Does Aid Promote Fiscal Indiscipline? Evidence from Dynamic Panel Model

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Abstract

This paper examines the impact of foreign aid flows on public sector behaviour in developing countries. It contributes to the fiscal response literature on two main fronts. Firstly, it provides a new fiscal response model. Secondly, on the estimation front, it departs from the existing literature by using the system GMM estimator approach to dynamic panel to empirically test the model. The key findings of the paper can be summarised as follows. 1) Public investment is positively related to aid flows. 2) With regard to government consumption, the evidence shows that aid flows do not increase non-developmental expenditure, whilst their impact on developmental expenditure is positive and significant. 3) Aid does not appear to reduce government revenue collection efforts. Finally, 4) borrowing and aid flows are found to be substitutes.

JEL classification: C5, F3, H2, H5, H6

Keywords: Public sector fiscal behaviour; Foreign aid; Dynamic Panel

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1. INTRODUCTION

The debate over the effectiveness of development aid has been revived in recent years, though much of it is still centred on the aid-growth nexus. However, given that most aid goes through the public sector, its impact on the recipient economy, and thus growth, will depend on how it affects the behaviour of the latter (McGillivray and Morrissey, 2000). The fiscal response literature, pioneered by Heller (1975), addresses this shortcoming. Specifically, tt looks at how aid recipient governments behave vis-à-vis of aid flows. Early studies include Mosley *et al.* (1987), Gang and khan (1991), Khan and Hoshino (1992) and Otim (1996) and the literature has witnessed a slight boom in recent years with authors such as Gupta (1997), Franco-Rodriguez *et al*. (1998), Gang and Khan (1999), McGillivray and Ahmed (1999), McGillivray (2000), Franco-Rodriguez (2000), Mavrotas (2002), Mavrotas and Ouattara (2003), and McGillivray and Ouattara (forthcoming).

A general feature of the aforementioned studies is that the estimation method used is generally based on the Three-Stage Least Square (3SLS) or the Non-linear Three-Stage Least Square (N3SLS) techniques. Little effort has been made, since Heller (1975), to depart from these static estimation methods despite the existence of more advanced econometric techniques which could allow us to capture the dynamic effect of aid flows on the recipient governments behaviour.

The purposes of the present paper are twofold. Firstly, it develops a new fiscal response model and provides solutions that can be estimated using cointegration techniques or a panel data approach. Secondly, it tests the model using a relatively

sophisticated econometric technique, the dynamic panel approach known as the system GMM estimator suggested by Arellano and Bover (1995), Blundell and Bond (1998), and Blundell, Bond and Windmeijer (2000), for a group of developing countries between the period of 1980-2000. The results obtained from the estimation generally indicate that aid flows increase public investment and government developmental consumption (health and education) and, contrary to common view, do not reduce government revenue collection efforts.

The papers is organised in the following way. Section 2 outlines the settings of the model and derive its solutions. Section 3 deals with data issues and describes the methodology used in the estimation process. Section 4 presents the results and their interpretation. Concluding remarks are left to the final section.

2. THE MODEL

Like in previous fiscal response models, it is assumed that decision-makers in the public sector behave as a single individual with a well-behaved, homothetic preference map and with the following utility function:

$$U = f\left(Ig, G, \mathrm{R}, A, B\right) \qquad [1]$$

where Ig stands for public investment, G for government consumption, R for government revenue (tax and non-tax), A for net foreign aid disbursements and B for the flow of public borrowing from other sources (domestic and foreign).

It is then assumed that the public authorities minimise the following quadratic loss function:

$$U = \alpha_0 - \frac{\alpha_1}{2}\left(Ig - Ig^*\right)^2 - \frac{\alpha_2}{2}\left(G - G^*\right)^2 - \frac{\alpha_3}{2}\left(R - R^*\right)^2 - \frac{\alpha_4}{2}\left(B - B^*\right)^2 \quad [2]$$

where the starred variables indicate exogenously determined targets and $\alpha_i > 0$, $\forall\ i = 1,....,4$ represent the weight attached to each element of the utility function.

