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What Determines Foreign Aid to Papua New Guinea?

An Inter-temporal Model of Aid Allocation

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Abstract

This paper models the inter-temporal allocation of foreign development aid to Papua New Guinea (PNG). A formal theoretical model of aid allocation is developed, in which aid to any one country is determined jointly with aid to all other recipient countries. This is recognized in the econometric application of this model, which simultaneously models aid to number of countries in addition to PNG. Results based on data for the period 1969 to 1998 indicate that both recipient need and donor interest variables determine the amount of Australian and total foreign aid to PNG and most other countries under consideration.

Keywords: foreign aid, allocation, Papua New Guinea, time-series

JEL classification: C30, F35

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I. Introduction

What determines the amount of foreign aid allocated to a developing country? Researchers have been attempting to answer this question empirically for more than 30 years. It is generally hoped that humanitarian criteria play an important role and, if so, aid will be allocated on the basis of relative need. The needier the country the more aid it can be expected to receive. It is however conceded that donor interests will also play a role. Most studies therefore turn to a range of donor interest and recipient need variables as determinants of aid allocation. Various hypotheses are tested, almost always using cross country data. Most studies reject recipient need as a determinant of aid allocation. McKinlay and Little (1979, p. 243), for example, concluded that there are "no grounds for asserting that humanitarian criteria have any significant direct influence" on aid allocation. Similarly, Maizels and Nissanke (1984, p. 891) concluded that "bilateral aid allocations are made ... solely ... in support of donors' perceived foreign economic, political and security interests".

Some relatively recent studies have attempted to model aid allocation using time series data (Gounder, 1999; Gounder and Sen, 1999). This is a very useful development. We clearly need to know whether aid is sensitive to the needs or developmental requirements of countries at a particular point in time. But we also need to know whether aid responds to the needs or developmental requirements of individual countries over time. In short, inter-temporal considerations are just as important as spatial considerations. Gounder (1999), examines the determinants of aid to Papua New Guinea (PNG); an interesting case study from a number of perspectives. It has received more aid than any other South Pacific country, but unlike many of these countries it has experienced significant economic and social decline over recent decades. It has also received almost all its aid from a single donor, Australia. Gounder's results sharply contrast to those of most cross country studies, in that recipient needs, but not donor

interests, are found to dominate the allocation of aid to PNG.

This paper also provides a time series analysis of aid to PNG. In doing so it addresses an implicit assumption of all previous time analyses - that aid flows to each country are determined independently of such flows to all other countries. This is a brave assumption. All aid allocations are determined in the context of a broader budgetary constraint. Increasing aid to one country, for a given total aid budget, must lead to decreases in aid to at least one other country. The econometric approach of this paper allows for a situation in which aid allocations are jointly determined, but is not invalidated if these allocations are determined independently of aid to other countries. The approach involves simultaneously modelling aid to a number of recipient countries in addition to PNG. Equations explaining aid allocations to 10 major aid recipients are modelled individually, along with an equation explaining the residual sum of aid allocated to all other countries, for the period 1968 to 1999. Results indicate that both recipient need and donor interest variables determine the allocation of aid to PNG and most other countries under consideration.

The remainder of this paper is organised as follows. In Section II a theoretical model of aid allocation is derived. This model is subsequently applied to both Australian and total OECD Development Assistance Committe (DAC) bilateral development aid flows to the recipient countries under consideration for the above mentioned period.[1] Australia is by far PNG's largest aid donor, typically providing more than 90 percent of PNG's total annual bilateral aid. Section III discusses the econometric procedure and data used in this paper. Section IV presents and interprets the results, while Section V concludes.

II. Theoretical model of aid allocation

Surprisingly few studies of aid allocation have derived a theoretical model of aid allocation prior to their empirical estimation. Trumbull and Wall (1994), Wall (1995), Tarp *et al.* (1999) and Lahiri and Raimondos-Møller (2000) are relatively recent exceptions. These studies develop a similar model to the one originally proposed by Dudley and Montmarquette (1976). In these models, the aid decisions of donors are motivated by an aid impact function relating to recipient need. The model developed in this Section departs from that proposed by Dudley and Montmarquette by focusing on the behaviour of those actually responsible for allocating bilateral aid among developing countries - bureaucrats within the donor aid agency. In the case of Australia, these bureaucrats are the officials of the Australian Agency for International Development (AusAID). Aid allocations are the outcomes of the decisions of these people and it is therefore these decisions that aid models seek to explain.

Bilateral aid allocation is a complex task. Donor policy statements, especially those of the larger donors, have tended to emphasise humanitarian, commercial and political, and diplomatic and strategic objectives. This is typified by PNG's largest aid donor. The objective of Australia's overseas aid program is "to advance Australia's national interest by assisting developing countries to reduce poverty and achieve sustainable development" (Downer, 1998, p. 4). The humanitarian objective of reducing poverty and achieving sustainable development involves allocating aid either favouring those countries in greatest need or those which can best achieve development outcomes. The other objective of advancing Australia's national interest, includes the promotion of commercial opportunities, allocating aid to strategically located countries or those with close ties to Australia and either rewarding or punishing countries for particular actions. The decision makers of the donor aid agency are required to take into account and weigh-up these often competing mandates or objectives for aid. Their task is to

ensure that aid allocations are as consistent with these objectives as possible. However, the decision makers have their own bureaucratic objectives. These include the aversion of conflict with their counterparts in other bureaucratic agencies (both in the donor and recipient countries) and seeking to allocate aid in a reasonably expedient manner.

A representative utility function of bilateral aid allocation decision makers may therefore be written as:

$$U = f(CN) \tag{1}$$

where CN is the subjectively measured concordance of the various mandates of the bilateral aid program. This variable is treated as a private good of the decision makers of the donor aid administration.[2] CN is defined more precisely as the sum of the concordances from allocating aid to or among m recipient countries, as follows:

$$CN = \sum_{j=1}^{m} CN_j = \sum_{j=1}^{m} CN(A_j, RN_j, DI_j, B_j) \tag{2}$$

where CN_j is the subjectively measured concordance of mandates achieved from bilateral aid to recipient j, A_j is the absolute amount of bilateral aid from the donor under consideration to j, RN_j is the recipient developmental need for aid of j, relating to the humanitarian concerns in this country, DI_j is the level of the donor's self-interests in j and B_j is the bureaucratic expediency associated with allocating aid to this recipient. RN_j, D_j and B_j are each vectors of variables. All variables are for period t. Donor self-interests relate to commercial, political, diplomatic and strategic considerations.

