ECONOMETRIC MODELS OF GOVERNMENTAL AID TO MULTILATERAL AGENCIES

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ABSTRACT

This paper investigates the extent to which donors' multilateral aid is affected by conditions in their own economics. For this purpose, we use multiple regression techniques consisting of a pooling of cross-section and time-series observations on a sample of eight major DAC members (United States, Germany, United Kingdom, France, Netherlands, Sweden, Norway, Denmark) over a 15-year period (1968 to 1982).

Despite the highly speculative nature of such an analysis - the volume of aid is ultimately a political decision - the results seem to indicate that economic factors, such as the growth of GNP, the budget surplus or the balance of payments position might influence the volume of multilateral aid. Furthermore, a comparison of the multilateral and bilateral aid outlays seems to suggest that they are differently influenced by economic factors.

However, these results are only statistically significant when the volume of aid is expressed in absolute terms (nominal or real terms). When it is expressed as a proportion of GNP, only the GNP per capita is significant as a predictor.

RESUME

Cette étude a pour objet de préciser à quelle mesure les conditions dans leur propre économie influence le volume de l'aide multilatérale dispensé par les principaux pays membres du CAD. A cette fin, nous procédons à une combinaison de coupe instantanée et de séries temporelles sur un échantillon de huit pays membres du CAD (Etats-Unis, Allemagne, Royaume-Uni, France, Pays-Bas, Suède, Norvège, Danemark) pour une période de 15 années (1968-1982).

En dépit du caractère spéculatif d'une telle analyse - dans la mesure où le volume de l'aide publique procède en dernier lieu d'une décision politique - les résultats paraissent néanmoins confirmer une certaine influence d'indicateurs tels que la croissance du PNB, le solde budgétaire ou de la balance des paiements, sur le volume de l'aide multilatérale. Une

comparaison de l'allocation d'aide multilatérale et bilatérale semble, par ailleurs, indiquer que les contraintes économiques influencent différemment ces deux catégories d'apports.

Il convient de souligner que ces différents résultats ne sont statistiquement significatifs que lorsque l'aide est exprimée en terme absolu (nominal ou réel). Lorsque l'effort d'aide est exprimé en pourcentage du PNB, seul le PNB par habitant est significatif.

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1. INTRODUCTION

After the rapid increases during the early 1970's, multilateral contributions from Development Assistance Committee (DAC) member countries declined. The average annual growth of DAC's multilateral assistance has decreased, in nominal terms, from 27.2% during the period 1970/71 - 1977/78 to 6.5% during the years 1977/78 - 1982/83.[1] The stagnation in United Nations Development Program (UNDP) funding and the difficulties concerning the replenishment of the International Development Association (IDA) provide evidence for the reduced priority now given by major donors to multilateral aid allocation.

It is generally assumed that persistent economic recessions in donor countries explain this trend. No study, however, has attempted to identify the real influence of macroeconomic factors on multilateral aid allocation. Our purpose is to measure this relationship, using multiple-regression techniques on a sample consisting of the major donor countries.

2. MULTILATERAL AID ALLOCATION MODELS

As pointed out by M. Beenstock,[2] development aid can be considered as a positive argument in the objective function of governments. Each of them tends to maximize a certain set of objectives which can be promoted by aid policies and which reflect a range of economic, cultural, ideologic and humanitarian considerations. The relative importance of these vary largely from one country to another and determine the amount of aid they allocate through multilateral channels. Thus, in the extreme, multilateral assistance has a strong position in the Scandinavian countries where many influential people believe that multilateral channels are more neutral and

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[1]Organization for Economic Cooperation and Development (OECD), Development Cooperation, 1984 review, p. 96.

[2]M. Beenstock, "Political Econometry of Official Development Assistance", World Development, Vol. 8 (1980), pp, 137-144. According to this author, the objective function of donor governments can be expressed as follows: $G = G(ODA(+), BAL(+), POL(-), ...)$ where ODA is the amount of aid, BAL is the balance of payments pressures and POL is a measure of the political rancor that ODA might generate. Signs in parentheses indicate the partial derivatives for the respective variables.

less objectionable from the point of view of the developing countries.[3] On the other hand, some countries such as France, because of its colonial history, or the United States, for economic and strategic reasons, prefer bilateral relations with Third World countries.

Since the level of multilateral aid for each donor country is mainly determined by political factors (relatively constant over time) as mentioned above, its variations over time seem strongly influenced by economic considerations.[4] These affect directly the capacity of donor countries and the political climate towards development aid: pressures from public opinion and organized interest groups against giving aid are exacerbated with the worsening of the economic situation in these countries. Our purpose is to measure the influence of these economic constraints on the multilateral aid allocation process.