The rationale for specifying the utility function in this manner is that public decision-makers set annual targets (represented by the starred variables) for each of the decision variables and consciously strive to achieve these targets subject to budgetary constraint.[1] The utility function is specified in a way that if the decision-makers try to deviate from the targets it will result in a loss in utility.[2]

It is then assumed that the public sector policy-makers face the following budget constraint:

$$Ig + G = R + A + B \quad [3]$$

The above budget constraint assumes that expenditure (public investment + government consumption) must equal total government's receipts. In other words, it is

[1] Recent papers such as Franco-Rodriguez *et al*. (1998), McGillivray (2000) and Mavrotas and Ouattara (2003) have endogenised aid on the basis that it is a government choice variable. However, given that the target for aid is generally set as aid commitments this implies that the impact of aid obtained in the reduced form equations will be that of the commitment values and not the disbursement values. This will tend to over-estimate the impact of aid, as the amounts committed are generally higher than those disbursed.

[2] Bihn and McGillivray (1993) provide detail discussion about the specification of the utility function.

assumed that the government runs a balanced-budget. Some studies have introduced a second budget constraint to capture the distribution of government's receipts among expenditure types. However, White (1994) argues that the allocation of government's receipts to its expenditure types must be the outcome of the utility maximisation problem. Put differently, White (1994) is arguing that specifying the budget constraint as in [3] is the appropriate approach. What is more, the present paper is only interested in capturing the fiscal impact of aid flows and, therefore, specifying the budget constraint as in [3] is sensible.

The Langrangean is then applied to the maximisation problem, as follows:

$$L = \alpha_0 - \frac{\alpha_1}{2}\left(Ig - Ig^*\right)^2 - \frac{\alpha_2}{2}\left(G - G^*\right)^2 - \frac{\alpha_3}{2}\left(R - R^*\right)^2 - \frac{\alpha_4}{2}\left(B - B^*\right)^2 + \lambda\left(Ig + G - R - A - B\right) \quad [4]$$

where λ is the Lagrange Multiplier.

Taking the derivative of L with respect to the choice variables and λ, and solving the first order conditions through leads to the following semi-reduced form equations:[3]

$$Ig = \delta_1 Ig^* + \delta_2(A + B^* + R^* - G^*) \quad [5]$$

$$G = \delta_3 G^* + \delta_4(A + B^* + R^* - Ig^*) \quad [6]$$

$$R = \delta_5 R^* - \delta_6(A + B^* - Ig^* - G^*) \quad [7]$$

[3] The software Mathematica 4 was used in solving the maximisation problem.

$$B = \delta_7 B^* - \delta_8 (\mathrm{A} + R^* - Ig^* - \mathrm{G}^*) \qquad [8]$$

where the $\delta_j \ (i = 1, 2, ...8)$ are combinations of $\alpha_i \ (i = 1, ...4)$.[4]

One problem faced with most fiscal response studies has been to obtain the target variables included in the model. These targets exist in some cases only for short periods. To overcome this problem, target values have generally been estimated using ordinary least square, autoregressive or cointegration techniques. However, rather than deriving the target values through an estimation technique this paper approximates them from economic relationships.

It is assumed that the target for public investment can be approximated by the following economic relationship:

$$Ig^* = \gamma_0 + \gamma_1 Y + \gamma_2 D + \gamma_3 A \qquad [9]$$

where Y stands for GDP per capita, D is debt service and A denotes aid disbursements. Y measures the country's level of economic development. Public investment will also depend on the debt burden of the country measured here by debt servicing. It is also assumed that part of aid flows will be disbursed to finance public investment.

The target for government consumption is also approximated by a similar economic relationship:

[4] These coefficients can be obtained from the author upon request.

$$G^* = \eta_0 + \eta_1 Y + \eta_2 D + \eta_3 A \qquad [10]$$

where Y, D and A are defined as above. The argument for including these variables in the determination of this target is the same as that for public investment.

The target for government revenue (tax and non-tax) is approximated by:

$$R^* = \mu_0 + \mu_1 Y + \mu_2 X + \mu_3 M \qquad [11]$$

where Y is defined as above, X is exports and M is imports. Y captures revenue from income tax, indirect tax (VAT) on private consumption and non-tax revenues such as fines. The inclusion of X and M is based on the fact that many developing countries get revenue from exports as well as imports.

Finally the target for borrowing is approximated by the following relationship:

$$B^* = \varepsilon_0 + \varepsilon_1 Y + \varepsilon_2 A \qquad [12]$$

where Y and A are defined as above. Borrowing will depend on income as well as foreign aid flows.