Typically, donor decision makers strongly believe that the aid they administer is of benefit developmentally to recipients. Utility therefore increases unambiguously with the amount of aid allocated to country *j*. The relationship between utility and recipient need is more complex. It is agreed reasonably widely in donor circles that need is greater in countries with low levels of development and large populations, and that donors should respond positively to this need, irrespective of how well the recipient might use the aid provided. However, in some circles it is agreed that aid should be given to those countries which can use it best in terms of development outcomes, and these countries tend not to be the poorest and largest. Often they are countries with small populations and middle level incomes.[3] This implies that utility may either increase or decrease with changes in recipient need. Decision maker utility will also increase unambiguously with the donor self-interests in country *j* and the extent to which giving aid to this country is bureaucratically expedient. It therefore follows that:

$$\frac{\partial CN}{\partial A_j} > 0, \quad \frac{\partial CN}{\partial RN_j} > 0, \quad \frac{\partial CN}{\partial DI_j} > 0 \quad \text{and} \quad \frac{\partial CN}{\partial B_j} > 0.$$

Let the concordance function (2) be re-written as:

$$CN_j = DI_j^{\gamma} \; B_j^{\pi} A_j^{\alpha_j} RN_j^{\delta} \qquad \begin{array}{l} 0 \le \gamma \le 1 \\ 0 \le \pi \le 1 \\ 0 \le \alpha_j \le 1 \\ 0 \le \delta \le 1 \end{array} \tag{3}$$

The parameters are introduced in order to allow for diminishing returns. Note that the recipient specific parameter α_j is introduced since there are recipient specific characteristics of donor aid programs. Such characteristics might relate to the perceived effectiveness of the aid program in recipient *j*, the views and opinions of those administering aid at the time, or the

better lobbying skills of certain aid program managers.[4]

The task of the donor decision makers is to maximise the sum of the individual concordances subject to a budgetary constraint. The donor agency faces the following overall constraint:

$$TA = BI + M + OA + C \tag{4}$$

where TA is the total aid budget, BI is the total bilateral aid program, M is the total multilateral program (that is, the sum of funds allocated to developing countries via multilateral agencies), OA is the total of funds allocated to developing countries via other programs (such as regional-wide, humanitarian, refugee and other such assistance) and C is administrative costs not allocated to individual programs. It is assumed *ex ante* that each of the variables on the right-hand side of (4), like TA, are pre-determined. Donor decision makers are provided with an aid budget and are unable to influence the size of this budget. Moreover, in a given year, donors are unable to increase the size of their budget by reducing the amount of funds allocated to multilateral agencies. Each of these variables are fixed shares of TA and there is no substitution between them. It follows that (2) is maximised subject to:

$$BI = \sum_{j=1}^{m} A_j. \tag{5}$$

The Lagrangian can therefore be written as:

$$\max \mathcal{L}_j = \sum_{j=1}^{m} DI_j^{\gamma} B_j^{\pi} A_j^{\alpha_j} RN_j^{\delta} + \lambda \left(BI - \sum_{j=1}^{m} A_j \right) \tag{6}$$

The first-order conditions are:

$$\frac{\partial \mathcal{L}}{\partial A_j} = \alpha_j DI_j^{\gamma} B_j^{\pi} A_j^{\alpha_j - 1} RN_j^{\delta} - \lambda = 0, \qquad \text{and} \tag{7}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = BI - \sum_{j=1}^{m} A_j. \tag{8}$$

From (7) it follows that:

$$\lambda = \alpha_j DI_j^{\gamma} B_j^{\pi} A_j^{\alpha_j - 1} RN_j^{\delta} \tag{9}$$

Solving (9) for A_j yields:

$$A_j = \left(\frac{\alpha_j DI_j^{\gamma} B_j^{\pi} RN_j^{\delta}}{\lambda} \right)^{\frac{1}{1-\alpha_j}} \tag{10}$$

Taking the logarithms of both sides of (10) and adding an error term yields the following estimating equation:

$$\ln A_j = \beta_{0,j} + \beta_{1,j} \ln RN_j + \beta_{2,j} \ln DI_j + \beta_{3,j} \ln B_j + \mu_j \tag{11}$$

where

$$\beta_{0,j} = \frac{\ln(\alpha_j/\lambda)}{1-\alpha_j}, \qquad \beta_{1,j} = \frac{\delta}{1-\alpha_j},$$
$$\beta_{2,j} = \frac{\gamma}{1-\alpha_j} \qquad \text{and} \qquad \beta_{3,j} = \frac{\pi}{1-\alpha_j}.$$

Two comments on the model are warranted. The first concerns the recipient need, donor interest and bureaucratic variables. The allocation of aid is subject to informational time lags. Allocations for any given year are determined by donors towards the end of the preceding year. Decision makers can only base these decisions on currently-available information, and

in the case of most variables, especially those relating to need, this information will at best be for the year prior to that for which the aid is allocated. It is assumed that donors base their current decisions using this information so all explanatory variables are lagged and this also ensures that they are exogenous.

The second comment relates to the specification of the aid variable A_i. In this paper, aid is measured in absolute terms, rather than in per capita terms. This has been an issue of some contention in the literature on aid allocation, with most studies focusing on per capita aid. The prime purpose of a model of aid allocation is to explain observed aid allocations; as such the specification or measurement of the aid variable must ultimately rest on the most likely decision variable used in practice by donor agencies (see McGillivray and White, 1993). If the actual decision variable is per capita aid, the constraint becomes:

$$BI = \sum_{i=1}^{m} \left(\frac{A_i}{P_i} \right) P_i \tag{12}$$

where P_i is i's population. While (12) obviously reduces to (5) it implies a rather cumbersome allocative decision making process. It is much more likely that aid is allocated in absolute terms but taking into account the population of recipient countries. This is supported by anecdotal evidence. Aid administrators rarely speak of per capita aid, and their agencies rarely report aid in per capita terms: the focus is on absolute aid.[5]

III. Econometric procedure

The attempted econometric advances of this paper are twofold. Similar to many previous studies (including the time-series studies of Gounder, 1999 and Gounder and Sen,

1999) it seeks to explain aid allocation to PNG using donor interest and recipient need variables. However, it does not attempt to estimate separate donor interest and recipient need equations. This approach, although prevalent in the previous literature, is problematic econometrically if one posits *a priori* that both recipient need and donor interests influence aid allocation (see McGillivray and White, 1993). If this is true, then both models are mis-specified due to the omission of relevant variables.[6] This paper models aid allocation to PNG using an equation containing both recipient need and donor interest variables.

Second, previous studies have implicitly assumed that aid allocations to recipient countries are made independently of each other. Given that aid flows are allocated from a pre-determined pool of funds, as equation (5) makes clear, this assumption is incorrect. Aid allocations between i recipients are jointly determined. Given that aid administrative agencies wish to spend the entirety of the aid budget, decreasing aid to one country will result in a increase in aid to at least one other and vice versa. It follows that the error term of each equation will be correlated with the error terms from other equations. This implies that for each equation the expected value of the error term will be non-zero.[7] This violates an assumption of the classical regression model and OLS estimation will yield inefficient parameter estimates. Estimates will not exhibit minimum variance and the corresponding t-statistics are drawn into question. Given that the explanatory variables are exogenous due to their lags, Zellner's (1962) Seemingly Unrelated Regression (SUR) procedure is an appropriate method of estimating a system of equations simultaneously. Zellner's SUR method of estimation transforms the error terms of the two equations so that they have the same variance and are uncorrelated.