2.1. Aid Variables

To measure the aid performance of donor countries we use Official Development Assistance (ODA) as defined by the Organization for Economic Cooperation and Development (OECD).[5] This is primarily because an important share of multilateral aid channeled through international

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[3]R. Cassen, et al., Rich Country Interests and Third World Development (New York: St. Martin's Press, 1982), p. 298.

[4]Factors other than economic ones can influence the evolution of multilateral aid allocation, such as international political pressure. Therefore, we should take into account the influence of the 0.7% target fixed by UNCTAD IV in 1976. However, the trend in multilateral aid since 1977-78 clearly indicates that this recommendation had no influence on the volume of multilateral aid. Shifts in multilateral aid policy in DAC countries can also influence the multilateral aid allocation process. Nevertheless, with the exception of the United States at the end of the period we are considering, there were no major explicit shifts in DAC countries' multilateral aid policies.

[5]This concept refers to "grants or loans undertaken by the official sector, with promotion of economic development and welfare as main objectives, at concessional financial terms (if a loan, at least 25% grant element)": OECD, Development Cooperation, annual review. The main criticism of this concept is that it is calculated according to an arbitrary interest rate equal to 10% which tends to underestimate the true level of ODA when interest rates are rising (See M. Beenstock, op. cit.).

organizations is ODA. Another reason is that the political focus of governments' attention is usually expressed in terms of trends in ODA.

Multilateral ODA is expressed

- in nominal terms: in most public statements aid is conventionally measured in current dollars.[6] However, to take into account the effects of inflation in donor countries, we also express multilateral ODA in real terms;
- as a percentage of Gross National Product since this indicator is the most familiar representation of the aid effort.[7]

2.2. Independent Variables

To express economic constraints on the donor countries' aid decision, we use the following indicators:

- Unemployment rate (U), since this indicator reflects the extent to which an economy is in recession. We can expect that public opinion puts pressures on governments to focus on domestic problems instead of foreign aid when domestic unemployment is high.

- Gross National Product (GNP) which represents an important constraint on donor countries' ability to give aid. We use also the GNP per capita, assuming that the higher a country's GNP per capita is, the greater the amount of aid is.

- Balance of payments constraint (BAL): We assume that the stronger the balance of payments position is, the lower the constraint on aid allocation is. To express the balance of payments constraint, we use the current account surplus.

- Budget position surplus (BUDG): Even if aid constitutes a very small part of the national budget, we can expect nevertheless that the budget's position influences the policy makers' interest in aid. We hypothesize that governments cut back on the volume of foreign aid if the domestic budget is in deficit.

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[6]OECD, Development Cooperation, 1975 review, p. 100.

[7]Since the Pearson Commission has recommended that Northern States transfer 0.7% of their respective GNPs, most governments refer to this target. L.P. Pearson, Partners in Development, Report of the Commission on International Development (New York: Praeger Publishers, 1969).

These variables are expressed with a one year time-lag, based on the supposition that aid disbursements in the year t are influenced by constraints in the year t-1. We assume linear relationships between the independent variable and the explanatory variables. The sources and symbols of the data are reported in Section 4 of the Appendix.

According to this view, the multilateral aid allocation process can be expressed as follows:

$$ODAm_i^t = f(-U_i^{t-1};\ +BUDG_i^{t-1};\ +BAL_i^{t-1};\ +GNP_i^{t-1};\ +\frac{GNP}{P}_i^{t-1})$$

where signs indicate the expected signs on the partial derivatives for the explanatory variables; and $ODAm_i^t$ represents the amount of multilateral aid in the country i at the year t.

2.3. Alternative Models

According to this scheme, we propose to estimate the following regression equations:

$$[1] \qquad ODAm_i^t = \beta_1 + \beta_2\ BAL_i^{t-1} + \beta_3\ BUDG_i^{t-1} + \beta_4\ GNP_i^{t-1} + \varepsilon$$

This first equation states that nominal flows of multilateral ODA are positively influenced by nominal value of the balance of payments surplus, the budget surplus and the GNP. We do not take the unemployment rate into account because it is a relative variable.

$$[2] \qquad ODAm_i^{*t} = \beta_1 + \beta_2\ BAL_i^{*t-1} + \beta_3\ BUDG_i^{*t-1} + \beta_4\ GNP_i^{*t-1} + \varepsilon$$

In this second equation, variables are expressed in real terms (indicated by the asterisk). Each of them is deflated by the OECD GNP deflator at 1982 prices.[8] This is to eliminate the inflation effects.

$$[3] \qquad \frac{ODAm}{GNP_i}^t = \beta_1 + \beta_2\ U_i^{t-1} + \beta_3\ \frac{BAL}{GNP_i}^{t-1} + \beta_4\ \frac{BUDG}{GNP_i}^{t-1} + \beta_5\ \frac{GNP}{P_i}^{t-1} + \varepsilon$$

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[8]From OECD, Development Cooperation, 1984 review, p. 263. This deflator includes the effects of exchange rate changes.