Putting Equations [9]-[12] into Equations [5]-[8] gives the following full reduced-form equations:

$$Ig = \omega_0 + \omega_1 Y + \omega_2 D + \omega_3 A + \omega_4 \mathrm{X} + \omega_5 \mathrm{M} \quad [13]$$

$$G = \psi_0 + \psi_1 Y + \psi_2 D + \psi_3 A + \psi_4 \mathrm{X} + \psi_5 \mathrm{M} \quad [14]$$

$$R = \pi_0 + \pi_1 Y + \pi_2 D + \pi_3 A + \pi_4 \mathrm{X} + \pi_5 \mathrm{M} \quad [15]$$

$$B = \rho_0 + \rho_1 Y + \rho_2 D + \rho_3 A + \rho_4 \mathrm{X} + \rho_5 \mathrm{M} \quad [16]$$

where the ωs, ψs, πs and ρs can be traced back to the αs representing the weight attached to each element of utility function [2].

Traditionally, Equations [13]-[16] have generally been estimated using the 3SLS or the N3SLS techniques, which are static estimation techniques. However, other developments in econometrics, namely cointegration (in the context of specific studies) and panel data techniques, provide us with more powerful tools to test these relationships among economic variables. These techniques can be applied to each of the Equations [13]-[16]. In this paper, the above equations will be estimated using panel data econometrics technique.

3. Methodology and Data Issues

Methodology

The methodology employed, here, is based on the system generalized method of moments (SYS-GMM). As the GMM approach requires the inclusion of the lagged dependent variable in the model to be estimated, each of the Equations [13]-[16] can be represented by the following dynamic reduced-form regression:

$$Y_{i,t} = \alpha_1 Y_{i,t-1} + \alpha_2 X_{i,t} + \eta_i + \varepsilon_{i,t} \quad [17]$$

where Y is the dependent variable, X is a set of explanatory variables, η stands for country-specific effects and ε is the error term. i and t represent country and time period, respectively. To control for country specific effects Equation [17] is expressed in first difference, as follows:

$$\left(Y_{i,t} - Y_{i,t-1}\right) = \alpha_1 \left(Y_{i,t-1} - Y_{i,t-2}\right) + \alpha_2 \left(X_{i,t} - X_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right) \quad [18]$$

Some of the Xs in [18] might be endogenous, and thus estimation based on OLS might lead to endogeneity problems. To overcome these problems Arellano and Bond (1991) recommend using instrumental variables. More specifically, they propose using lagged values of the explanatory variables as instruments.

The standard GMM estimator, as proposed by Arellano and Bond (1991), has been extensively used in applied economics in recent years. However, more recently, Bond and Bover (1995), Bond and Blundel (1998) and Blundell, Bond and Windmeijer (2000) document that in the presence of weak instruments the standard GMM has large biases and low asymptotic precisions. Applied work also shows that when time series are persistent and the panel relatively short, the standard GMM perform badly. The SYS-GMM approach overcomes the problem by combining regressions in levels with regressions in differences. More specifically, recent applications of the standard GMM and the SYS-GMM by Blundell, Bond and Windmeijer (2000), Bond, Hoeffler

and Temple (2001) and Hoeffler (2002) show the superiority of the SYS-GMM over the standard GMM.

The validity of the instruments used in the estimation process can be tested using standard Sargan tests of overidentifying restrictions. The Sargan test is asymptotically distributed as χ^2 and tests the null hypothesis of validity of the (overidentifying) instruments. In addition to the Sargan test, it is also important to check for the absence of serial correlation in the error term, as consistency of the estimates depends on it. First-order, AR(1), and second-order, AR(2), serial correlation tests are used for this purpose. While first order serial correlation is expected by construction, failure to reject the null hypothesis of " absence of second order serial correlation" leads to the conclusion that the original error term is serially uncorrelated. The test statistics are asymptotically distributed as standard normal variables.

The data

The data used here come from three main sources and covers the period of 1980-2000. Data on aid (defined as net ODA) is obtained from the OECD-DAC online database (Table 2a). For estimation purposes this data was expressed in percentage of each country GDP. Data on government consumption (G), government revenue (R), debt service (D), exports (X), Imports (M) (all expressed as a percentage of GDP), Y (GDP per capita) and GDP (market price) were obtained from the World Bank World Development Indicator 2002. Data on borrowing (B) is the public sector borrowing requirement, obtained as a residual from constraint [3], in the model. Data on public investment is obtained from World Bank Global Development Network Growth

Database. For the estimation the logs of the variables were taken. Table 1 (in appendix) presents summary statistics of the data.