Thus aid is allocated simultaneously between recipients and the aid allocation process must be modelled using a system of equations. Each equation seeks to explain aid allocation to an individual recipient and the error term of each equation will be correlated to the error term of the other equations. Therefore, an equation which explains the amount of aid distributed to PNG belongs to a system of equations explaining aid to other developing country recipients. This system may be written as the following:

$$\begin{aligned}
\ln A_{j,t} &= \beta_{0,j} + \beta_{1,j}\ln RN_{j,t-i} + \beta_{2,j}\ln DI_{j,t-i} + \beta_{3,j}\ln B_{j,t-i} + \mu_{j,t} \\
\ln A_{k,t} &= \beta_{0,k} + \beta_{1,k}\ln RN_{k,t-i} + \beta_{2,k}\ln DI_{k,t-i} + \beta_{3,k}\ln B_{k,t-i} + \mu_{k,t} \\
&\vdots \\
\ln A_{m,t} &= \beta_{0,m} + \beta_{1,m}\ln RN_{m,t-i} + \beta_{2,m}\ln DI_{k,t-i} + \beta_{3,m}\ln B_{m,t-i} + \mu_{m,t} \qquad (13)
\end{aligned}$$

where $j = 1,\ldots,k-1$
$k = j+1,\ldots,m$
$i \geq 1$
$\operatorname{cov}(\mu_{j,t},\mu_{k,t}) = \sigma_{j,k,t}$

$A_{j,t}$ and $A_{k,t}$ are aid allocations to individual countries. There may be numerous aid recipients, each represented by a separate equation up to $A_{m,t}$. The assumption $\operatorname{cov}(\mu_{j,t},\mu_{k,t})=\sigma_{j,k,t}$ indicates that there is contemporaneous correlation. That is the error terms of the equations are, at the same point in time, correlated. Estimating (13) is a daunting task as it involves obtaining data for a large number of recipient countries. More than 150 countries receive official development assistance (ODA) and most donors, including Australia, individually provide aid to more than 100 recipients. Some compromise is warranted. In this paper the econometric model is applied to (i) Australian aid and (ii) DAC bilateral aid. There are eleven recipient countries under consideration in each case. These countries have been the largest Australian and DAC ODA recipients since 1970 for which time series data are available.[8] These countries vary according to whether the model is applied to Australian data or total

DAC data. A further equation is included in the model which describes aid allocated to all other recipient countries. The following system of twelve equations is therefore posited:

$$\ln A_{j,t} = \beta_{0,j} + \beta_{1,j} \ln RN_{j,t-i} + \beta_{2,j} \ln DI_{j,t-i} + \beta_{3,j} \ln B_{j,t-i} + \mu_{j,t}$$

$$\sum_{k=j+1}^{m} \ln A_{k,t} = \beta_{0,k} + \beta_{1,k} \sum_{k=j+1}^{m} \ln RN_{k,t-i} + \beta_{2,k} \sum_{k=j+1}^{m} \ln DI_{k,t-i} + \beta_{3,k} \sum_{k=j+1}^{m} \ln B_{k,t-i} + \mu_{k,t} \qquad (14)$$

where $j = 1, \ldots, k-1$
$k = j+1, \ldots, m$
$i \geq 1$
$k = 12,$
$\text{cov}\left(\mu_{j,t}, \mu_{j,t}\right) = \sigma_{j,k,t}$

The first eleven equations in (14) describe aid to the top ten largest Australian or DAC recipients. The twelfth describes Australian or DAC aid to all other countries.[9]

Careful consideration was given to the measurement of the aid variable. This paper adopts the commonly used Official Development Assistance (ODA) measure for aid. Three feasible options are available: net disbursements, gross disbursements and commitments. Commitments are the amount the donor agrees to make available to the recipient during the relevant time period. Disbursements are the actual amount of aid transferred from donor to recipient. They are the amount of the commitment actually spent during the relevant time period. Net disbursements are simply gross disbursements minus any repayments relating to the previous period's ODA loans. Commitments are primarily supply-side determined, by the donor country. As equations (14) basically describes a donor decision making process, ODA commitments are the logical choice of dependent variable. Unfortunately, Australian ODA commitment data appear erroneously reported to the DAC, exhibiting large annual unexplained fluctuations. In this paper Australian ODA disbursements are used but ODA commitments are used for the model explaining total DAC bilateral aid to PNG.

This paper largely follows McKinlay and Little (1977, 1978a, 1978b, 1979), Maizels and Nissanke (1984), Gounder (1999) and Gounder and Sen (1999) in terms of the specification of individual recipient need and donor interest variables. The elements of the recipient need vector are country *j*'s population, per capita GNP, per capita GNP growth rate, balance of payments and 'other' aid receipts. The balance of payments variable is net of official transfers and measured as a ratio of GNP. It is used as a measure of economic performance and not of a gap which needs to be filled with aid inflows. Other aid receipts relate to multilateral aid and bilateral aid from other donors in the model of Australian aid to PNG and to multilateral aid in the model of DAC aid to PNG. Other aid is viewed as a substitute for Australian or DAC bilateral aid, in the sense that countries with low amounts of other aid need *ceteris paribus* more assistance. Alternatively, the two inflows could serve as complements with bilateral donors topping-up other receipts or *vice versa.* Dudley and Montmarquette (1976) label this a "bandwagon effect". The expected sign of the coefficient attached to other aid is therefore ambiguous; so too are the expected signs of the remaining recipient need variables given the reasoning outlined in Section II. The elements of the donor interest vectors are the values of Australian and DAC investment, exports and arms transfers to country *j* measured in Australian and US dollars respectively. For reasons discussed above, *i* was set to one for each of the above variables.

The bureaucratic expediency vector *B* contains a single element only, a lagged dependent variable. These variables are intended to capture a possible allocative inertia in the aid allocation process. It is well known that donor agencies tend to avoid large year-on-year fluctuations in aid, especially downward, given the administrative and political difficulties involved. These difficulties relate to the winding back of existing projects or programs and identifying new ones, and the offence often caused to recipients through significant reductions

in aid. One would expect, relatively smooth aid flows over time, with the sign attached to the lagged dependent variable being positive.

Equations (14) were supplemented with additional variables. The first was the GNP deflator, either the Australian deflator or donor deflators averaged across the DAC. The inclusion of this variable is based on the reasoning that donors are sensitive to the real value of their aid, and adjust allocations on the basis of the movement of prices. This is not to say however that allocations are determined in real dollar amounts, otherwise the dependent variable would be measured in this manner, simply that adjustments are made on the basis of concerns for the real value of allocations. Additional variables, added to some but not all equations in (14), are binary dummy variables, intended to capture major events in a recipient's history which have influenced the provision of aid from Australia and the DAC and are not captured by other explanatory variables. Dummy variables may differ for recipients depending on whether the model is applied to Australian or DAC aid flows. Donor react differently to different events from one another according to the relative importance of the recipient. Further details are in the Appendix (see Tables A3 and A4).