This equation states that the share of multilateral ODA in proportion to the donors' GNP is influenced negatively by the rate of unemployment and positively by the current account balance position, the budget surplus, and the GNP per capita. This last variable is expressed at constant prices.

These equations are estimated for a sample of eight major donor countries: the United States, Germany, the United Kingdom, France, the Netherlands, Sweden, Norway and Denmark.[9]

The observation period is 1968-1982 (15 years) and has been mainly determined by the availability of statistics. We have decided to pool the cross-section and time-series data[10] because the time-series are too short to leave sufficient degrees of freedom for hypothesis testing on each individual country. This method generates N x T observations in the time-series.

3. THE REGRESSION RESULTS

These are different models designed to deal with cross-section and time-series data.[11] In this case we use a covariance model assuming that the intercepts are different for each cross-section but constant over time. This is primarily to take into account country differences in the amount of multilateral aid which are not captured by the explanatory variables: i.e., the degrees of economic, humanitarian or ideological interests vary among the different donor countries and influence the amount of ODA channeled through international organizations. We assume that these factors do not vary significantly over time.

Under these assumptions, the regression equations then become:

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[9]We do not take Japan into account, although it is a major donor country, because statistical data are lacking.

[10]The pooled data method is used by Beenstock, loc. cit., p. 141.

[11]See J. Kmenta, Elements of Econometrics (New York: Macmillan, 1971), pp. 508-517, as an example.

$$Y_{i,t} = \alpha_i + \sum_{i=2}^{n} \gamma_i D_{i,t} + \sum_{k=1}^{K} \beta_K X_{ki,t} + \varepsilon_{it}$$

where $D_{i,t}$ = 1 for the ith cross-sectional unit
= 0 otherwise (i = 2, ... n)

We use N - 1 dummy variables because if we include both the constant term and N dummy variables, we will be introducing perfect multi-collinearity and the regression program will not run.

These models are treated within the framework of the classical regression model assuming that the stochastic disturbances have constant variance and are independently distributed over time and individuals. These assumptions can be expressed as follows:

$E(\varepsilon_{it}^2) = \sigma^2$ (homoskedasticity)

$E(\varepsilon_{it}\ \varepsilon_{jt}) = 0\ (i \# j)$ (cross-sectional independence)

$E(\varepsilon_t\ \varepsilon_s) = 0\ (t > s)$ (non autoregression)

In each case studied, we estimate a restricted and unrestricted model (Table 1) to test whether the intercepts are different, using an F-statistic test as described in Section 1 of the Appendix. The hypothesis of different intercepts for the cross-section units is confirmed in each case.

However, we are confronted with a problem of serial correlation as the insignificant D-W statistic values show. A general source of serial correlation is that some variables which should have been included in the equation are omitted, and that these omitted variables are themselves autocorrelated.[12] Hence, we attempted to remove serial correlation by assuming a first-order autoregressive scheme:

$$\varepsilon_{it} = \rho_i\ \varepsilon_{i,t-1} + u_{it}$$

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[12]See J. Johnston, Econometric Methods, Third edition, (New York: McGraw-Hill, 1984), pp. 309-310.

TABLE 1

MULTILATERAL AID PROCESS: RESULTS OF FIRST REGRESSION ANALYSIS
(with serial correlation)

Equation	Estimation Method	Dependent Variable	BAL	BUDG	GNP	BAL*	BUDG*	GNP*	U	$\frac{GNP^*}{P}$	$\frac{BAL}{GNP}$	$\frac{BUDG}{GNP}$	Constant	SSE	$S_{\hat{y}}$	$\bar{R}^2$	D-W	F
1	O.L.S.	ODA_m	0.009* (1.84)	-0.006* (1.90)	0.0007** (8.36)	--	--	--	--	--	--	--	0.11** (4.22)	6.99	0.25	0.77	2.13**	137.1**
2	OLS with dummy variables	ODA_m	0.012** (2.68)	-0.0017 (0.60)	0.0012** (10.99)	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-0.78** (5.85)	4.70	0.20	0.83	2.73	62.7**
3	OLS	ODA_m*	--	--	--	0.006 (1.33)	-0.008** (3.47)	0.0005** (8.42)	--	--	--	--	0.20** (5.66)	8.75	0.29	0.78	2.50	127.0**
4	OLS with dummy variables	ODA_m*	--	--	--	0.007 (1.60)	-0.006** (2.73)	0.001** (5.74)	--	--	--	--	-2.21** (3.64)	6.83	0.27	0.82	2.97	48.0**
5	OLS	$\frac{ODA_m}{GNP}$	--	--	--	--	--	--	-0.0001* (1.89)	0.0003** (5.01)	-0.0001** (3.27)	-0.007 (1.59)	-0.0009 (1.69)	9.10^{-4}	0.92	0.36	0.58	17.7**
6	OLS with dummy variables	$\frac{ODA_m}{GNP}$	--	--	--	--	--	--	0.00004 (1.42)	0.0003** (7.10)	-0.003 (1.19)	-0.001 (0.42)	-0.003** (7.11)	2.10^{-4}	0.50	0.81	1.30	47.4**

NOTES: The figures in parentheses below the estimated coefficients are the t-values.

