) *Separation of Recipient Need and Donor Interest Variables*

The separate estimation of recipient need and donor interest models is methodologically flawed. The approach suffers from specification error due to the omission of relevant variables. Unless it can be shown that the omitted variable(s) is orthogonal (totally uncorrelated) with all included variables, the expected value of the error term is a function of the latter and hence non-zero. OLS regression analysis in this situation yields biased estimates of slope coefficients and their variances and of the variance of the error term. As a consequence, the analysis provides misleading conclusions regarding the value and statistical significance of the coefficients. This bias will also be present in the limited dependent variable models.

Separate estimation of the recipient need and donor interest models is likely to be prone to specification error since it does not allow for a situation where a donor determines its aid allocations on the basis of both recipient need *and* its

own self-interests. Indeed, if one accepts that both recipient need and donor interests influence aid allocation, as McKinlay and Little and others hypothesise, then one must accept that these models are misspecified and that the results obtained from them will potentially be misleading. In other words, specification error is inherent in the very methodological approach adopted by these studies.[22]

The problem of specification bias is equally applicable to developmental models estimated by Davenport (1970), Edelman and Chenery (1977) and their counterparts, as outlined above, given their exclusion of donor interest and other potentially relevant variables. On the same grounds, it is also applicable to narrowly specified biases models such as that estimated by Dowling and Hiemenz (1985), their treatment of Middle Eastern and Socialist countries notwithstanding. Indeed, if one accepts that the donor interest variables dominate aid allocation (although as argued below the basis on which this conclusion has been drawn is flawed), then non-inclusion of these variables is more serious than non-inclusion of recipient need variables in donor interest models.

To further examine this issue, we estimated a recipient need model identical to that of Maizels and Nissanke (1984), as in equation (6) above.[23] Our objective is to see whether the estimates obtained from this model are actually robust with respect to the inclusion of donor interest variables. As is common in issues relating to model specification, our interest is whether the corrected functional fits improve markedly and whether coefficients change significantly.

Like Maizels and Nissanke, we used the average 1978-80 per capita net bilateral ODA disbursements of France, Japan, the United Kingdom and the United States. We also imposed the same restriction as Maizels and Nissanke; namely, removing $PQLI_i$ from all regressions except those reported for France. As shown in Table 4, the results obtained are reasonably similar to those reported by Maizels and Nissanke (shown in Table 2). The conclusions drawn by Maizels and Nissanke, namely the rejection of recipient need as a criterion for the distribution of ODA on the basis of the low $\bar{R}^2$s, would appear to be supported by these results.

The recipient need equation was then supplemented by three donor interest variables from equation (7). The model therefore becomes a hybrid. These variables are: donor exports to each recipient as a percentage of total world exports to that country, a political/strategic dummy taking the value of 1 or 0 and arms transfers. We adopted the approach Maizels and Nissanke with regard to the dummy variable. That is, in the cases of France and the United Kingdom, assigning a value of 1 if the recipient was a former colony or 0 if otherwise. For Japanese ODA, we assigned a value of 1 if the recipient was located in the Asian region, and for the United States a value of 1 if the recipient was located in the Western hemisphere.

Results for the hybrid model are also shown in Table 4. As one would expect, the $\bar{R}^2$s increase substantially due to inclusion of the donor interest variables. More pertinently, the estimated regression coefficients and their t ratios change. Three coefficients loose their significance, two become so that were not previously and only two that were

Table 4
Recipient Need and Hybrid Model Estimates, 1978-80 ODA

	Net Per Capita ODA Disbursements							
	France	Japan	U.K.	U.S.	France	Japan	U.K.	U.S.
Constant (α_0)	9.52* (4.41)	1.21* (3.82)	-0.13 (-0.14)	-8.14 (-1.24)	3.17* (1.80)	1.06* (3.35)	-0.95 (-1.17)	3.71* (2.12)
Population (β_1)	-0.01 (-1.14)	-0.00 (-1.07)	-0.002 (-0.46)	0.02 (0.42)	-0.001 (-0.16)	-0.004* (-2.28)	-0.005 (-1.10)	-0.004 (-0.45)
GNP per capita (β_2)	——	-0.00* (-2.56)	-0.00 (-0.54)	0.01* (3.89)	——	-0.00* (-2.32)	-0.00 (-1.38)	-0.002* (-2.02)
POLI (β_3)	-0.11* (-3.46)	——	——	——	-0.03 (-1.05)	——	——	——
GNP Growth Rate (β_4)	-0.13 (-0.53)	0.08* (1.99)	0.19 (1.39)	-0.77 (-0.79)	-0.02 (-0.13)	0.06 (1.43)	0.19 (1.56)	-0.15 (-0.60)
Balance of Payments (β_5)	0.01 (0.78)	0.002 (1.41)	-0.01* (-2.77)	-0.07* (-2.36)	0.01* (2.25)	0.002 (1.03)	-0.01* (-2.11)	0.001 (0.16)
Arms transfers (β_6)	——	——	——	——	0.19* (3.20)	0.001 (0.72)	0.28* (2.79)	0.22* (34.82)
Political & Strategic (β_7)	——	——	——	——	11.52* (6.69)	1.48* (3.54)	3.76* (5.67)	3.14* (1.96)
Exports (β_{10})	——	——	——	——	-0.005* (-2.39)	-0.00 (-0.72)	-0.00 (-1.45)	-0.001 (-1.23)
$\bar{R}^2$	0.12	0.06	0.10	0.14	0.53	0.18	0.41	0.95
F	3.70*	2.23*	3.26*	4.25*	14.33*	3.57*	9.14*	217.29*
n	83	83	83	83	83	83	83	83

*: significantly different from zero at the 90 percent confidence level.

Table 5
F and Likelihood Ratio Tests

Donor	F	LR
France	1.49	6.54
Japan	2.61*	11.11*
United Kingdom	3.48*	14.37*
United States	1.25	5.50

* - significant at the 90 confidence level.

significant remain so.[24] Table 4 also provides F statistics testing for the overall significance of the recipient need model. Maizels and Nissanke did not report F statistics for any of their regression equations. Specification and other econometric problems aside, these would have been a better basis for rejection of the recipient need model (we return to

this issue below). If those reported in Table 4 are any guide to what Maizels and Nissanke may have obtained, perhaps they should not have as hastily rejected recipient need as a criterion for aid allocation.

The question of the significance of the RN variables should, anyhow, be pursued with reference to the hybrid model.[25] Since this model is more comprehensively specified it provides a better basis for hypothesis testing. The null hypothesis tested was that the recipient need variables in the hybrid model in Table 4 play no role in determining per capita net ODA allocations: that is H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$. The results are shown in Table 5, an asterisk indicating that the null is rejected at the 90 percent confidence level. Based on these results, which have been obtained from the same set of recipient need variables used by Maizels and Nissanke, the same dependent variable relating the same period and using the same method of estimation, the general conclusion is that need ought not have been so universally rejected as a criterion for bilateral aid allocation.[26]

Table 6 shows estimates of Table 3's hybrid model using alternative measures of the aid variable. Not unexpectedly, rather different results were obtained when absolute, as opposed to per capita, average 1978-80 ODA is used. In particular, much higher $\bar{R}^2$s and F statistics are almost always obtained when absolute ODA is the dependent variable, be it in terms of disbursements or commitments. Note also that the results do differ between disbursement and commitment data, seemingly confirming our earlier comments regarding the use of commitments versus disbursements.