The paper also attempts to account for the time-series properties of the data. However, this is problematic. Most economic series are found to be non-stationary processes. Such series do not have a constant mean and they tend to trend over time. Granger and Newbold (1974) and a number of other studies have found that OLS estimation in the presence of non-stationary variables can yield spurious results. The problem of estimating spurious relationships can be overcome by differencing series to achieve stationarity. A series is integrated of order *d* if after being differenced *d* times it becomes staionary. For example, a series which is stationary in levels in integrated of order zero I(0). If a series is stationary in first differences

it is integrated of order one, I(1).

The process of differencing has two important drawbacks. The first is that differencing results in the loss of long run information in the data. Second, differencing can lead to inefficient parameter estimates if the assumption of a unit root is untrue. Further, some argue that the question of whether a series has a unit root or not is inherently unanswerable when dealing with a finite sample (Blough, 1992; Cochrane, 1991; and Stock, 1990). Unit root tests have very low power in trying to distinguish between a series with a unit root and a series with a near unit root. This is particularly true when the tests are applied to variables belonging to a system of equations dues to the correlation of their error terms.

Putting all of these problems aside, it is important to guard against the possibility of estimating spurious relationships. Augmented Dickey Fuller (ADF) tests were carried out and indicate that the data contain a mixture of I(0), I(1), and I(2) variables. Since variables are integrated of different orders in each equation, it is not possible to test for cointegration. At the expense of long run information, the models were run with non-stationary variables differenced in order to ensure stationarity.

Like many of the pre-existing studies comprising the aid allocation literature, we are interested in whether a vector of recipient need variables and a vector of donor interest variables determine aid allocations. We test, therefore, the joint significance of the recipient need and donor interest coefficients, respectively.[10] In the case of the first equation of (14) this involves evaluating the null hypotheses that

$$H_0: \psi_{1,1,j} = \psi_{1,2,j} = \ldots = \psi_{1,p,j} = 0$$

and

$$H_0: \psi_{2,1,j} = \psi_{2,2,j} = \ldots = \psi_{2,q,j} = 0$$

using a Chi-squared test. Further details are given below.

ODA, multinational aid, GNP per capita, population and investment data were obtained from the OECD database (2000) and the Australian Bureau of Statistics. Data on current accounts and exports were obtained from the IMF's International Financial Statistics and Direction of Trade statistics, respectively. Data on arms transfers were provided by the Stockholm International Peace Research Institute (SIPRI) database. The relevant time period is 1968 to 1999. This is the longest series that could be constructed given data availability for Australia's and the DAC's largest aid recipients.

IV. Results and interpretation

The model of aid allocation developed in this paper is applied to two sets of data; (i) Australian aid flows and (ii) total (DAC) bilateral aid flows. All estimations were carried out using the statistical package STATA 7.0. Each set of results is discussed in turn.

(i) Australian aid allocation

A summary of the results for Australian aid allocation are presented in Table 1. Statistically satisfactory results were obtained. Chi-squared tests which evaluate the null hypothesis that the slope coefficients of the equations are zero, indicate that all equations in the system are individually significant. R^2s are generally high, ranging from 0.68 for the case of Pakistan to 0.98 for the cases of Indonesia, Malaysia, Philippines and for the equation explaining the allocation of aid to all other developing countries. Moreover, a Breusch-Pagan χ^2 test for independence exhibits a value of 97.36, indicating that there is significant correlation

between the error terms at the 1 per cent level of confidence. This result is important as it shows that using the SUR simultaneous equation approach is validated and that using single equation OLS estimation is likely to yield misleading conclusions.

Table 1
Econometric results: summary statistics for Australian aid allocation

Recipient country	R^2	χ_1^2	χ_2^2	χ_3^2
Papua New Guinea	0.97	1331.59**	90.01**	67.16**
Ethiopia	0.89	284.90**	18.52**	3.50*
Fiji	0.97	1032.43**	36.97**	3.28
India	0.79	136.79**	24.95**	0.12
Indonesia	0.98	1573.22**	34.86**	18.71**
Malaysia	0.98	2462.31**	122.56**	10.96**
Pakistan	0.68	94.57**	18.58**	2.01
Philippines	0.98	1437.19**	24.19**	11.90**
Samoa	0.92	412.87**	16.62**	2.89
Sri Lanka	0.80	141.82**	9.80*	0.53
Thailand	0.97	1385.65**	21.18**	28.70**
All others	0.98	1463.35**	13.19**	8.36**

* significant at the 90 per cent level. ** significant at the 95 per cent level or greater.

The results provide evidence that Australia considers *both* recipient need *and* donor interests in determining the amounts of aid allocated to PNG and most other developing countries. This result is in contrast to those presented in the numerous cross-country studies of aid allocation. This is based on the statistics χ_2^2 and χ_3^2, which test for the joint significance of the coefficients attached to the recipient need and donor interest variables respectively. In the case of Sri Lanka, recipient need variables are significant as a group at the 90 per cent level of confidence. In all other cases χ_2^2 is statistically significant at the 95 per cent level of

confidence, highlighting the importance of recipient needs in the Australian aid allocation process.

Equally interesting results were obtained for χ^2_3, given the overwhelming importance previous studies have attached to the importance of donor interests as determinants of aid allocation. In the case of Australia, results indicate that donor interests are *not* important in determining the amounts of foreign aid to Fiji, India, Pakistan, Samoa and Sri Lanka. However, these results must be evaluated with the knowledge that data availability restricted the number of donor interest variables which could be employed in the model for all of these countries with the exception of Fiji.

On balance, results suggest that Australia considers both recipient need and donor interests when determining foreign aid amounts and this is true for the case of PNG. The results provided in Table 2 show that, as expected, Australia has provided less aid in response to higher growth rates in PNG per capita GNP and less aid in response to increases in aid to PNG from other donors and multilateral agencies. Interestingly, Australian aid is positively associated with per capita GNP and the balance of payments current account (as a percentage of GNP). The positive coefficient on the per capita GNP variable suggests that Australia may reward increases in per capita income with more aid due to a greater perceived return on its aid. Results also suggest that Australia rewards PNG for improvements in its balance of payments position. In terms of donor interests, the coefficients on the Australian investment and arms transfers variables are statistically significant with the coefficients exhibiting the expected positive signs.[11]

Table A1 in the appendix reports and compares the results for PNG from SUR with those from single equation estimation. The results for the latter, reported in column two appear to indicate that single equation estimation does yield inefficient standard errors as expected. The coefficients on the growth and balance of payments variables are not significant while the coefficient on the GNP per capita variable is significant at the 10 per cent level compared to the 5 per cent level in SUR estimation. Results for the model estimated in which the time-series properties of the data are accounted for are reported in the third column of Table A1. For the case of PNG results change little and the overall conclusions regarding the joint significance of recipient need and donor interest variables is unchanged.

Table 2 provides further results from applying the model to Australian aid flows. A positive coefficient on the lagged aid variable indicates that inertia exists in the Australian aid allocation process. Inertia exists in the allocation of Australian aid for all countries under consideration with the exception of PNG and Samoa. A positive coefficient is also expected on the population variable and this result is confirmed for the cases of Ethiopia, Indonesia, Philippines, at the 95 per cent level of confidence and for India at the 90 per cent level. However, the negative coefficient on this variable for the cases of Fiji, Pakistan and Sri Lanka indicates that increases in Australian aid have not kept up with population growth in these countries.