R^2 is the corrected coefficient of determination.

SSE is the error sum of squares.

S_y is the standard error of the estimate.

F indicates the F-value.

D-W is the Durbin-Watson statistic value.

OLS indicates ordinary least squares.

Asterisks mean that the variable is expressed in real terms.

** = Significant at the 1% level.

* = significant at the 5% level.

TABLE 2

MULTILATERAL AID PROCESS: RESULTS OF SECOND REGRESSION ANALYSIS
(serial correlation removed)

Equation	Number of Countries	Period	Number of Observations	Dependent Variable	U	BAL	BUDG	GNP	BAL*	BUDG*	GNP*	$\frac{GNP^*}{P}$	$\frac{BAL}{GNP}$	$\frac{BUDG}{GNP}$	U.GNP	Constant	SSE	$S_{\hat{y}}$	$\overline{R^2}$	D-W	F
7	8	68-82	120	ODA_m	—	0.0083** (2.57)	-0.008** (3.57)	0.0010** (12.58)	—	—	—	—	—	—	—	-0.65** (7.38)	3.82	0.18	0.86	1.79**	79**
8	8	68-82	120	ODA_m	—	0.010** (2.76)	-0.010** (3.37)	0.0012** (5.87)	—	—	—	—	—	—	-0.00003 (1.05)	-0.72** (6.52)	3.78	0.18	0.86	1.71**	72**
9	8	70-82	104	ODA_m*	—				0.0042 (1.49)	-0.011** (7.23)	0.0011** (7.36)	—	—	—	—	-1.66** (4.61)	4.71	0.22	0.87	1.89**	73**
10	8	68-82	120	$\frac{ODA_m}{GNP}$	0.00004 (1.25)	—	—	—	—	—	—	0.0003** (6.27)	0.003 (0.13)	-0.003 (0.91)	—	-0.003** (6.27)	2.10^{-4}	0.46	0.83	2.11**	56**
11	5	68-82	75	ODA_m	—	0.009* (2.40)	-0.007** (2.83)	0.001** (10.43)	—	—	—	—	—	—	—	-0.65** (6.15)	3.47	0.22	0.85	1.69**	64**
12	5	68-82	45	ODA_m	—	0.003 (0.97)	0.009** (3.15)	0.004** (15.46)	—	—	—	—	—	—	—	-0.05** (3.67)	0.03	0.02	0.92	1.96**	111**
13	8	68-75	64	ODA_m	—	0.0007 (0.31)	-0.002 (1.68)	0.0014** (24.65)	—	—	—	—	—	—	—	-0.96** (0.90)	0.06	0.03	0.96	1.95*	202**
14	8	75-82	64	ODA_m	—	0.008* (2.66)	-0.008* (2.56)	0.0008** (9.20)	—	—	—	—	—	—	—	-0.36* (1.67)	2.11	0.19	0.89	2.18**	55**

NOTES: The figures in parentheses below the estimated coefficients are the t-values.

R^2 is the corrected coefficient of determination.

SSE is the error sum of squares.

S_y is the standard error of the estimate.

F indicates the F-value.

D-W is the Durbin-Watson statistic value.

OLS indicates ordinary least squares.

Asterisks mean that the variable is expressed in real terms.

** = Significant at the 1% level.

* = significant at the 5% level.

where u_{it} is a spherical disturbance independent of the disturbance

$\varepsilon(u_{it} \sim N(0, \sigma_u^2))$.

To estimate these equations we use a Cochrane-Orcutt iterative procedure as described in Section 2 of the Appendix. The serial correlation is thereby removed, the Durbin-Watson test being significant at a 1% level.[13] When re-estimated, the standard errors of the estimates are reduced (see Table 2).

All the equations in Table 2 are specified with country dummy variables. Nevertheless, due to space limitations, the results for the dummy variables are not reported. However, for illustrative purposes we report the estimated parameters of the dummy variables in the following table, for the Equations 7 and 9.