Table 6
Hybrid Model Estimates, 1978-80 ODA

		Absolute ODA Disbursements				Absolute ODA Commitments			
		France	Japan	U.K.	U.S.	France	Japan	U.K.	U.S.
Constant	(α_0)	10.20* (2.30)	20.02* (2.03)	3.98 (1.30)	45.01* (1.93)	13.76* (2.09)	28.61 (1.53)	0.48 (0.07)	49.50 (1.35)
Population	(β_1)	0.01 (0.63)	0.03 (0.46)	0.26* (15.35)	0.11 (0.88)	0.05* (1.89)	0.05 (0.43)	0.49* (13.67)	0.35* (1.80)
GNP per capita	(β_2)	——	-0.01* (-2.94)	-0.003* (-2.75)	-0.02* (-2.02)	——	-0.02* (-2.60)	-0.01* (-1.94)	-0.03 (-1.54)
PQLI	(β_3)	-0.15* (-2.24)	——	——	——	-0.21* (-2.13)	——	——	——
GNP Growth Rate	(β_4)	-0.30 (-0.61)	1.12 (0.75)	-0.62 (-1.33)	1.53 (0.46)	-0.05 (-0.06)	2.28 (0.81)	0.23 (0.23)	4.37 (0.85)
Balance of Payments	(β_5)	0.01 (0.96)	0.06 (1.39)	-0.01 (-0.33)	0.14 (1.37)	0.02 (0.77)	0.11 (1.30)	-0.003 (-0.11)	0.16 (1.01)
Arms Transfers	(β_6)	-0.24 (-1.58)	0.04 (1.11)	0.44 (1.15)	0.87* (10.33)	-0.40* (-1.81)	0.07 (1.02)	0.41 (0.49)	0.58* (4.44)
Political & Strategic Interests	(β_7)	33.15* (7.65)	61.10* (4.69)	15.74* (6.23)	-8.29 (-0.37)	38.78* (6.02)	91.48* (3.71)	23.52* (4.35)	-14.05 (-0.40)
Exports	(β_{10})	0.03* (6.41)	0.004 (0.64)	-0.001 (-0.77)	0.003 (0.40)	0.05* (6.14)	0.01 (1.31)	-0.004 (-1.00)	0.005 (0.38)
$\bar{R}^2$		0.75	0.40	0.81	0.59	0.69	0.34	0.75	0.20
F		35.81*	8.67*	49.57*	17.82*	26.69*	7.04*	35.82*	3.98*
n		83	83	83	83	83	83	83	83

*: significantly different from zero at the 90 percent confidence level.

(ii) *General Criteria for the Selection of Explanatory Variables*

Mosley (1981), in a comment critical of McKinlay and Little (1979), raised two issues. One of these issues (we consider the other below) relates to the choice of variables representing relative need. Mosley was of the view that McKinlay and Little's selection of variables were poor measures of need, arguing per capita income growth to be

especially inappropriate, since according to this variable Switzerland would at that time have been among some of the neediest countries in the world.

Mosley's argument is, however, flawed. First, it is inappropriate to use Switzerland as an example. Switzerland is not a developing country and is therefore ineligible for aid. Even if it by accident was, donors would be most unlikely in the extreme to even consider giving this country aid. In other words, it would at no stage enter the aid decision making process, and as such its income growth rate would be quite irrelevant. Second, a multiple regression considers growth holding other factors constant - that is the coefficient measures how much aid is given to a country on account of its growth rate compared to another country with a different growth rate but comparable in other respects. A final, and perhaps most serious point, is that it is not the basis on which Mosley would allocate aid among developing countries that is relevant. As the bureaucratic/incremental models imply, what it is relevant is those variables which the *aid decision makers* are likely to use. Whether these variables are good, bad or terrible indicators of need is quite irrelevant.

As Gulhati and Nallari (1988) argue, the emphasis ought to be on the "crude rules of thumb" used by those who make aid allocation decisions. Allocating aid across a range of likely recipients in a manner consistent with policy objectives is not necessarily straightforward, especially if the number of countries involved is large. Not only is this an argument in favour of using a lagged dependant variable, but that the range of regressors should be reasonably parsimonious and

utilise common, widely used and published indicators (such as GDP growth). With regard to the number of regressors, is the case that donors would finally juggle say between eleven variables, as the Bowles (1989) and Wittkopf (1972) models suggest in determining aid allocations across a given sample of countries? One would think not.

Moreover, if the data published by donor agencies are a guide, then a case can be made for the utilisation of reasonably simple indicators. This would favour use of absolute level variables rather than shares or ratios, and hence the underlying hypotheses relating to gross importance of recipients rather than the intensity of relations with recipients. Indeed, more generally, gross importance is probably more appropriate in considering economic variables. For example, a number of the studies surveyed above use exports to the given recipient as a percentage of total world exports to that country. This procedure produces a number of anomalies and would surely be ruled out by aid decision makers. A quick examination of British trade ties highlights this. For example, in 1985 British exports accounted for 2.60 percent of the value of world exports to Comoros, which was twice the equivalent percentage for the Peoples' Republic of China. Yet, the total value of British exports to China in 1985 was 515 million US dollars, 515 times that of the value to Comoros. Similarly, British exports to Singapore and Lesotho in 1985 were the equivalent of 15.5 and 16.00 percent of the value of total world exports to these countries respectively, and yet the respective values of British exports to these countries were 3.89 billion and 4 million US dollars (IMF, 1986).

Numerous other cases of seemingly inappropriate choices of explanatory variables can be found. For example, Grilli and Riess in their above cited paper computed an index unique to their study. Modelled around the UNDP's Human Development Index[27], this index is defined as the residual of a weighted arithmetic average of index values of four variables, life expectancy, infant mortality, calorie intake, and real GDP growth, each of are scaled between 0 and 1. This index may well be a valid, incisive and superior indicator of development levels. It may even be an index on which donors ought to base aid allocation decisions. As such, it is both an interesting and indeed appropriate measure on which and evaluation of aid allocation decisions. In the context of explaining aid allocation decisions, however, such an index is of little value unless donors happen, by chance, to use a highly similar index. Indeed, at a more general level, the crucial distinction between evaluating and explaining aid allocations seems not well understood in the literature.

III(c) SIMULTANEITY

The issue of simultaneity (endogeneity or bidirectional causality) between aid and recipient country economic variables has featured heavily in the literature in the macroeconomic effectiveness of aid. Yet it has received precious little attention in the aid allocation literature. This is unfortunate since error terms and endogenous variables of an equation may not be independent in a simultaneous system, so that OLS estimation produces biased and inconsistent results. We now highlight three instances in which simultaneity has either been suggested or is likely to be prevalent.

(i) *Recipient Economic Variables*

This potential problem was the second issue discussed in Mosley (1981). Mosley argued that one the explanatory variables in McKinlay and Little's (1979) recipient need model, GDP per capita, is likely to both affect and be affected by aid inflows. Since McKinlay and Little used OLS, Mosley argued that one should not infer from their study that humanitarian criteria play no significant role in determining US aid. Mosley proposed the use of two-stage least squares. In the first stage, OLS is used to estimate a reduced form equation to obtain fitted values for per capita income. These values are then used (instead of actual values) to obtain estimates of the recipient need model.[28] The only other aid allocation studies to explicitly consider simultaneity were those of Bowles (1987, 1989). In the latter study, Bowles tested for simultaneity between $(A/POP)_{it}$ and SY_{it-1}, ΔSY_{it}, GR_{it-1} and AOD_{it-1}. In each case, the presence of simultaneity was rejected.

Mosley's comment and Bowles' tests notwithstanding, there is little justification for expecting that simultaneity may exist between aid allocations and recipient economic and other relevant variables. Indeed, both Bowles and Mosley have overlooked a very simple operational aspect of aid allocation. Consider aid and recipient income. There is certainly a case for expecting that aid affects recipient national income, as much of the aid effectiveness literature holds. Indeed, as Mosley (1981) himself notes, there "would (otherwise) be no economic logic in giving aid!". In the context of explaining aid flows, this is not a relevant issue. The scenario implicit to aid allocation models is one where donors determine these

flows on the basis of information currently available. This is the notion underlying the lags assigned to regressors, as originally implemented by Kato (1969), where, for example, current aid is *inter alia* a function of lagged income. Clearly, it is impossible for current aid to have any effect whatsoever on previous years' income levels.[29] Assuming for the moment that lagging time dependent regressors is appropriate on theoretical grounds, then one must concede that simultaneity is not an issue. This of course deems Bowles' tests for simultaneity with the lagged regressors unnecessary, including that for AOD_{it-1} (total aid from other donors).