Table 2
Econometric results: SUR estimates of coefficients of inter-temporal model of Australian aid allocation

Country	Constant (β_0)	Population ($\psi_{1,1}$)	Per capita GNP ($\psi_{1,2}$)	Growth in per capita GNP ($\psi_{1,3}$)	Balance of payments ($\psi_{1,4}$)	Multilateral aid ($\psi_{1,5}$)	Australian exports ($\psi_{2,1}$)	Australian investment ($\psi_{2,2}$)	Australian arms transfers ($\psi_{2,3}$)	Lagged aid ($\psi_{3,1}$)	Australian GNP deflator (ψ_4)	Dummy variables ($\psi_{5,1}$)	($\psi_{5,2}$)
Papua New Guinea	-0.60	0.66	0.20**	-0.27**	0.24**	-0.29**	0.04	0.19**	0.39**	-0.03	-0.08	0.13**	-0.58**
	(-0.18)	(1.34)	(1.98)	(-2.06)	(2.44)	(-6.70)	(0.48)	(2.89)	(7.27)	(-0.28)	(-0.77)	(3.67)	(-8.33)
Ethiopia	-42.28**	3.76**	2.14**	-1.56**	7.99**	0.12	0.16*	-	-	0.39**	-1.61**	-0.64**	-1.59**
	(-3.07)	(2.70)	(3.22)	(-3.14)	(2.68)	(0.61)	(1.87)	-	-	(2.44)	(-2.60)	(-2.44)	(-4.01)
Fiji	17.92**	-4.28**	1.14**	-1.18**	-1.21	-0.17**	-0.34*	-0.05	-0.04	0.47**	1.14**	0.93**	
	(1.55)	(-2.14)	(4.80)	(-3.13)	(-1.40)	(-2.21)	(-1.77)	(-0.51)	(-0.43)	(4.93)	(3.33)	(4.24)	
India	-42.72	4.02*	-3.01**	-0.77	-16.70**	-0.25	-0.09	-	-	0.44*	1.87**	-0.95**	
	(-1.61)	(1.82)	(-4.26)	(-0.77)	(-2.46)	(-0.84)	(-0.35)	-	-	(3.44)	(3.13)	(-3.15)	
Indonesia	-75.58**	6.78**	-0.26**	0.53**	0.38	-0.05	-0.54**	0.05	-0.01	0.44**	0.42**	-0.26*	
	(-5.21)	(5.20)	(-2.66)	(3.64)	(0.46)	(-0.79)	(-3.61)	(0.92)	(-0.04)	(2.88)	(2.12)	(-1.86)	
Malaysia	11.70	-1.95**	1.65**	0.93**	-0.43	-0.17**	-0.79**	-0.03	0.18	0.34**	0.40*	1.68**	
	(1.64)	(-2.51)	(7.69)	(2.26)	(-1.14)	(-4.59)	(-3.21)	(-0.90)	(1.34)	(7.87)	(1.74)	(18.62)	
Pakistan	31.66**	-4.12**	1.58**	-1.98**	1.50	0.35*	-0.19	-	-0.08	0.35**	1.46**	-1.09**	-1.05**
	(2.95)	(-3.38)	(3.29)	(-2.48)	(0.67)	(1.72)	(-1.37)	-	(-0.32)	(2.94)	(3.44)	(-5.40)	(-3.42)
Philippines	-62.13**	5.95**	-0.03	1.21**	-3.56**	0.01	-0.41**	0.03	0.26**	-0.03	0.91		
	(-4.38)	(4.12)	(-1.08)	(2.59)	(-2.12)	(0.10)	(-2.55)	(0.25)	(2.20)	(-0.02)	(2.79)		
Samoa	-7.91	1.14	0.24	0.75	0.58**	0.22**	0.01	-	0.40*	0.41**	0.26		
	(-0.43)	(0.27)	(0.63)	(1.56)	(2.84)	(2.25)	(0.05)	-	(1.68)	(2.75)	(0.56)		
Sri Lanka	16.61	-2.32	0.33	-0.07	-2.06*	-0.28**	0.10	-	-	0.40**	1.38		
	(1.01)	(-1.12)	(0.51)	(-0.10)	(-1.77)	(-2.02)	(0.73)	-	-	(3.28)	(3.60)		
Thailand	-20.64	2.06	0.23	1.54**	2.37**	0.09	-0.41**	0.09	0.21**	0.86**	-0.34		
	(-1.49)	(1.41)	(0.92)	(4.13)	(2.65)	(1.34)	(-3.45)	(1.52)	(3.00)	(9.74)	(-1.25)		
All others	-2.16	-0.17	0.34**	0.17	-4.87**	-0.05	0.15	0.24**	-0.01	0.27*	0.29		
	(-0.17)	(-0.18)	(2.14)	(0.83)	(-2.13)	(-0.20)	(0.52)	(2.11)	(-0.35)	(1.68)	(0.68)		

*, **: significantly different from zero at 90 and 95 per cent confidence levels, respectively.

Australian aid is allocated on a recipient specific basis, with the country providing more aid to some recipients which exhibit a greater a greater perceived return to aid but not to others. There are positive and significant coefficients on the per capita GNP variable in six cases and a negative and significant coefficient for three. For the growth in per capita GNP variable, four coefficients are positive and statistically significant but an equal number are negative. Equally conflicting evidence is provided for the balance of payments variable. Australian has reduced aid flows to India, Philippines, Sri Lanka, and on average, to all other developing countries following improvements in their balance of payments positions (relative to GNP) but the rewarded improvements in this variable in the cases of Ethiopia, Samoa, and Thailand.

In general Australia views its aid and aid from all other donors as substitutes. This is indicated by the negative coefficient on the this variable for the cases of PNG, Fiji, Malaysia and Sri Lanka. However, there is evidence of a bandwagon effect in Australia's behaviour towards Pakistan and Samoa. First identified by the cross-section study of Dudley and Montmarquette (1976), this effect has donors providing more aid to recipients which receive more aid from other donors.

Table 2 provides strong evidence that Australia views foreign aid and its exports as substitutes. There is a negative and significant coefficient on the export variable in five cases and a positive coefficient only for the case of Ethiopia. This indicates that Australia has decreased its aid to recipients which receive of its exports as these exports are already effectively serving the donor's commercial interests. Other than the case of PNG the only evidence that the level of Australian investment is an important determinant of Australian aid

is provided by the equation explaining aid to all other developing countries. Australian arms are positively related to its aid flows for the cases of PNG, the Philippines and Thailand.

Finally, there is fairly strong evidence to suggest that Australia is sensitive to the real value of its aid flows. The coefficient on the Australian GNP deflator is statistically significant in six cases although for the case of Ethiopia it exhibits an unexpected negative sign. All coefficients on the binary dummy variables are statistically significant.