TABLE 3

ESTIMATED PARAMETERS OF THE DUMMY VARIABLES

Countries	Equation 7			Equation 9		
	Estimated Parameters	t-ratios (109d.f)	Estimated Standard Errors	Estimated Parameters	t-ratios (109d.f)	Estimated Standard Errors
Germany	0.73	9.78	0.07	1.62	5.81	0.27
United Kingdom	0.76	9.27	0.08	1.73	5.77	0.30
France	0.64	8.24	0.07	1.58	5.28	0.29
Netherlands	0.76	8.30	0.09	1.78	5.11	0.34
Sweden	0.77	8.27	0.09	1.79	5.07	0.35
Norway	0.72	7.71	0.09	1.75	4.88	0.35
Denmark	0.73	7.81	0.09	1.75	4.90	0.35

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[13]According to the table from N.E. Savin and K.J. White, "The Durbin-Watson test for serial correlation with extreme sample size or many regressors", <u>Econometrics</u>, Vol. 45, No. 8, Nov. 1977, pp. 1989-1996.

From these data, we can test whether the estimated parameters of the country dummy variables are different. For example, we tested the equality of the estimated coefficients for France and Sweden, using the following test:

$$H_0 : \beta_F = \beta_S$$

$$H_1 : \beta_F \neq \beta_S$$

$$\frac{\hat{\beta}_F - \hat{\beta}_S}{S_{\hat{\beta}_F - \hat{\beta}_S}} \sim t_{n-k}$$

where $S_{\hat{\beta}}$ is the estimated standard error and

$$S_{\hat{\beta}_F - \hat{\beta}_S} = \sqrt{S^2_{\hat{\beta}_F} + S^2_{\hat{\beta}_S} - 2 \text{ Est. cov}(\hat{\beta}_F, \hat{\beta}_S)}$$

The estimated cov($\hat{\beta}_F$, $\hat{\beta}_S$) is taken from the variance-covariance matrix of the estimated parameters. Since the absolute value of t is statistically significant at a 1% level (the t-statistic values are 2.48 and 5.61 respectively in Cases 7 and 9), the hypothesis that the two coefficients are equal must be rejected. This means that some considerations not taken into account by the explanatory variables affect differently the amount of multilateral aid channeled by these countries.

3.1. The Multilateral Aid Allocation Pattern

When multilateral ODA is expressed in nominal magnitudes (Equation 7) the balance of payments surplus and the GNP have a statistically significant influence (at a 1% level) with the expected sign. The budget surplus, although it is statistically significant, has an unexpected negative sign.

Equation 8 represents an attempt to take into account the unemployment rate. Since this variable is in relative terms, we scaled it by GNP as M. Beenstock did.[14] The estimated coefficient has the expected sign but is not statistically significant (although GNP and U.GNP are correlated, this does not significantly alter the regression analysis since the estimated

[14]Beenstock, loc. cit., p. 140.

coefficients do not change much when U.GNP is included). We do not use this variable in the following equations since it appears difficult to interpret its regression coefficient.

In Equation 9, the variables are expressed in real terms, and only the GNP is statistically significant. The balance of payments variable, although it is not significant, has nevertheless the expected sign.

When multilateral ODA is expressed relatively to GNP (Equation 10) only the GNP per capita is statistically significant: the higher the country's GNP per capita is, the greater the ODAm/GNP ratio is.

These results suggest that GNP (when multilateral ODA is expressed in absolute terms) and GNP per capita (when multilateral ODA is expressed as a proportion of GNP) are the main economic determinants of the multilateral aid allocation. The balance of payment constraint appears, also, to have an impact on the amount of multilateral ODA but only when this variable is expressed in nominal terms. The other explanatory variables - unemployment rate and budget surplus - fail to confirm the hypotheses developed in Section 2.

3.1.1. Comparison of the multilateral aid allocation process in the Scandinavian countries and in the other donor countries

Scandinavian countries have a stronger interest in closer international cooperation than the other countries because they are small states. Indeed, multilateral channels reduce their administrative costs of sharing aid so that multilateral aid programs are relatively more important in these countries than in larger states.[15] According to this, it seems interesting to determine whether economic factors have a different influence on multilateral aid allocation in these two samples of countries. For this purpose, we estimate two allocation functions on a sample of three Scandinavian countries (Norway, Sweden, Denmark) and five other donors (the United States, Germany, the United Kingdom, France, and the Netherlands). The results of these regressions are reported in Table 2 (Equations 11 and 12).

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[15]For a comparison of the foreign aid policies of small states and large states, see J.S. Hoadley, "Small States as Aid Donors", International Organization, Vol. 34, No. 1, 1980, pp. 121-137.