Another interpretation is that aid allocation decision makers base decisions on their expectations of variables. To illustrate, assume that a donor decides to allocate aid solely on the basis of its expectation of per capita income for period t, thus;

$$A_{it} = \alpha_0 + \beta_1 YCAP^e_{it}. \qquad (28)$$

The question now turns to the grounds upon which $YCAP^e_{it}$ is determined. Of course, there is quite a literature in economics on the formation of expectations. Notwithstanding, one approach, most probably valid, is to assume that the expectation is formed on the basis of the previous (or most recently available) observed actual data, thus:

$$YCAP^e_{it} = \lambda_0 + \lambda_1 YCAP_{it-1} \qquad (29)$$

Substituting (29) into (28) of course results in an estimating equation with a lagged regressor and simultaneity remains unproblematic.[30]

Yet another alternative, also not considered in the aid allocation literature, would be to assume that donors take

into account the expected incremental impact of their aid. Again assuming that the only recipient characteristic taken into account in per capita income, this suggests the following:

$$YCAP^{e}_{it} = \lambda_0 + \lambda_1 YCAP_{it-1} + \lambda_2 A_{it} \qquad (30)$$

where λ_2 is the expected incremental affect of aid. In this event, $YCAP^{e}_{it}$ both affects and is affected by A_{it} and, therefore, simultaneity certainly must be accounted for in estimation. While possibly an interesting area for future research, justification for this approach would require some evidence that donors actually do take into account the expected impact of aid. This is perhaps unlikely in the case of smaller aid donors, or more generally, where the given donor's aid is small relative to the size of the recipient economies.

(ii) *Total Aid*

There are two rather different possibilities for endogeneity in the context of the models surveyed. The first relates to the total amount of aid available for distribution in the current year. As mentioned, Bowles (1987, 1989) used this variable (denoted $TEECA_{it}$ in the 1992 study) as a regressor. The crucial issue in this context is whether this variable is determined <u>prior</u> to allocations to individual countries, without consideration of those variables which would normally affect the manner in which aid is allocated among countries. In this situation, aid allocations are essentially constrained by an adding-up condition, that is, their sum must not exceed the total amount of aid available for distribution. (This is the type of budgetary process envisaged above in our discussion of the choice between per

capita and absolute aid). If this procedure is the actual decision making process of the donor, then one can reasonably conclude that there is not simultaneous causation between total aid and that to individual countries.

A possible weakness with this argument, however, is ambiguity over the total amount of aid "available for distribution". Is this the total amount of aid allocated to the aid program, or is it the total amount of bilateral aid to be allocated under this program? After all, donors invariably have two main components of their overall aid programs: bilateral aid and multilateral aid. For the studies cited above, the important component is bilateral aid. If this component is predetermined, then simultaneity between total aid available for distribution and individual country allocations does not arise. However, it could well be the case that a donor may decide to determine the share to be allocated bilaterally on the basis of the humanitarian, commercial and political importance of chosen recipients. There may be some notional upper limit to the amount of bilateral aid to be allocated and this should not be significantly exceeded. However, the total amount of bilateral aid distributed to all countries will in the final analysis be determined on the basis of the characteristics of recipients. What remains is then allocated to multilateral institutions. Under this scenario, simultaneity will exist between the total amount of aid available for distribution (total bilateral aid) and that allocated to each country, thus invalidating the use of OLS and the maximum likelihood techniques discussed above.

(iii) *Other Aid*

The remaining possibility for simultaneity relates to current aid from other donors. Recall that Dudley and Montmarquette (1976, 1978) used this variable as a regressor indicating a possible bandwagon effect in aid allocation. Given informational time lags, a donor can respond to aid flows from other donors if there is discussion among donors at the time their allocations are determined. Co-ordination between donors has been a DAC policy issue for some years. Such coordination will give rise to the joint determination of aid flows, and thus of simultaneity between current aid from the donor under consideration and that from other donors.[31] If this was the case during the period to which Dudley and Montmarquette's estimates are possibly biased and inconsistent. Moreover, the possibility of joint determination of aid flows and the resultant need for systems estimation is another consideration for future research. Alternatively, if joint determination is deemed unlikely, but it is still thought that donor's pay attention to other donors' aid, then lagged other aid would seem appropriate (as used by Wittkopf (1972), Bowles (1987, 1989) and McGillivray and Oczkowski (1992)).

III(d) ADDITIONAL STATISTICAL ISSUES

(i) *Country-specific Time Series Data*

The use of time series data (as in Eggleston (1987), Gulhati and Nallari (1988), Gang and Khan (1989) and Gounder (1991)) is beneficial in that it allows recipient country-specific analyses, avoiding some of the often restrictive assumptions underlying cross country analysis (in particular, that the regression coefficients are fixed across all

countries in the sample employed). Like all regression analysis, the reliability of the information conveyed by these studies is subject to the appropriateness of the econometric techniques employed.

There is, however, at least one basis for doubting the reliability of the results reported by these studies, which is the context in which an individual country's aid recipient is determined. Aid flows to any specific country, or region, are not usually determined in isolation from those to other countries. Indeed, if one accepts the argument that a given recipient's aid is allocated from a predetermined pool of total funds, then it must follow this country's aid is jointly determined along with that to other recipients. This is in the sense that any positive allocation to this country will lessen the amount of funds available for other countries. In this situation, the error term of the regression equation for the chosen country (or region) will be correlated with the error terms of equations describing aid to other countries (or regions). If OLS (or most other estimators) are used the results will be inefficient estimates of the regression coefficients. Provided that the regressors are exogenous, an appropriate estimation procedure is the Seemingly Unrelated Regressions (SUR) method.[32] Until this, or another suitable alternative method is used, one should exercise caution over the results of the time series analysis.[33]

(ii) *Region and category specific Data*

The preceding argument also applies to region- and category-specific (that is, grants, loans, food aid and so on) cross country aid data. For example, is United States aid to

Latin America or DAC aid to Eastern and Southern Africa (as used by Gang and Lehman and Gulhati and Nallari respectively) determined independently of aid to other regions? For example, does an increase in US aid to Latin America in a given year dictate a reduction in aid to other regions?, as would be the case if total US aid was a predetermined pool. Similarly, as intimated above, are ODA grants and ODA loans, or even concessional and non-concessional aid flows (ODA and OOF) to individual countries determined independently? As shown above, the separate application of aid allocation models to various ODA categories has been extremely common in the literature. If the answer to these questions is "no", then the results of these studies are also likely to be misleading due to biased regression coefficients.[34]

(iii) *Pooled Data*

It is not uncommon in the literature to pool cross country data over time, as in Dowling and Hiemenz (1985), Eggleston (1987), Bowles (1987, 1989), McGillivray and Oczkowski (1991, 1992) and McGillivray (1992). The regression models outlined above (implicitly) assume that both the intercept term and slope coefficients remain unchanged over time (that is, $\alpha_{0,t} = \alpha_{0,t+1} = \ldots = \alpha_{0,t+k}$ and $\beta_{j,t} = \beta_{j,t+1} = \ldots = \beta_{j,t+k}$). Estimated coefficients will be misleading if either of these assumptions are incorrect.