(ii) *Total DAC aid allocation*

This paper now turns to the results for total DAC aid commitments to PNG and other major developing country recipients. Again, statistically satisfactory results were obtained. The chi-squared tests (χ^2_i) depicted in Table 3 indicate that all equations are individually significant, R^2s range from 0.71 to 0.99 (in the cases of Pakistan and all other developing countries, respectively) and a Breusch-Pagan χ^2 test statistic of 88.66 reveals that, once again, there is significant correlation between their error terms of the equations.

Table 3
Econometric results: summary statistics for DAC aid allocation

Recipient country	R^2	χ_1^2	χ_2^2	χ_3^2
Papua New Guinea	0.92	382.23**	24.58**	4.18
Egypt	0.92	397.17**	32.24**	19.93**
India	0.75	118.28**	9.71*	11.74**
Indonesia	0.76	111.38**	16.44**	10.92**
Israel	0.95	573.11**	48.52**	6.00
Kenya	0.88	242.83**	31.09**	4.58
Morocco	0.94	560.18**	41.40**	53.67**
Pakistan	0.71	99.14**	28.20**	48.44**
Philippines	0.96	1062.94**	20.75**	17.44**
Tanzania	0.97	943.58**	56.79**	21.30**
Thailand	0.96	726.03**	50.83**	13.58**
All others	0.99	3232.60**	14.42**	16.06**

* significant at the 90 per cent level. ** significant at the 95 per cent level or greater.

The χ_2^2 and χ_3^2 statistics suggest that, similar to Australia, DAC bilateral aid donors consider both recipient need and donor interests in determining the amounts of aid allocated over time to developing countries. χ_2^2 is significant for all equations estimated. This is with a 95 level of confidence for all countries except India where recipient need variables are significant at the 90 per cent level of confidence.

Donor interests are significant as a group in all equations except those explaining DAC aid allocation to PNG, Israel and Kenya. This suggests that despite being an important determinant of Australian aid, donor interests are not important for DAC donors as a group. The result is in contrast to Gounder (1999) who finds that recipient need and donor interests are important in determining aid amounts to PNG using single equation estimation. This result is particularly interesting for the case of Israel, a country commonly perceived as being

politically and strategically important to donors. Israel's relationship with the United States is arguably one of the most intense between a donor and recipient. Yet donor interest variables, as a group, appear not to have influenced inter-temporal allocations to Israel and the same is true for Kenya.

Other results obtained from estimating the model for DAC aid are presented in Table 4. In the case of PNG, results suggest that inertia exists in the DAC aid allocation process. DAC aid flows to PNG have not kept pace with population increases, but the country has been rewarded by donors for improving its balance of payments position (relative to GNP). The positive coefficient on the multilateral aid variable lends support to a bandwagon effect of DAC donors as discussed. Results also suggest that DAC aid flows are positively associated with the level of DAC investment in PNG.[12]

For other major aid recipients, the negative coefficient on the lagged DAC aid variable reveals that allocative inertia has reduced the amount of DAC aid to Morocco. This result reflects the scaling down of DAC donor aid to this country after controlling for other factors. For Israel, Pakistan, and the equation explaining aid to all other developing countries, inertia exists in the allocation process. Results also indicate that aid commitments have not kept pace with population growth in several countries. The coefficient on population is negative and significant for eight of the aid recipients. Only in the cases of Israel and Morocco have aid commitments increased with increases in population.

Table 4
Econometric results: SUR estimates of coefficients of inter-temporal model of DAC aid allocation

Country	Constant (β_0)	Population ($\psi_{1,1}$)	Per capita GNP ($\psi_{1,2}$)	Growth in per capita GNP ($\psi_{1,3}$)	Balance of payments ($\psi_{1,4}$)	Multilateral aid ($\psi_{1,5}$)	DAC exports ($\psi_{2,1}$)	DAC investment ($\psi_{2,2}$)	DAC arms transfers ($\psi_{2,3}$)	Lagged aid ($\psi_{3,1}$)	DAC GNP deflator (ψ_4)	Dummy variables ($\psi_{5,1}$)	($\psi_{5,2}$)	($\psi_{5,3}$)
Papua New Guinea	9.41**	-0.92**	0.10	-0.23	0.34*	0.10**	0.02	0.02**	0.01	0.28**	0.25	0.13**	-0.32**	
	(4.15)	(-2.96)	(0.63)	(-1.14)	(1.83)	(3.25)	(0.18)	(1.99)	(0.30)	(2.18)	(1.31)	(2.57)	(-3.30)	
Egypt	-2.30	0.97	-2.72**	-0.98	-3.64**	0.19**	0.59**	0.11	0.04	-0.0	2.32**			
	(-0.10)	(0.39)	(-3.54)	(-1.07)	(-2.72)	(2.30)	(2.50)	(1.53)	(0.57)	(-0.32)	(2.78)			
India	57.26**	-4.35**	1.49**	-1.31*	-9.24**	-0.06	-0.72**	0.27**	-0.18**	-0.08	1.83**	-1.24**		
	(2.61)	(-2.38)	(2.36)	(-1.90)	(-2.03)	(-0.76)	(-2.27)	(2.89)	(-1.98)	(-0.77)	(3.66)	(-6.37)		
Indonesia	47.10*	-4.15*	-0.26	0.72**	-10.26**	0.02	-0.42	-0.08	0.11*	0.32	3.00**	1.71**		
	(1.90)	(-1.78)	(-0.77)	(2.16)	(-3.23)	(0.14)	(-1.46)	(-1.59)	(1.80)	(1.42)	(4.22)	(3.23)		
Israel	-31.31**	4.52**	0.22	-0.15	-6.83**	0.16**	-0.39	-0.01	-0.08**	0.45**	-0.47	0.46*	-1.93**	-1.03**
	(-2.46)	(2.36)	(1.08)	(-1.38)	(-5.70)	(2.33)	(-0.67)	(-0.18)	(-2.41)	(4.95)	(-0.58)	(1.95)	(-7.30)	(-3.92)
Kenya	32.35**	-4.51**	0.75**	-0.84	-1.94	-0.35**	0.13	0.03	-0.08**	0.15	3.16**	0.67**		
	(3.82)	(-4.26)	(2.07)	(-1.61)	(-1.19)	(-3.03)	(0.27)	(0.52)	(-2.13)	(1.09)	(4.50)	(2.81)		
Morocco	-54.70**	6.74**	-0.58	-0.30	0.06	-0.10*	0.41	-0.04	0.18**	-0.69**	-0.54			
	(-5.40)	(5.46)	(-1.56)	(-0.83)	(0.07)	(-1.83)	(1.35)	(-1.29)	(7.29)	(-4.24)	(-1.12)			
Pakistan	26.32**	-2.92**	-1.07*	-1.93**	1.45	0.30*	2.29**	-0.10*	-0.28**	0.53**	-0.43	1.75**		
	(2.33)	(-2.34)	(-1.94)	(-3.23)	(0.66)	(1.66)	(5.65)	(-1.71)	(-3.24)	(3.87)	(-0.73)	(5.53)		
Philippines	39.33**	-4.54**	0.48	-1.49**	2.95**	-0.27**	0.57**	-0.14**	0.02	0.13	2.30**	0.72**	-0.69**	
	(2.52)	(-2.62)	(1.45)	(-2.93)	(1.96)	(-2.91)	(2.38)	(-3.66)	(0.55)	(1.26)	(5.63)	(3.34)	(-4.64)	
Tanzania	30.26**	-4.03**	0.57**	0.29*	-0.21	-0.02	-0.33	0.09**	-0.11**	0.21	3.42**	-0.37**		
	(5.31)	(-6.03)	(2.80)	(1.91)	(-0.33)	(-0.30)	(-1.46)	(2.79)	(-3.69)	(1.62)	(7.91)	(-2.66)		
Thailand	39.89*	-4.41*	1.42**	1.50**	10.61**	0.56**	-0.45	0.16**	0.11	-0.04	1.55**	-0.97**		
	(1.80)	(-1.89)	(2.65)	(2.08)	(5.06)	(5.00)	(-1.15)	(2.70)	(1.61)	(-0.32)	(2.47)	(-4.13)		
All others	6.06	-0.27	0.19**	-0.22**	0.36	0.14	-0.51**	0.13**	0.16**	0.40**	1.01**			
	(1.49)	(-0.90)	(2.04)	(-2.51)	(0.34)	(1.00)	(-3.20)	(2.91)	(2.75)	(4.07)	(5.65)			