A comparison of these equations seems to prove that economic factors influence Scandinavian countries differently from the other countries: First, the results show that a budget deficit influences negatively the Scandinavian countries' aid allocation contrary to the other states. Furthermore, the balance of payments constraint is not statistically significant for the sample of Scandinavian countries whereas it significantly affects, in the predicted positive direction, the multilateral aid allocation from the other countries. To determine whether these differences are statistically significant, we use a Chow-test (see Section 3 of the Appendix), testing the hypotheses:

H_0: The economic factors have the same influence on multilateral aid allocation in the Scandinavian countries as they do in the other countries.

H_A: The economic factors have a different influence.

The F-value is equal to 3.47 and is significant at a 5% level. This result confirms that economic constraints affect differently the multilateral aid allocation in Scandinavian countries than in the other countries.

3.1.2. Comparison of the multilateral aid allocation process before and after the 1973-74 crisis

Was the influence of economic factors on multilateral aid allocation changed after the 1973-74 crisis? To answer this, we estimate separately two functions for the periods 1968-75 and 1975-82 (Equations 13 and 14, Table 2) and test the hypotheses:

H_0: The economic factors have the same effect in these two periods.

H_A: The economic factors have a different effect.

The F-value, calculated as previously, is equal to 30.9 which is significant at a 1% level. Hence we can reject H_0 and conclude that the influence of economic factors on the donor's multilateral aid allocation did change after the 1973-74 crisis. The nature of this difference is reflected by the fact that the balance of payments position is not a significant variable for the period 1968-1975 whereas it is significant at a 5% level for the years 1975 to 1982. The economic crisis appears, therefore, to have increased the influence of the balance of payments constraints on the multilateral aid allocation process.

3.2. Comparison of the Bilateral and Multilateral Aid Allocation Processes

Bilateral and multilateral aid are, by nature, very different.[16] Multilateral aid seems to provide less direct benefits to the donor's foreign policy than does bilateral aid. Indeed, through the bilateral channel, donor governments deal directly with the recipient countries so that economic aid can be used to put pressure on the recipients' foreign policy. One would also believe that bilateral aid is less affected by a balance of payments constraint than multilateral aid in that bilateral aid remains largely tied to purchases in donor countries. For these reasons we can expect a different pattern in bilateral and multilateral aid allocation processes.

To verify this assertion, we estimated bilateral aid allocation functions. The results, presented in Table 4, are quite different from the results of the multilateral aid functions.

When the amount of aid is expressed in nominal terms (Equation 15) the model gives a good explanation of the bilateral aid allocation process. Ninety-six percent of the variance of ODA_B can be attributed to the variation of the explanatory variables. All the parameters have the expected sign and both the budget surplus and the GNP are statistically significant at a 1% level.

When bilateral ODA is expressed in real terms (Equation 16) only the GNP and the budget surplus have a statistically significant influence with the expected sign. This estimation explains 94% of the variance of bilateral aid.

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[16]For a comparative analysis of bilateral and multilateral aid, see T. Balogh, "Multilateralism versus Bilateralism in Foreign Aid", in J. Bhagwati, R. Eckaus, Foreign Aid, Selected Readings (New York: Penguin Books, 1970), pp. 201-222; and D. Wall, The Charity of Nations: The Political Economy of Foreign Aid, the Political Economy of International Relations Series (London: Macmillan, 1973), pp. 126-149.

TABLE 4

BILATERAL AID PROCESS: RESULTS OF REGRESSION ANALYSIS[a]

Equation	Period	Number of Observations	Dependent Variable	U	BAL	BUDG	GNP	GNP*/P	$\frac{BAL}{GNP}$	$\frac{BUDG}{GNP}$	BAL*	BUDG*	GNP*	Constant	SSE	$S_{\hat{y}}$	$\bar{R}^2$	D-W	F
15	68.82	120	ODA_B	—	0.005 (1.11)	0.0049* (1.96)	0.0017** (6.27)	—	—	—	—	—	—	2.68* (1.58)	5.08	0.21	0.96	1.93**	330**
16	70.82	104	ODA_B^*	—	—	—	—	—	—	—	-0.003 (0.54)	0.001* (2.30)	0.00012** (4.34)	5.11** (5.75)	12.4	0.36	0.94	1.98	182**
17	68.82	120	$\frac{ODA_B}{GNP}$	0.00002 (0.38)	—	—	—	0.0003** (2.42)	0.00001 (0.70)	0.000005 (0.56)	—	—	—	-0.003 (0.95)	5.10^{-5}	0.71	0.83	2.09*	56**

NOTES: [a]These equations use pooled data in a first autoregressive scheme with dummy variables.

The figures in parentheses below the estimated coefficients are the t-values.

$\bar{R}^2$ is the corrected coefficient of determination.

SSE is the error sum of squares.

S_y is the standard error of the estimate.

F indicates the F-value.

D-W is the Durbin-Watson statistic value.

OLS indicates ordinary least squares.

Asterisks mean that the variable is expressed in real terms.