The first of these assumptions will be violated if aid flows increase over time in a manner independent of recipient country characteristics (say due to an increase in the total amount of aid available for distribution). The second assumption will be violated if there is a change in the manner

in which aid is distributed, with, for example, donors deciding to shift aid from highly populated countries to lowly populated ones, or from those whose prospects for development are poor to those whose prospects are good or to favour a particular region (as has been the case for sub-Saharan Africa during the 1980s). Given that such shifts have been common in practice, it is clearly imperative that tests for the appropriateness of pooling be conducted and, when required, corrections made. Regrettably, there have been four instances only where these issues have been considered: Dowling and Heimenz (1985), McGillivray and Oczkowski (1991, 1992) and McGillivray (1992).[35] Dowling and Heimenz and McGillivray included intercept dummies to pick-up changes in aid over time. McGillivray and Oczkowski explicitly tested the null that $\beta_{j,t} = \beta_{j,t+1} = \ldots = \beta_{j,t+k}$, rejecting this hypothesis for UK ODA.

(iv) *Sample Selection*

The notion of limited dependent variables has profound implications for the aid allocation literature, from which very few studies based on cross country data are exempt. This will remain as such while there are developing countries who are denied aid, or as McGillivray and Oczkowski hold, denied "significant" aid allocations. Here we further consider the basis of, and justification for limited dependent variable techniques. This largely turns on the inappropriateness of OLS in the context of these variables.

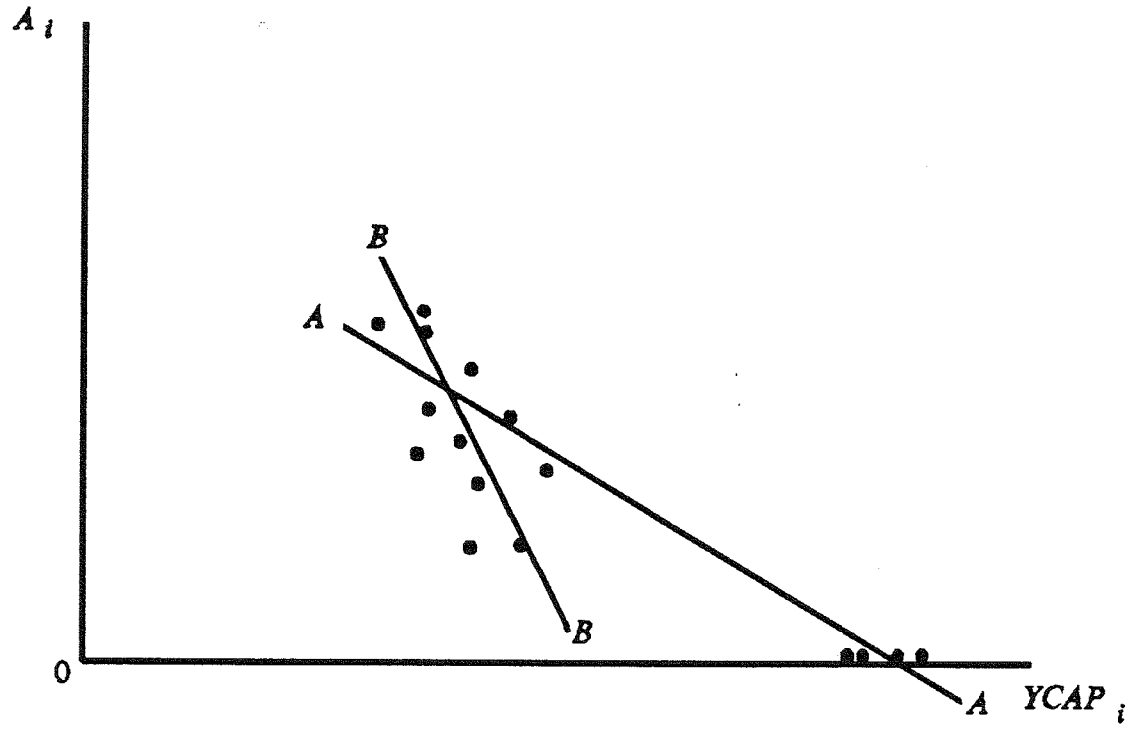
Except for the limited dependent variables studies, most aid allocation studies have been rather vague about the basis for sample selection. Data availability issues aside, there

are a number of approaches one could use, such as including: (i) all developing countries in the sample, irrespective of whether they have received aid or not; (ii) actual recipients only; (iii) recipients which have received aid allocations above some arbitrary quantitative threshold (or "principal" aid recipients); (iv) those belonging to some predetermined country list (such as those included in the detailed statistical tables of the *World Development Report* or those for which detailed data are available in the OECD's *Geographical Distribution of Financial Flows to Developing Countries*) and; (v) countries of special interest (for example, those located in some region or belonging some political grouping). If OLS is used, each of these criteria are highly problematic.

Consider including all developing countries in the sample, irrespective of whether they have received aid. This procedure results in misleading estimates of the regression coefficients, as demonstrated in Figure 1. We again assume for simplicity that the aid allocation is a function of per capita income alone. The hypothetical situation depicted in Figure 1 is one where four countries receive zero aid. The line of best fit with these countries included in the regression sample is *AA*. However, the "true" regression line, without these zero aid observations, is *BB*. In this situation, therefore, the slope coefficient is underestimated.

Of course, one could simply exclude the zero aid observations from the sample and hence include actual recipients only (as one expects most studies have done), or those who have received aid of at least some threshold value

Figure 1
Hypothetical Regression Lines



(as in options (ii) and (iii)) above. Analytically, there is little difference between these options as the threshold could be zero. Let's assume that some threshold is adopted, denoted Z. This option, however, is equally problematic. To demonstrate, consider a regression based on per capita income alone:

$$A_i = \alpha + \beta YCAP_i + \mu_i \qquad (31)$$

where $A_i \geq Z$ and $\beta < 0$. This implies that:

$$\beta YCAP_i + \mu_i \geq Z \quad \text{or} \quad \mu_i \geq Z - (\alpha + \beta YCAP_i) \qquad (32)$$

Clearly, by truncating A_i, $E[\mu_i \mid \mu_i \geq Z - (\alpha+\beta YCAP_i)]$ is not equal to zero, being a function of $YCAP_i$. The error term is therefore correlated with $YCAP_i$, and applying OLS to (31) provides misleading estimates of β. Since $\beta < 0$, $E[\mu_i \mid \mu_i \geq Z - (\alpha+\beta YCAP_i)]$ increases with increases in $YCAP_i$. OLS estimates of β are, therefore, upward biased.[36]

The outcome just demonstrated is an econometric basis for using the Tobit estimator which provides unbiased estimates of regression coefficients when the dependent variable is truncated as above. Unfortunately, the story does not end at this point: even if we ignore truncation as described, OLS will be likely to yield biased results if non-random self selectivity is present in the data. This leads to sample selection bias and forms a justification for the sample selection models estimated by McGillivray and Oczkowski (1991, 1992), but not that of Dudley and Montmarquette (1976, 1978).[37]

To demonstrate the implication for aid allocation models, consider the following equations in which we again assume that aid is solely a function of per capita income:

$$E_i = \alpha_1 + \beta_1 YCAP_i + \mu_{1i} \quad (33)$$

$$A_i = \alpha_2 + \beta_2 YCAP_i + \mu_{2i} \quad (34)$$

where E_i represents an index of the eligibility for aid, A_i is the amount of aid received and β_1, $\beta_2 < 0$. As such, equations (33) and (34) are a simple general representation of the sample selection models outlined in Section II.[38] Now assume that $A_i > 0$ (or, more generally, observed) if $E_i > 0$ (or some other threshold). In this case:

$$E(\mu_{1i} \mid A_i > 0,\ E_i > 0) = E[\mu_{1i} \mid \mu_{1i} > (\alpha_2 + \beta_2 YCAP_i)] \quad (35)$$

which is clearly not zero.[39]

The Tobit procedure will be valid in the case of self selectivity if it can be shown that the joint density of μ_{1i} and μ_{2i} is a singular normal density ($\mu_{1i} \equiv \mu_{2i}$), an identical vector of variables determines both eligibility and actual aid allocations for all i, and $\beta_{1i} \equiv \beta_{2i}$ (Heckman, 1979). That is,

aid eligibility and amounts are determined jointly, with no separation of the decisions.[40]

Heckman (1979) argues that sample selection bias may arise in practice for two reasons. First, there may be self selection inherent in the data.[41] Second, sample selection decisions may be made by those undertaking the study in much the same fashion as self selection. Both reasons are highly relevant to aid allocation. If there indeed is a separate eligibility decision, donors may well decide to allocate aid only to countries whose per capita income is below some threshold (as Figure 1 implies), or to those whose population is above some threshold, or those with specific political associations: that is, selection is inherent in the data. Alternatively, as in approaches (v) and (iv) above, it could be that researchers deliberately exclude countries from a specific regions from their analysis, irrespective of whether they have received aid, or those belonging to some predetermined list.