*, **: significantly different from zero at 90 and 95 per cent confidence levels, respectively.

From a needs perspective one would hope that decreases in per capita GNP would be associated with increases in aid commitments. Results indicate that this is true for the cases of Egypt, and Pakistan. However, for India, Kenya, Tanzania and Thailand, results indicate that DAC donors respond to improvements in per capita GNP by increasing aid. The same is true for the equation explaining aid to all other countries. As mentioned above, this result is explained by donors tending to favour countries with higher levels of growth due to a greater perceived return on their aid. This suggests that donors provide aid to countries where it has the greatest developmental impact and is further evidenced by positive coefficients on the growth in per capita GNP variable for the cases of Indonesia, Tanzania and Thailand.

The coefficient on the balance of payments variable takes on an unexpected positive sign for the Phillippines and for Thailand in addition to PNG. This indicates that improvements in the current account (relative to GNP) are associated with increases in aid. Both these countries have consistently recorded current account deficits up until the late 1990s and the result is explained by DAC donors rewarding these countries for improving their balance of payments positions. For multilateral aid, a bandwagon effect appears to exist for Egypt, Israel, Pakistan and Thailand. However, DAC donors have reduced the amount of aid allocated to Kenya, Morocco and the Philippines in response to increases in multilateral aid provided to these countries.

The coefficients on the donor interest variables are expected *a priori* to be positive and this result is confirmed in many cases. However, there are a number of coefficients on the exports, investment and arms variables which are negative and significant. As mentioned above, these results are explained by donors viewing aid and these variables as substitutes. This explanation is particularly true for arms transfers where increases in arms are associated with

lower transfers for five of the aid recipients. Finally, the coefficients on the DAC Deflator were positive and significant in eight of the equations, indicating that the DAC donors are sensitive to the real value of their aid and adjust allocations accordingly. All coefficients on the binary dummy variables are statistically significant.

Table A2 in the appendix reports and compares the results for PNG from SUR with those from single equation estimation. Results again appear to indicate that single equation estimation yields inefficient standard errors. Further, results and conclusions for PNG do not differ greatly once the time-series properties of the data are accounted for.

V. Conclusion

This paper has attempted to model the allocation of aid to PNG, examining time series data for the period 1968 to 1999. It investigated the motives of all DAC donors in providing aid to PNG in addition to examining the allocative behaviour of its major donor: Australia. The paper's main concern was to investigate whether recipient need and donor interests have been important allocating foreign aid to PNG. Aid flows to developing country recipients are not determined independently from one another and a system of twelve equations was estimated simultaneously using the Seemingly Unrelated Regressions approach. Eleven of these equations related to the largest recipients of Australian or DAC total official development assistance, for which data were available. The twelfth related to aggregated aid flows to all other recipient countries.

Essentially, this paper has shown that it is important to account for the joint determination of aid allocations and that failure to do so is likely to result in incorrect inferences and invalid conclusions. Moreover, motives for providing aid are both donor and

recipient specific. Future empirical studies of aid allocation should therefore model the allocative behaviour of a single donor to its numerous recipients using a simultaneous system of equations.

Results indicated that aid allocated to PNG does respond over time to developmental conditions within the country. This is true for Australian aid and total DAC aid to PNG and to other major aid recipients. Coefficients on recipient need variables were jointly significant in all twelve equations estimated in models for both Australian aid and total DAC aid. While some individual need coefficients displayed signs which are not entirely consistent with a needs approach to aid allocation, developmental criteria very clearly influence the amounts of aid that PNG and other developing countries receive over time. This evidence stands in sharp contrast to the results obtained by previous studies, which indicate that aid is not sensitive to relative developmental conditions in countries at particular points of time.

Results suggest that recipient needs are important in determining DAC and Australian aid to PNG. This results is encouraging since increasing aid flows to PNG in response to increasing humanitarian concerns should assist in increasing growth and alleviating poverty. Although it is not necessarily the case that aid allocated on a recipient need basis will be more effective than if allocated according to donor interests, it is likely to be true. It is also encouraging that DAC donors as a group do not consider their interests when determining the amounts of aid to provide to PNG. The same can be said for Australia alone and the country's lingering donor interests could potentially hamper the effectiveness of its aid.

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Appendix

Table A1: Comparison of different models explaining Australian aid to PNG

	SUR	Single equation	Time-series
Constant	-0.60	3.13	-5.06
	(-0.18)	(0.58)	(-1.50)
Aid(-1)	-0.03	-0.09	-0.07
	(-0.28)	(-0.47)	(-0.58)
Population	0.66	0.10	1.28**
	(1.34)	(0.12)	(2.55)
GNP capita	0.20**	0.28*	0.22**
	(1.98)	(1.76)	(2.18)
Growth	-0.27**	-0.23	-0.25**
	(-2.06)	(-1.07)	(-1.98)
BofP	0.24**	0.27	0.07
	(2.44)	(1.60)	(0.72)
Other aid	-0.29**	-0.30**	-0.25**
	(-6.70)	(-3.99)	(-5.75)
Exports	0.04	0.13	-0.10
	(0.48)	(0.87)	(-1.00)
Investment	0.19**	0.24**	0.17**
	(2.89)	(2.17)	(2.29)
Arms	0.39**	0.39**	0.36**
	(7.27)	(4.45)	(6.72)
Deflator	-0.08	-0.12	-0.02
	(-0.28)	(0.58)	(-0.25)

Note: t-statistics in parenthesis. *, ** significantly different from zero at the 90 and 95 per cent confidence levels respectively.