4. Empirical Results

The results of estimating Equations [13]-[16] are reported in Table 2. The econometrics package used is DPD02 for Ox (Doornik, Arellano and Bond (2002)). The "robust standard errors" option was used to correct for heteroskedasticity. We report the two-step parameter estimates for the SYS-GMM estimations, based on Windmeijer (2000) correction. The author, using Monte Carlo simulation, shows that the corrected variance of the two-step estimator leads to more accurate inference in finite samples, and especially for the SYS-GMM estimator.[5]

For the estimation, we started by including all the countries in the OECD-DAC database. We then dropped countries that have less than 15 observations in our dependent variable and in our variable of interest, aid. Given that our panel covers 21 years it means that we are only allowing 6 missing values in these variables and that our panel is unbalanced. It is also important to note that, contrary to many previous panel studies, we use the whole sample in each regression rather than using periods. This ensures that the results are not sensitive to the length of the period chosen.[6] All regressions include time dummies which were found to be jointly significant in all the regressions. In order to conserve space the coefficients on the time dummies are not reported.

[5] The finite sample correction for the variance of linear two-step GMM estimators is incorporated in the version of DPD for Ox used in the present estimation.

[6] Periods are often chosen arbitrarily based on 5, 6 or 10-year average. The length of the period might affect the results and using the whole sample avoids this problem.

Before analysing the results, it is important to check their robustness. Firstly, the null hypothesis of " absence of second order serial correlation" cannot be rejected. This leads to the conclusion that the original error term is serially uncorrelated. Secondly, the P-value of the Sargan test indicates in all regressions that the instruments used are valid. Thirdly, the coefficient of the lagged dependent variable in all the regressions is less than one in absolute value, thus indicating that the models are stable and not explosive. The coefficients of the lagged dependent variables are highly significant in all cases.

Starting with the equation of public investment (Ig) the results show that foreign aid, our variable of interest, bears a positive (0.054) and statistically significant sign, suggesting that aid flows are associated with increases in public investment. This result corroborates earlier findings by Heller (1975), Khan and Hoshino (1992) and Franco-Rodriguez et al. (1998).. From the same regression it can also be seen that the coefficient of debt servicing is negative (-0.035) and statistically different from zero. This indicates that debt servicing is a constraint to public investment in developing countries, a situation known as debt overhang.

Turning to the government consumption variable, contrary to the finding of Boone (1996) and others, we find no evidence that aid monies are used to finance consumption. The next two equations labelled NDE and DE refer to non-developmental expenditure and developmental expenditure equations, respectively. Non-developmental expenditure mainly includes wages, salaries and subsidies. Developmental expenditure includes expenditure on education and health.[7] The NDE

[7] Data on NDE and DE has been calculated from the World Bank WDI 2002.

regression results show that coefficient of aid with respect to NDE is negative (-0.125) but not statistically significant, suggesting that aid flows are not directed to non-developmental activities. On the contrary, results based on the DE equation clearly show that aid flows are associated with increases in developmental expenditure (health and education). The coefficient of aid in that equation is positive (0.189) and significant.

The impact of aid on the government revenue collection effort is assessed in the regression labelled R. The coefficient of aid is positive but statistically insignificant, implying that aid bears only a weak relationship to revenue effort. Put differently, the evidence suggests, contrary to general belief, that government in developing countries do not reduce their revenue collection efforts when aid is made available to them. This confirms earlier findings by Otim (1996) and Franco-Rodriguez (2000).

Finally, turning to the borrowing regression equation, B, the coefficient of aid is negative (-0.887) and highly significant. The size of the coefficient suggests that governments would substitute borrowing for aid, almost, on a one-to-one basis. This result supports the widely held view that governments in developing countries are likely to reduce other forms of borrowing for aid.[8]

5. Conclusion

One area of the wider aid effectiveness debate, fiscal response studies, has attempted to look at the how governments in developing countries behave vis-à-vis aid flows.

[8] The argument is based on the fact aid is "cheaper" compared to borrowing

The present paper uses the fiscal response framework as a point of departure in modelling the impact of aid flows on public sector fiscal aggregates. It provides a new model with solutions that can be tested using more advance econometric techniques such us cointegration, in the context of country specific studies, or panel data techniques, in cross-countries studies. The paper then tests the solutions of the model using a relatively sophisticated technique known as the system GMM estimator to dynamic panel, for a group of developing countries over the period of 1980-2000.