In each of the two cases just noted OLS and, unless the previously mentioned conditions are satisfied, Tobit will produce biased results. Analysis of, and allowance for eligibility decisions is therefore more than of intrinsic value: it can be a matter of statistical necessity. Moreover, the choice between Tobit and the more complex sample selection models ultimately depends on how one views the aid allocation process. If one believes this process to be one of two distinct components, the first determining eligibility with the second determining amounts to eligible countries, then one should use the sample selection techniques. Alternatively, if

one believes that eligibility is implicit to amount determination, then one should use Tobit: but this prior belief can and should be tested against the actual data.

(v) *Diagnostic Tests*

Since the first aid allocation studies have appeared in the literature a number of diagnostic tests have been developed for violations of the assumptions on which OLS estimates are based. These are easily accessible in most statistical computer programs. Yet despite this, there has been very little diagnostic testing in aid allocation studies. Indeed, the norm has been to provide no tests at all.[42]

A number of specific diagnostic tests would seem most warranted. The first relates to heteroscedasticity, where the regression equation error term does not have a constant variance. In this event, the variances of the regression coefficients are biased, thus invalidating tests of significance. Heteroscedasticity is typically present when using cross section data. This is especially the case when those data relate to countries, given large variations in economic and demographic data.[43] It is therefore essential that appropriate tests be conducted, and remedial measures be taken, otherwise one can have little or no faith in the results of the study.[44] Of those studies outlined, only Bowles (1987, 1989), Grilli and Reiss (1992), McGillivray (1986, 1991) and McGillivray and Oczkowski (1991, 1992) consider heteroscedasticity.

A number of other common tests could be applied, including Ramsey's RESET test and, for time series analyses,

tests for serial correlation, stationarily and cointegration.[45] Another specification test is that proposed by Bera and McAleer, which can be used to discriminate between log-linear and linear models (see Maddala, 1989: 179-180). Given that these are very much competing specifications in the aid allocation literature, it would seem appropriate to formally test for their applicability. None of the studies surveyed has used this test or an alternative.

(vi) *Data Reliability*

There is a general scepticism over the reliability of data on developing countries due to measurement error and, as a consequence, of the reliability of results from applied studies. We are all aware of the truism that results can only be as valid as the data on which they are based. With one exception, this scepticism is however misplaced in the context of the aid allocation literature. A point already made is that aid allocation decisions can only be based on information available to decision makers. Since it is these decisions that aid allocation studies are attempting to model, it makes no difference whether the data are accurate or not. This, however, is on the proviso that the studies use the same, or not significantly dissimilar, data. If data published by donors themselves are any guide, then this would not seem problematic. These data, like those used by the aid allocation studies, are typically those published by the leading international institutions such as the OECD, the World Bank, the IMF and the United Nations. Alternatively, if donors actually disbelieve these data and make significant, unannounced revisions, then the perception of data unreliability is a real problem.[46]

(vii) *Miscellaneous Shortcomings*

In addition to those already referred to in Section II, there are a number of other statistical shortcomings of the explanatory literature. Unlike most outlined above, these are largely problems of commission rather than omission. We highlight three problem areas.

A common tendency is for studies using cross section (country) data to report the Durbin-Watson (DW) statistic, a well known diagnostic statistic for autocorrelation.[47] These studies include Mosley (1980), Maizels and Nissanke (1984) and Tsoutsoplides (1991). Unfortunately, unless there is some ordering of the observations, this statistic is meaningless in the context of cross-section data. Altering the order in which the observations appear changes the value of the DW statistic, and yet does not alter the regression coefficients and their standard errors (and hence also *t* ratios), F statistics, the R^2s and so on.[48] If the data <u>do</u> follow some order (for example, being sorted by income per capita) then autocorrelation may be symptomatic of misspecification (most commonly functional form) - but such an interpretation has not appeared in the literature.

Another criticism of some studies is what can described as somewhat "odd" interpretation of regression coefficients based on *t* ratios. Two cases blatant cases are worth highlighting. The first occurs in Bowles (1987). Bowles found that a significantly negative correlation existed between British exports and per capita aid. The explanation offered for what was thought to be a surprising result was that a number of principal aid recipients (Bangladesh, Sudan, Sri

Lanka, Tanzania, and Zambia) were involved in relatively little trade with Britain compared to recipients of smaller aid allocations (Nigeria, Hong Kong and Singapore). Yet this is not an explanation at all; it simply restates the information given by the correlation.

The second, more serious case occurs in Gulhati and Nallari (1988). In their interpretation of regression results, variables were classified as follows: (a) "relevant" variables, whose coefficients displayed the "right" sign but were insignificantly different from zero at less than the 80 percent confidence level; (b) "significant" variables, whose coefficients were significantly different from zero at 90 percent level of confidence; (c) (slightly more) "relevant" variables, whose coefficients displayed the "right" sign but were insignificantly different from zero at less than the 90 percent confidence (but significantly different from zero at the 80 percent level), and; (d) "irrelevant" variables, whose coefficients display the "wrong" sign. There are a number of problems with this classification system, in addition to it being somewhat cumbersome. Firstly, and most seriously, it is statistically mischievous, having advocated the use of regression analysis, to dismiss a variable as irrelevant because its coefficient displays the wrong sign, especially if it is significantly different from zero. It should only be judged irrelevant or relevant on the basis of hypothesis tests (*t*, F or LR) relating to it being significantly different from zero or being significantly negative or positive. This remark also applies to Gulhati and Nallari's (a) and (c) classifications. In general, one chooses a confidence level (typically no less than 95 but occasionally 90 percent) and

judges a variable as being relevant/irrelevant on the basis of the relevant statistic reaching the corresponding critical level. Of the 217 coefficients reported by Gulhati and Nallari, 112 fall under categories (a) and (d), and 12 under (c).

Finally, there is a common tendency to judge the performance of models based on $\bar{R}^2$s, especially among the recipient need/donor interest studies. This can be misleading, especially if sample sizes vary. For any given set of explanatory variables, $\bar{R}^2$s tend to decrease as the sample sizes increase. For this reason, it is more appropriate to look to the significance of the $\bar{R}^2$ as measured by the usual F statistic, or similar hypothesis tests for the equation as a whole such as an appropriate likelihood ratio test. Moreover, without the use of an F statistic, deciding between acceptable and unacceptable $\bar{R}^2$ is inherently an arbitrary judgement. This point is emphasised by the recipient need and donor interest models reported above in Table 3. Using the implied rule of thumb applied by Maizels and Nissanke (1984), these would be deemed unacceptably low leading to the rejection of need of a criterion for aid allocation, when the F statistics indicated quite the reverse.

IV(e) THEORETICAL ISSUES

(i) *More on Time Lags*

Our earlier discussion of simultaneity assumed that lagging time dependent variables, as was the practice of Kato (1969), Wittkopf (1972) and others, was appropriate on theoretical grounds. We now evaluate this assumption. Given

budgetary realities, aid allocations (especially commitments) are, as Kato argues invariably determined and sometimes even announced during the year preceding that to which they relate.[49] Thus, even if one ignores informational delays, time lags are warranted since aid allocation decisions, either directly or indirectly via the formation of expectations, can only be made on the basis of currently available data. On these grounds, a one year lag is warranted. Further, given the delays in the dissemination of comparable developing country economic and social data (typically no less 12 to 18 months)[50], lags of at least a further year would seem warranted.