** = Significant at the 1% level.

* = significant at the 5% level.

When bilateral ODA is expressed as a proportion of the GNP (Equation 17), only the GNP per capita comes out statistically significant. The budget and balance of payments variables have the expected sign. The unemployment rate is not significant and has an unexpected positive sign, as in the case of the multilateral aid allocation process.

We compared these regression results with those concerning the multilateral aid process by means of the Chow-test. The following hypotheses were tested:

H_0: The economic factors have the same effect on multilateral aid as they do on bilateral aid.

H_A: The economic factors have a different effect.

To apply this test, we pooled the bilateral and multilateral data in order to get the restricted residual sum of squares (Table 5). The F-statistic values are 35.4, 18.8, and 9.4 when ODA is expressed, respectively, in nominal terms, real terms and as a percentage of the GNP. These F-values are statistically significant at a 1% level and confirm that economic factors influence differently the bilateral and multilateral aid allocations.

It seems interesting to observe in addition that, when ODA is expressed in absolute terms (Equations 18 and 19), the pooling of multilateral and bilateral aid data gives a good explanation of the total aid allocation process. In both equations, the explanatory variables have a statistically significant influence in the predicted positive direction. These estimations explain respectively 88% and 87% of the variance on the independent variables.

4. CONCLUSION

Since the late 1970's there has been a decline in the rate of increase of financial contributions channelled through multilateral agencies by DAC member countries. In this context, it seemed worthwhile to examine aid-givers' behavior. For this purpose, we have analysed the influence of economic factors on the multilateral aid process in a group of major DAC

TABLE 5

POOLING[a] OF MULTILATERAL AND BILATERAL AID: RESULTS OF REGRESSION ANALYSIS

Equation	Number of Countries	Period	Number of Observations	Dependent Variable	U	BAL	BUDG	GNP	GNP/P	BAL/GNP	BUDG/GNP	BAL*	BUDG*	GNP*	Constant	SSE	$S_{\hat{y}}$	$\overline{R^2}$	D-W	F
18	8	68-86	240	in nominal terms	--	0.014** (2.96)	0.082** (3.05)	0.001** (10.78)	--	--	--	--	--	--	0.39 (0.87)	23.21	0.31	0.88	2.36	190**
19	8	70-82	208	in real terms	--	--	--	--	--	--	--	0.010* (2.02)	0.0048* (1.96)	0.0010** (2.46)	0.0018 (1.54)	0.004	0.004	0.87	2.33	132**
20	8	68-82	240	as proportion of GNP	0.00004 (0.87)	--	--	--	0.00026** (3.37)	0.00051 *0.18)	-0.0018 (0.47)	--	--	--	-0.002* (1.74)	0.0001	0.0007	0.83	2.31	101**

NOTES: [a]According to a first autoregressive scheme with dummy variables.

The figures in parentheses below the estimated coefficients are the t-values.

R^2 is the corrected coefficient of determination.

SSE is the error sum of squares.

S_y is the standard error of the estimate.

F indicates the F-value.

D-W is the Durbin-Watson statistic value.

OLS indicates ordinary least squares.

Asterisks mean that the variable is expressed in real terms.

** = Significant at the 1% level.

* = significant at the 5% level.

member countries, using multiple-regression techniques. We expressed multilateral ODA in nominal terms, real terms and as a proportion of GNP. In this last case, the results are quite disappointing since only GNP per capita significantly influences this variable. ON the contrary, when multilateral ODA is expressed in nominal or real magnitudes, the results are more interesting.

First, they indicate that, in addition to GNP, the balance of payments constraint significantly influences the DAC members' multilateral aid allocation: the stronger the balance of payments position is, the lower the constraint on aid allocation is. This is particularly evident after the 1973-74 crisis and for all the countries considered except the Scandinavian ones. Indeed, for these countries, the budget constraint seems to explain in a better way the multilateral aid allocation pattern. The increasing budget deficit in these states since the late 1970's might explain the relative slowing down of the volume of aid they channel through multilateral agencies.

The comparison of bilateral and multilateral aid allocation further indicates how these are differently influenced by economic factors. In particular, the balance of payments constraint has no significant influence on the bilateral aid allocation, contrary to the multilateral contributions. This result might be explained by the fact that bilateral aid is more directly tied to purchases in donor countries than is multilateral aid, so that the balance of payments constraint has a different and insignificant impact on the bilateral aid allocation. The budget position also appears to influence differently the bilateral and multilateral aid allocation. Though this variable has an unexpected influence on the distribution of multilateral aid (i.e., the more important the budget deficit is, the greater the amount of aid is), it has the expected impact on the volume of bilateral aid: the greater the budget deficit is in the year t-1, the less important the volume of bilateral aid is in the year t. These results suggest that governments cut down on the volume of bilateral aid rather than on the volume of multilateral aid to decrease budget deficits.