Table A2: Comparison of different models explaining DAC aid to PNG

	SUR	Single equation	Time-series
Constant	9.41**	10.10**	10.74**
	(4.15)	(3.10)	(5.25)
Aid(-1)	0.28**	0.24	0.21
	(2.18)	(1.25)	(1.61)
Population	-0.92**	-0.99**	-0.99**
	(-2.96)	(2.32)	(-3.54)
GNP capita	0.10	0.04	-0.08
	(0.63)	(0.20)	(-0.56)
Growth	-0.23	-0.24	-0.39**
	(-1.14)	(-0.77)	(-2.06)
BofP	0.34*	0.32	0.54**
	(1.83)	(1.19)	(3.05)
Multilateral aid	0.10**	0.08	0.08**
	(3.25)	(1.71)	(2.32)
Exports	0.02	0.08	0.20**
	(0.18)	(0.63)	(2.24)
Investment	0.02**	0.01	0.002
	(1.99)	(0.35)	(0.20)
Arms	0.01	0.001	0.04
	(0.30)	(0.11)	(1.07)
Deflator	0.25	0.27	0.20
	(1.31)	(1.00)	(1.07)

Note: t-statistics in parenthesis. *, ** significantly different from zero at the 90 and 95 per cent confidence levels respectively.

Table A3: Binary dummy variables (Australian aid)

Recipient country	Period for which variable equals one	Explanation
Papua New Guinea	1972-5	Build up of aid prior to independence
	1999	Skate Government - poor economic management
Ethiopia	1992-4	Unstable period - rebels attack Addis Ababba, Mengistu flees, unstable coalition governs the country, Eritrea becomes independent
	1997-9	Border war with Eritrea
Fiji	1984 onwards	Jackson report called for a greater regional focus of the Australian aid program
India	1972-3	War with Pakistan
Indonesia	1984 onwards	Jackson report called for a greater regional focus of the Australian aid program
Malaysia	1984-94	International student scholarships classified as ODA during this period
Pakistan	1982-8	Period of instability, with martial law and undemocratically elected government
	1984	Nuclear tests

Table A4: Binary dummy variables (total aid)

Recipient country	Period for which variable equals one	Explanation
Papua New Guinea	1972-75	Build up of aid prior to independence
	1999	Skate Government - poor economic management
Egypt	1990-92	Gulf war
India	1990 onwards	Liberalised economy
	1998-99	Nuclear testing
Indonesia	1998-99	Asian economic crisis
Israel	1978 onwards	Camp David agreement
	1995	US budgetary difficulties
	1997 onwards	Classified as Part II country
Kenya	1982 onwards	Post adjustment era
Pakistan	1972-73	Political instability
Philippines	1985 onwards	Post-Marcos era
	1996	Unable to disburse ODA in the preceding two years
Tanzania	1981 onwards	Poor performing economy
Thailand	1975 onwards	Post-Vietnam war period

Endnotes

1. Development aid, or Official Development Assistance (ODA), is defined by the DAC as grants or loans to developing countries which are: (a) undertaken by the official sector; (b) with the promotion of economic development and welfare as the main objective; (c) at concessional financial terms (a loan must have a grant element of at least 25 per cent). In addition to financial flows, technical co-operation is included in ODA. Grants, loans and credits for military purposes are excluded. Transfer payments to private individuals (e.g. pensions, reparations or insurance payouts) are in general not counted. Only countries which belong to Part I of the DAC's list of developing countries can receive ODA. The DAC, whose membership comprises all major Western aid donor countries, collects and reports aid flows on behalf of its member countries. See OECD (1999) for further details.

2. It could be argued that the bilateral aid decision makers also derive utility from the impacts of other programs funded by the agencies in which they are located, such as the multilateral aid program. However, as the bilateral aid decision makers have little or no control over the allocation of these funds, this impact is exogenous with respect to the preferences of these people and including such a variable in the utility function makes no difference to the behavioural and estimating equation derived.

3. A number of studies have tested for what are referred to as the small and middle-income "biases" in aid allocation, where aid decreases with population and increases with per capita income over given ranges of these variables. See for example Arvin (1998) and Arvin and Drewes (2001) for recent evidence.

4. The implications of introducing the parameter α_j is that the coefficients attached to the recipient need and donor interest variables are allowed to vary across recipients. This is both practically realistic and econometrically valid. Tests for the equality of coefficients indicates that this is not the case.

5. The decision variable could also be aid shares, with aid measured as a percentage or ratio of the total bilateral aid budget. Econometrically, using this measure or absolute aid makes very little difference with only the constant term being affected.

6. The relevant variables omitted from the recipient need model are the donor interest variables and *vice versa*. Unless it can be shown that none of the donor interest variables omitted from the recipient need model are orthogonal with the recipient need variables

omitted from the donor interest model, which is unlikely in the extreme, then it in turn follows that the error terms of both models are not independent of their respective explanatory variables. The *t* ratios, *F* tests and R^2s resulting from separate estimation of the models are therefore invalid and the conclusions based on these statistics are likely to be misleading.

7. The error terms of the equations may also be correlated with each other due to changes in the volume of the aid budget. This provides a further reason to model aid allocation using a system of equations.

8. Large recipients of Australian aid for which a long time-series were not available include China, Bangladesh, Viet Nam, Cambodia, the Solomon Islands and Vanuatu. China and Bangladesh have also been two major recipients of DAC aid but data availability did not permit a long time-series. China started receiving aid from the DAC in 1979 and Bangladesh in 1972 (formerly West Pakistan). However, all of these recipients are included in the equation explaining aid to all other countries. Note also that Israel was no longer classified as a DAC Part 1 developing county from 1997 onwards. However, as it continues to receive DAC "aid" (but not ODA), as a Part II country on the DAC list, it is included in the sample. See OECD (1999) for further details.

9. This equation will clearly be subject to a number of econometric issues, arguably the most serious being aggregation bias. Estimates of its parameters should therefore be treated with more than the usual degree of caution. However, its role is purely econometric, being to provide efficient estimates of the parameters of the other 11 equations in (14).

10. The studies which have tested for the relevance of these categories of variables include McKinlay and Little (1977, 1978a, 1978b, 1979), Maizels and Nissanke (1984), Gounder (1999), and Gounder and Sen (1999), and have done so by separately estimating recipient need and donor interest models of aid allocation. The former are comprised by recipient need variables only and the latter by donor interest variables. Conclusions regarding the overall significance of these vectors tend to be based on the adjusted R^2 of each model. However, this approach is inherently problematic econometrically due to the reasons outlined in endnote 5.

11. For single equation estimation explaining Australian aid to PNG, the coefficients on the growth in income per capita variable and balance of payments variable are insignificant. This provides further evidence that the error term of this equation is correlated with the error terms from other equations. The parameter estimates are therefore inefficient and the corresponding t-statistics are invalid.

12. For single equation estimation explaining DAC aid to PNG, the coefficients on the balance of payments, multilateral aid, investment and lagged aid variables are insignificant. In contrast to system estimation, this leads to the rejection of recipient need as a determinant of aid allocation. This provides further evidence that the rejection of recipient need as a determinant of aid allocation found by the previous empirical literature is likely to be due to single equation estimation.