The problem is further complicated by the practice of many donors to determine allocations on the basis of various fiscal periods, given the publication of developing country data often relating to calendar years. Generally speaking, the earlier in the calendar year does the fiscal year end, the longer are the informational lags likely to be. For example, an aid allocation relating to the year ending June 30 1993 would typically be determined sometime in the period March to April of 1992. It could be the case that 1991 calendar year data may not have been finalised by then, with the 1993 fiscal year allocation therefore being a function of 1990 data. Alternatively, if the allocation was determined later in the year, as would be the case with calendar year allocations, then such data would presumably be available and a 2 year lag would seem appropriate.

The conclusion arising out of the preceding comments is, of course, that current aid cannot be a function of current,

time dependent variables. In principle, correlations between these variable are therefore spurious. Whether in practice this is of consequence remains to be seen and will be dependent on the existence of an underlying stability in developing country data, both over time and across countries. A simple test for this is to regress current values of variables against their lagged values, the null hypothesis being that the regression coefficient is equal to one. Results of such a test, based on data for 94 developing countries, are shown in Table 7. As can be seen, the null hypothesis, in the context of 1, 2 and 3 year lags can be rejected in the overwhelming majority of cases. Very similar results were obtained when the dependent variable related to 1986 and 1985 data. Based on these data, it seems that lags do matter in practice.[51]

(ii) *Administrative Aspects of Aid Allocation*

The incorporation of bureaucratic influences into aid allocation models is a welcome development. Bureaucracies are important players in the aid allocation process. They are delegated the responsibility for the determination of aid allocations. It is their decisions, subject to the usual ministerial approval, which finally determine aid allocations. In effect, therefore, it is their decisions that are being modelled. It would thus seem important to consider the motives of the bureaucracy in addition to the government. Indeed, there is a literature which emphasises the importance of both aid bureaucracies and of the distinction between donor bureaucracies and donor governments. For example, White (1974, p.303) asserts, "the makings of an aid policy lie in the hands of those who administer it".[52] In a corresponding vein, Rix

Table 7
Regression Coefficients - Current on Lagged Values (n = 94)

Variable	Regression Coefficients 1 Year Lag	2 Year Lag	3 Year Lag
1989 GNP Per Capita	1.10**	1.21**	1.28**
1988 GNP Per Capita	1.11**	1.18**	1.26**
1989 Population	0.84**	1.03**	1.05**
1988 Population	1.04	1.06	1.08
1989 GDP Growth	0.42**	0.16**	0.08**
1988 GDP Growth	0.27**	0.07**	0.33**
1989 Current Account Balance	0.52**	0.52**	0.62**
1988 Current Account Balance	1.05	0.83	0.42**
1989 Total Imports from OECD Members	1.24**	1.42**	1.46**
1988 Total Imports from OECD Members	1.15**	1.18**	1.34**
1989 Private Investment from OECD Members	0.81**	-0.06**	0.44**
1988 Private Investment from OECD Members	0.07**	0.57**	2.00**
1989 Total DAC Bilateral ODA Commitments	0.77**	1.05	1.04
1988 Total DAC Bilateral ODA Commitments	1.29**	1.34**	1.25*

* - significantly different from 1 at the 95% confidence level.
** - significantly different from 1 at the 99% confidence level.

(1980, p.16) argues that "aid administration and aid administrators [are] the variables in the aid relationship which cannot be ignored". Similar comments are made by Cunningham (1974).

The previous comments notwithstanding, the efforts of the bureaucratic/incremental studies should be viewed as preliminary steps only. Clearly, while inertia is important, one wonders whether a range of other bureaucratic influences

may also not impinge on inter-country aid allocation. Moreover, is a simple lagged dependent variable an adequate representation of inertia? Gang and Khan's (1990) simple partial adjustment model is a certainly improvement in modelling inertia, but are there other more valid representations? A number of obvious representations exist in the economic literature generally, such as the various distributed lag models.[53] These questions may possibly be answered by consulting the reasonably extensive literature on bureaucratic conduct.[54] The microeconomic literature on rigidity in decision making is also worth considering.

(iii) *Recipient Country Input*

We have saved our most potentially damning criticism of the aid allocation literature to last. None of the studies comprising this literature is exempt from this criticism. As noted, the aid allocation models outlined in Section II describe a donor decision making process, irrespective of the dependent variable used. Yet it is well known that recipient countries do have input into the determination of aid flows - Indonesia's rejection of Dutch aid in 1992 because of the latter's complaints over human rights violations being one of the clearest examples. Yet the fact of recipient input into the allocation process has been totally overlooked by the literature. If it can be shown that recipients systematically affect the actual levels of aid allocated among them by all donors, then the results obtained from all studies should be rejected, irrespective of the sophistication of the estimation techniques employed.

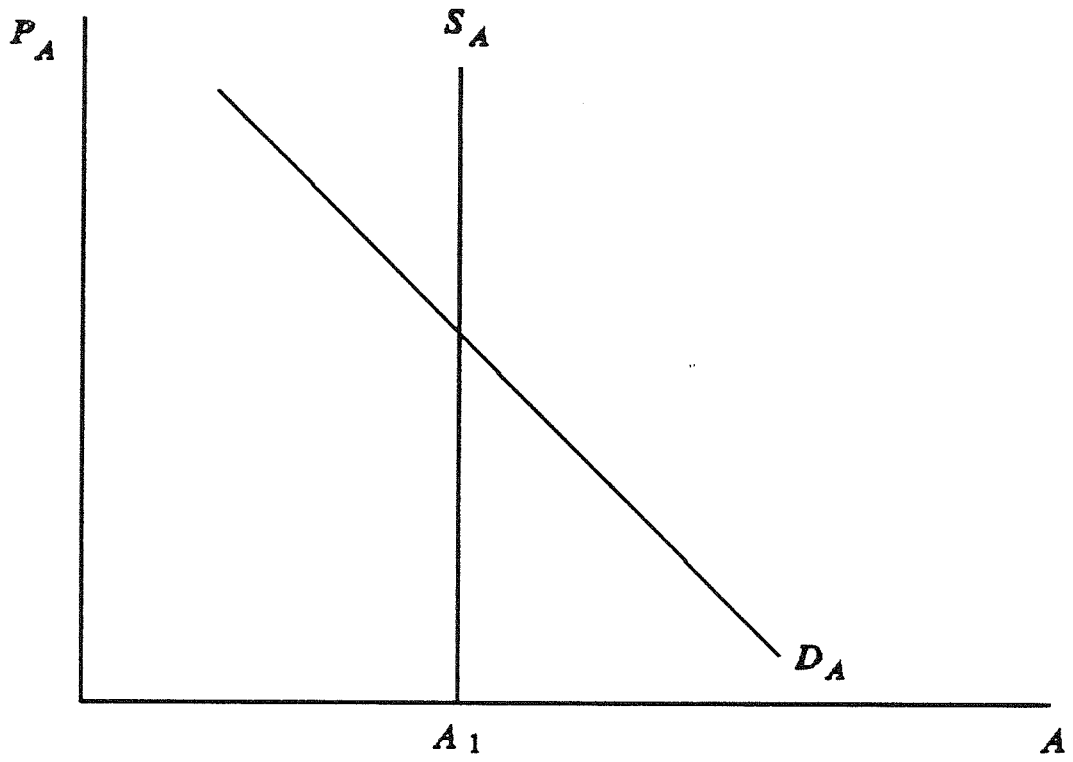
One possible means of incorporating recipient country

input into aid allocation models focusing on aid amounts would to be use an aid demand-supply framework. A starting point is to assume some unobserved endogenous "price" of aid. Supply-side donor interests and recipient need and/or performance variables would be treated (appropriately) as exogenous. Some of these variables could also be on the demand-side, as could be a range of other variables taken into account by recipients. Since the price of aid, however one may wish to define this variable, is unobserved, the demand and supply equations can be solved in terms of the aid amount to obtain a reduced form equation, which could then be estimated using an appropriate method. Alternatively, if the price of aid can be observed, one can estimate both demand and supply equations and their reduced forms using simultaneous estimation methods.