In conclusion, the limits and the possible extension of such an analysis should be emphasized. First, it seems necessary to remember the highly speculative nature of this analysis, since aid allocation is ultimately a political decision. Second, since we take into account only economic considerations, there is no assurance that the models tested are not misspecified, so that the correlations we found may be due to excluded variables, and may be quite unrelated to causality.

Finally, it appears possible to improve upon the specification of the different alternative models by using, for example, different time-lag periods or more appropriate variables. (For example, the rate of unemployment may not be an appropriate proxy variable to measure the domestic climate towards aid in donor countries.)

APPENDIX

1. To test whether or not the intercepts are different we used the following F-test:

$$F = \frac{SSE_R - SSE_U/r}{SSE_{U/df}} \sim F_{r,df}$$

testing the hypothesis H_0: $\alpha_1 = \ldots\ldots \alpha_N$

H_A: the α_i are not all equal

where r = number of restrictions = N - 1
df = degrees of freedom = (T x N) - K in the unrestricted model
K = number of parameters to estimate
SSE_U = unrestricted residual sum of squares
SSE_R = restricted residual sum of squares

The results are as follow:

Cases 1-2: F = 7.58
Cases 3-4: F = 4.38
Cases 5-6: F = 19.46

The F-values are, in every case, statistically significant at a 1% level.

Source: Maddala, G.S., Econometrics (New York: McGraw-Hill, 1977), pp. 323-324.

2. The Cochrane-Orcutt iterative procedure consists of the following steps:

a. We estimate the following equation by OLS:

$$Y_t = \alpha + \beta X_t + \varepsilon_t \tag{1}$$

We get the residual e_t and estimate ρ by:

$$\hat{\rho} = \frac{\Sigma\ e_t\ e_{t-1}}{\Sigma\ e_{t-1}^2} \quad (t = 2, \ldots\ldots, T)$$

b. Then, by lagging (1) by one time period and multiplying by $\hat{\rho}$, we get:

$$\hat{\rho} Y_{t-1} = \alpha\hat{\rho} + \beta\hat{\rho} X_{t-1} + \hat{\rho}\,\varepsilon_{t-1} \tag{2}$$

Subtracting (2) from (1) we get:

$$Y_t - \hat{\rho}Y_{t-1} = \alpha(1 - \hat{\rho}) + \beta(X_t - \hat{\rho}X_{t-1}) + u_t$$

where $u_t = \varepsilon_t - \hat{\rho}\,\varepsilon_{t-1}$.

We obtain OLS estimates which may be called $\hat{\hat{\alpha}}$ and $\hat{\hat{\beta}}$, and lead to residuals $\hat{e}_t$. These residuals are used to obtain a new estimate of ρ:

$$\hat{\rho} = \frac{\Sigma\, \hat{e}_t\hat{e}_{t-1}}{\Sigma\, \hat{e}_{t-1}} \qquad (t = 2, \ldots n)$$

c. We can retransform the variables, recompute the estimates and get a new estimate of until successive values of ρ are approximately the same. In this case the Cochrane-Orcutt transformation involves a loss of 8 observations. However, the Shazam econometrics computer program used to run this transformation avoided dropping the first observations by using the following Prais-Winsten transformation:

$$Y_t = \sqrt{1-\rho}\quad Y_t \qquad\qquad \text{for } t = 1.$$

3. The Chow-test can be expressed as follows:

$$\frac{(SSE_R - SSE_U)/k}{SSE_U/(n_1 + n_2 - 2K)} \sim F_{K,\, n_1 + n_2 - 2K}$$

To obtain the unrestricted residual sum of squares, we estimate each equation separately (Equations 11 and 12), get the residual sum of squares for each equation, and add them. To obtain the restricted residual sum of squares, we pool the data and estimate a single equation (Equation 7). K is the number of restrictions. n_1 and n_2 are respectively the number of observations in Equations 11 and 12.

Source: Maddala, p. 198.

TABLE A

VARIABLES AND DATA SOURCES

Symbol	Variables	Source
ODA_m	Multilateral Aid Disbursements	DAC Annual Reports
ODA_b	Bilateral Aid Disbursements	DAC Annual Reports
U	Unemployment Rate as % of active population	OECD, Economic Outlook
GNP	Gross national Product	DAC Annual Reports
GNP^*/P	GNP at 1980 Market Prices divided by Midyear Population	IMF, Supplement On Output Statistics, 1984
BAL	Current Account Balance	IMF, International Financial Statistics
BUDG	Net Budget Surplus[a]	IMF, International Financial Statistics

NOTE: [a]Converted into US dollars using an average of exchange rates taken from IFS.

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