The findings in this paper, in terms of the effectiveness of development aid, are rather encouraging. We discovered a positive and significant relationship between aid flows and public investment. The evidence also shows that aid flows are not used to increase government consumption. What is more (the evidence indicates that) aid does not lead to increases in non-developmental expenditure (wages, salaries and subsidies); but does induce increases in development expenditure (health and education). In terms of the analysis on the revenue side of the public sector, contrary to the conventional wisdom, aid does not reduce incentives for the mobilization of public resources. These findings constitute evidence that aid does not lead to fiscal indiscipline in recipient countries. Another finding of the paper is that recipient governments in developing countries substitute borrowing for aid on a one-to-one basis. Finally, the results appear to support the view that debt servicing has a negative effect on public investment.

One policy implication of this study is that increasing aid to developing countries is not only going to help them boost public investment, which in turn might crowd in private investment, but it would also augment the- financing of expenditure in health

and education, and this is clearly in line with the millennium development goals (MDGs). However, increasing aid might generate more debt, which might hamper public investment (as suggested by the results). To counteract this effect, donors can either alter the composition of aid in favour of grants or remove the existing debt burden through debt cancellation or forgiveness. Furthermore, as suggested by McGillivray and Ouattara (forthcoming), expansion of developing countries export revenues through the adoption of fair trade policies by advanced countries could provide them with the resources needed for the financing of their development strategy and reduce their dependence on foreign aid. Finally, introduction of severe measures by governments in developing countries to minimise capital flight might help to bring in the required resources.

This paper has also some research implications. Firstly, as argued by Morrissey and McGillivray (2000) aid effectiveness studies need to first consider the question of government behaviour vis-à-vis aid flows before studying their broad macroeconomic impacts. The relationship between aid and growth might not be a straightforward one, as many aid-growth studies seem to assume. Therefore, understanding how these flows affect fiscal aggregates might shed new light on the aid debate. Secondly, it might also be worth analysing whether the fiscal behaviour of the recipient government depends on the nature or the type of aid. Thirdly, although panel studies are sophisticated and allow us to have more insight into economic relationships than previous techniques such as cross-section analysis, country specific studies are still needed. The use of cointegration and error-correction estimation techniques can serve well for this purpose.

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Appendix

Table 1: Summary Statistics

Variables (*in logs*)	Mean	Std. Dev.	Min	Max
Public Investment	1.975	0.583	-0.916	3.856
Government Consumption	2.557	0.386	1.090	3.998
Non-Developmental Expenditure	1.765	0.556	-0.580	2.942
Developmental Expenditure	2.158	0.586	-0.569	3.998
Revenue	2.978	0.476	-2.700	4.125
Aid	0.878	1.932	-7.851	4.346
Borrowing	1.136	1.270	-2.017	3.467
GDP per capita	7.428	0.816	5.613	9.371

Table 2 System GMM Estimation Results

	Ig	G	NDE	DE	R	B
Lagged Dependent Variable	0.741***	0.716***	0.496**	0.517**	0.777***	0.164***
GDP per capita	0.104***	-0.007	-0.312**	0.593*	0.041**	0.804***
Debt Service	-0.035**	0.097*	-0.052	0.083	-0.012	0.015
Aid	0.054**	-0.126	-0.125	0.189**	0.005	-0.887***
Exports	-0.755	-0.108	-0.501*	0.180	0.120**	-0.313**
Imports	0.389***	0.245***	0.284	0.182	0.066*	0.467***
Constant	-2.849***	0.298	8.845**	-13.713	-0.867*	0.063*
AR(1)	-2.350	-3.633	-2.445	-2.756	-4.038	-3.487
p-value	(0.019)	(0.000)	(0.015)	(0.006)	(0.000)	(0.000)
AR(2)	0.775	0.358	1.859	0.347	0.828	0.635
p-value	(0.438)	(0.721)	(0.063)	(0.728)	(0.408)	(0.525)
Sargan Test (p-value)	1.000	1.000	1.000	1.000	0.312	0.952
No of Countries	68	68	56	56	46	39

, **, * indicate significance at the 10, 5 and 1 percent levels, respectively.*