Within a demand-supply framework, however, it is not enough for recipients to have input into the aid allocation process: they must ultimately have some influence on the amount of aid that is actually allocated. In other words, the supply of aid must not be perfectly inelastic with respect to price. This scenario is presented in Figure 2, where P_A, A, S_A and D_A respectively denote the price of aid, the quantity of aid, the supply of aid and the demand for aid. In this case, given the perfectly inelastic supply of aid, the amount of aid is totally unresponsive to recipient demand, being fixed at quantity A_1. This amount, moreover, will be determined by exogenous supply-side factors only. In this event, econometric and other issues aside, the general approach used by the aid allocation literature would seem valid, being interpreted as the reduced form of an aid supply equation.

This analysis is, of course, highly simplified, ignoring

Figure 2
Aid Demand and Supply Schedules



such issues as joint determination of aid flows, eligibility decisions and so on. It is also highly speculative, and for these reasons should be treated as indicative of the sorts of issues to which future research could turn. More importantly, it also serves to emphasise a rather serious general criticism of the aid allocation literature: that the models proposed have insufficient theoretical underpinnings and as a consequence one can not only question the validity of results, but also the interpretation of these results.

IV CONCLUSION
DESIRABLE ATTRIBUTES OF AN AID ALLOCATION MODEL

We conclude by considering possible directions for future research based on what we consider to be appropriate attributes for an aid allocation model. Our focus is on the estimated model, hence this involves consideration of both

theoretical and statistical issues.

The most fundamental requirement, in our opinion, is that the model be an approximation of the operational nature of aid determination. Indeed, this is central to our criticisms of the literature. An aid allocation is not the outcome of, say, the equilibrating forces of the economy. Nor is it some abstract construction, or a phenomenon determined by the laws of physics. Our thesis is that an aid allocation is the outcome of a bureaucratic decision making process, which is subject to both bureaucratic criteria and the economic, political and other relations between the donor and recipient. Aid allocations are subject to all the sorts of pressures and constraints to which other expenditures are subject. These involve weighing-up and trading-off competing objectives, information time lags and uncertainty, ensuring that funds are fully committed and so on. Failure to consider precisely what it is that one is attempting to model will almost certainly ensure that the outcome of this attempt is at best capricious, or at worst, misleading.

Against this background, when modelling aid allocation one should:

- endeavour to use the actual decision variable as the dependent variable, not the outcome of this decision (in our view this should be absolute ODA commitments for data from 1969);
- attempt to provide a sufficiently comprehensive model specification, in particular avoiding estimating separate recipient need and donor interest models, or narrowly specified biases models;

- pay attention to the issues of eligibility and amount decisions and specify the model accordingly (for example, if a good case can be made separate decisions, a two-part sample selection model should be used);
- recognise the distinction between describing (evaluating) and explaining aid allocation (given the use of regression techniques, there is absolutely no guarantee that both can be simultaneously achieved);
- give consideration to informational time lags;
- consider whether aid allocations are simultaneously determined, both <u>across</u> donor aid programs (as may be the case if donor's current aid decisions are coordinated) and <u>within</u> donor programs (as will be the case if current aid allocations are financed from a common pool of funds);
- consider whether recipients have input into aid allocation decisions and then formulate the model accordingly;
- explore the sorts of administrative factors likely to impinge on the decision making processes;
- give consideration to the limited dependent variable and non-random sample selection issues, both of which invalidate OLS; and,
- conduct appropriate diagnostic tests.

We acknowledge that it may often be difficult to fully implement and satisfy each of these points: applied research of this nature invariably involves compromises. This is not, however, an excuse to avoid addressing the issues and continue to crudely estimate carelessly formulated regression equations. Unfortunately, this has all too frequently been the

case in the aid allocation literature.

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NOTES

1. These aspects of aid are comprehensively covered in a number of earlier qualitative studies, including Abbot (1973), Behrman (1955), Chenery (1964), Friedman (1970) and Wall (1973).

2. Levitt cites an earlier quantitative study by A.M. Strout, "Factors Affecting the Allocation of Foreign Economic Aid", which was presented to the Econometric Society Meeting in Boston during 1963. Unfortunately this paper, like the others presented during the same session, were not published in the proceedings and have not been obtained by the authors of the current paper. Although descriptive in nature, a even earlier quantitative study of aid allocation is Pilvin (1962), who looked at the percentile distribution of total aid by various categories.

3. Recipients were assigned a score based the percentage of i's votes which were on the same side as the United States. The precise nature of these scores was not reported by Levitt.

4. Kato tested models with both 2 and 3 year lags, concluding that there was "no serious disagreement" between them (Kato, 1969, p.205).

5. The expected negative sign of β_1 reflects a possible small country bias, as discussed below.

6. We define the term ODA below.

7. Grilli and Riess (1992) also reported results using per capita aid as the dependent variable in their analysis of 1971, 1980 and 1988 EC aid.

8. This justification was also used by Maizels and Nissanke (1984). We discuss this study below.

9. See Morris (1979).

10. These biases could of course also arise due to donors being allocating aid on the basis of past performance and absorptive capacity, as mentioned earlier.

11. See Ryrie (1986) for an aid administrator's perspective of this issue.

12. Kaplan (1975) looked at both US military and "economic" aid. It was analysis of the later which places Kaplan into the developmental model category.

13. We employ the notation used in Amemiya (1984) in describing Dudley and Montmarquette's general econometric model.

14. McGillivray and Oczkowski (1992) question conventional wisdom concerning the expected relationship between aid allocation and donor export flows. Aid is thought to serve donor commercial interests through the promotion of export markets for its domestic commodities. This, in turn, is achieved by increasing the exposure of exported commodities through the provision of aid. Conventional wisdom is that a donor will be likely to give to preference to countries which have previously purchased relatively large shares of that donor's total exports. One would thus expect a positive relationship between aid and exports. McGillivray and Oczkowski assert that this accords to a risk averse policy of export promotion via concentration of aid on those countries that have already revealed both the inclination and ability to purchase donor exports. It would also accord to a policy of seeking to protect or maintain important existing export markets. It was further argued, however, that aid decision-makers may alternatively pursue a more risky or aggressive policy of using aid to promote export ties with those countries which currently constitute lesser export markets. They may well be of the view that the export promotion capabilities of aid are greatest in such countries. Export commodities will generally speaking have already gained significant export exposure in larger export markets, so it would make good sense to provide aid to countries which have less exposure to these commodities. Therefore, it was argued that a negative relationship would exist between aid and donor exports.

15. McGillivray and Oczkowski (1991, 1992) formally tested for the Tobit model where, using their notation, $\alpha=\beta/\sigma$ and $\rho=0$. However, the applicability of this model was rejected for both British and Australian bilateral ODA.

16. For further details, see, for example, Gujarati (1989), pp.415-416.

17. The subjective views of researchers as to what ought to be included in aid are quite irrelevant in this context.The relevant issue is what donors themselves call "aid" since it is the donor's "aid allocation" decisions that are being explained. Indeed, if one wished to exclude some transfers from ODA, this would in effect serve to misrepresent the actual decision of donors.

18. See, for example, Bhagwati (1970).

19. A possible exception to this statement is PL480 food aid data.

20. This pool of funds is the total bilateral component of the aid program as a whole. The size of this program, or total funds allocated to it, is determined jointly with other appropriations from the donor government's budget after discussion and negotiation between the various government departments and agencies. Determinants of the size of DAC

members' aid programs have been modelled by Beenstock (1980) and Mosley (1985). Both studies found the size of these programs to be primarily a function of a range of supply-side variables pertaining to the state of donor country macroeconomy (for example, central government budget deficit, balance of payments and unemployment rate), lagged allocations and those of the international aid community.

21. In addition to those discussed above, Levitt (1968) reported estimated equations with per capita aid as the dependent variable. The R^2s obtained from these equations were disappointing, generally being below 0.10.

22. In the context of Maizels and Nissanke (1984), and putting aside other reservations, the "true" model is therefore:

$$(A/POP)_i = \pi_0 + \pi_1 POP_i + \pi_2 YCAP_i + \pi_3 PQLI_i + \pi_4 \Delta Y_i + \pi_5 (BP/Y)_i + \pi_6 ARMCAP_i + \pi_7 PDUM_i + \pi_8 TNC_i + \pi_9 M_{it} + \pi_{10} X_i + \pi_{12} SMDUM_i + \upsilon_i.$$

From equations (6) and (7) respectively, it follows that:

$$\mu_i = \pi_0 + \pi_6 ARMCAP_i + \pi_7 PDUM_i + \pi_8 TNC_i + \pi_9 M_{it} + \pi_{10} X_i + \pi_{12} SMDUM_i + \upsilon_i,$$

and

$$\mu'_i = \pi_0 + \pi_1 POP_i + \pi_2 YCAP_i + \pi_3 PQLI_i + \pi_4 \Delta Y_i + \pi_5 (BP/Y)_i + \upsilon_i.$$

The error terms μ_i and μ'_i are not therefore independent of their respective explanatory variables, except in the extremely unlikely event of each of the recipient need variables being uncorrelated with any one of the donor interest variables.

23. All data used in these and subsequent tests have been taken from Banks and Overstreet (1981), IMF (1978-90), Morris (1979), OECD (1979-90), World Bank (1984-92, 1988-91) and United States Arms Control and Disarmament Agency (1983-87).

24. For our current purposes we evaluate hypotheses using the 90 percent confidence level for both F and (two-tailed) *t* tests, which is consistent with the 95 percent level used by Maizels and Nissanke's for their one-tailed *t* tests.

25. The latter statistic is asymptotically distributed as χ^2_m under H_0, where *m* is the number of restrictions required to define the null (in this case, 4).

26. For a multitude of reasons outlined elsewhere in this paper, we emphasise that we do not in any way necessary purport these results to be representative of the actual aid allocation process. Our concern is the basis on which

conclusions have been drawn by Maizels and Nissanke (1984) and, by implication, those drawn by other studies using recipient need/donor interest models.

27. See UNDP (1992).

28. Maizels and Nissanke (1984), in a footnote, dismiss Mosley's criticism on the grounds that current aid probably affects future, and not current, income. While there is much debate in the aid effectiveness literature over the impact of aid on income, it is though unlikely that aid has absolutely no impact on current income.

29. A model could be constructed in which recipient expectations about future aid affected current economic behaviour. But we do not believe this to an avenue worth pursuing.

30. Expectations could, of course, be based on forecasts. Indeed, the expectations of recipient economic and social variables could be interpreted as forecasts, with the process which follows describing, albeit with a great degree of simplification, a process by which forecasts are obtained. Thus, rather than substituting equation (28) into (29), one could simply use actual donor forecasts as the measure of $YCAP^{e}_{it}$. While appealing, this approach would be difficult to operationalise given likely difficulties in obtaining data.

31. Note that this argument may well be equally applicable to different forms of aid. For example, as noted above, Levitt (1968) used current United States military aid ($USMA_i$) as an explanatory variable. If this and United States grants and loans are jointly determined, Levitt's results will also be biased and inconsistent due to the use of OLS.

32. See Zellner (1962).

33. As noted above, Gounder (1991) applied OLS to time series data. In a later paper, however, Gounder's original equations were re-estimated using the SUR procedure (see Gounder, 1992). It was concluded that this procedure yielded "better", theoretically more consistent results.

34. Consider the division between grant and loans. A possibility is that an individual country's total aid is first determined, and this is subsequently divided between grants and loans. When separate regression equations are applied to these aid categories in this situation, the grant amount appears in the residual of the loan equation and *vice versa*. As a consequence, the residuals of these equations are correlated and it is for this reason that their expected values are not zero and, in turn, that the regression coefficients are biased.

35. We acknowledge that other studies may have conducted appropriate tests and not referred to them in their papers.

36. Wittkopf (1972) ran two sets of regressions. One excluded countries whose aid receipts were zero, the other included them.

37. There are potentially a number of other sample selection models which could be applied. See Amemiya (1984) and Maddala (1983) for surveys.

38. In principle, all developing countries are potentially eligible for aid. However, the nature of the eligibility referred to is where country have been revealed to be actually eligible through receipt of a positive aid allocation.

39. Unless μ_{1i} and μ_{2i} can be shown to be independent, separate estimation of their amount of aid equation using OLS is also subject to specification bias. This is McGillivray and Oczkowski's criticism of the approach used by Dudley and Montmarquette.

40. As noted earlier, McGillivray and Oczkowski (1991, 1992) explicitly tested for and rejected the Tobit model.

41. Strictly speaking, Heckman's reference was to data units.

42. Or, at least, no reference to such tests is made in the published articles.

43. Seven heteroscedasticity tests were conducted for each of the recipient need and hybrid equations for which results are reported in Tables 4 and 6. These included the Bruech-Pagan-Godfrey, ARCH, Harvey and Glejser tests and were performed using SHAZAM Version 6.2 (see White, *et. al.*, 1990). Of the total of 16 equations, 6 failed 6 tests at the 95 percent confidence level, 3 failed 5 tests at this level, 1 failed 4, 1 failed 2 and 1 failed 1 test only. Two equations (both for US absolute aid) passed all tests.

44. A common, but not necessarily effective, remedy for heteroscedasticity is to transform the data to logarithms. This comment is therefore not necessarily applicable to those studies which have expressed explanatory variables in this manner. Many econometric packages will calculate White's heteroscedastic consistent standard errors - although OLS is still inefficient the calculation of t-statistics using these standard errors is at least consistent.

45. Rather good descriptions of these and many other tests are provided in Gujarati (1988) and Maddala (1989).

46. In this context, the problem is analogous to an errors in variable problem.

47. Gulhati and Nallari (1988) report the DW for their time series regressions. Their regression equations, as noted above, contained a lagged dependent variable. This invalidates the use of the DW statistic, since its asymptotic value is

biased toward the value of 2, which usually indicates an absence of (first-order) autocorrelation.

48. This is obvious upon examining the DW formula, which in the context of cross section data is:

$$DW = \frac{\sum_{2}^{n}(\mu_i - \mu_{i-1})^2}{\sum_{1}^{n}\mu_i^2}, \qquad i = 1, 2, \ldots, n.$$

Altering the order of the observations alters the term $(\mu_i - \mu_{i-1})$ in the numerator and hence the value of the DW statistic.

49. This ignores aid determined on the basis of multi-year forward plans. Notwithstanding, such allocations are generally reviewed on a yearly basis and alterations to forward commitments are not unprecedented.

50. For example, data contained in the annual editions of the World Bank's *World Bank Tables* and *World Development Report*, widely used sources of data, are at least two years out of date at the time of publication.

51. This conclusion is, of course, applicable to studies based on cross country data only.

52. White (1974) paradoxically argues that it is inappropriate to explain inter-country aid allocation on the basis of donor motives. This was on the belief that allocations did not closely reflect any of the humanitarian, political and strategic motives. But given the conclusion drawn by White, it is odd that he did not consider that this outcome could be due to the motives of the aid administrators.

53. Other possibilities include studies of the irreversibility of decisions. See, for example, Farrell (1952).

54. See, for example, Breton and Wintrobe (1982) and Wildavsky (1964).

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