# Fiscal Effects of Aid flows in Senegal

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This paper uses the fiscal response framework to study the effects of aid flows on key fiscal aggregates in Senegal, over the period 1970-2000. Attention is given to the interplay between aid and debt. The paper contributes to the empirics of fiscal response modelling by deriving the standard errors and p-values associated with the estimated impact coefficients of the structural and reduced-form equations. The main findings in this paper are: (i) a relatively large share of aid is used to finance debt servicing; (ii) the impact of aid flows on domestic expenditure is insignificant; and (iii) debt servicing has a significant negative effect on domestic expenditure. The main policy implication of this study is that reducing the debt of Senegal would be more effective in helping the country achieve some of the millennium development goals than giving additional aid (loans).

Keywords: aid, debt, fiscal policy, MDGs, Senegal

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## 1. INTRODUCTION

Aid flows constitute a major source of revenue for most developing countries. Given this importance of aid, it is imperative to assess its economic benefits on the recipient economies. The vast majority of the existing work on aid effectiveness is concerned with its effects on savings, investment, and economic growth. However, a drawback in these approaches is that most of these flows are channelled through the public sector and, therefore, understanding the role played by aid on the fiscal preference of the recipient government is the first step towards understanding its macroeconomic effects. This is the focal point of the fiscal response literature, which goes back to Heller (1975). This literature has witnessed a slight boom in recent years with contributions by 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). The last two studies have taken this literature a step further by addressing some of the criticisms by Franco-Rodriguez (2000) and McGillivray and Morrissey (2001). In particular, the two studies have reconciled the empirical and the theoretical aspects of fiscal response modelling by deriving consistent estimates, an issue overlooked by earlier studies.

Nonetheless, one problem with the existing fiscal response studies is that they do not provide us with any diagnostic tests in terms of the statistical significance of the estimated parameters of both structural and reduced form equations. The aim of this paper is twofold. First, it seeks to address the aforementioned shortcoming in the fiscal response literature by deriving the standard errors and p-values associated with the impact coefficients (direct and total). Second, the paper provides the first case study of

the fiscal response in the context of Senegal, over the period 1970-2000. Key findings in this paper are that a relatively large share of aid is used to finance debt servicing; debt servicing has a negative significant effect on domestic expenditure, which includes expenditure on health and education two key elements of the millennium development goals (MDGs). Moreover, the results show that the impact of aid flows on domestic expenditure is insignificant.

The remainder of this paper is organised as follows. Section 2 presents the fiscal response model used in this paper. The model is borrowed from McGillivray and Ouattara (forthcoming). An interesting feature of the model is that it takes into account the interplay between aid flows and debt. The paper's third section outlines the empirical strategy adopted and discusses the data. Section 4 presents econometric results and their interpretation. It starts by approximating the target variables and then estimates of the structural and reduced form equations with focus on the variables of interest. The final section concludes the paper.

## 2. THE MODEL

The model used in this paper, as noted earlier, is borrowed from McGillivray and Ouattara (forthcoming). It is assumed that public sector decision-makers are faced with the task of allocating resources among expenditure types subject to budgetary constraints. These decision-makers are further assumed to behave as if they were a single individual with a well-behaved, homothetic preference map and with the utility function:

$$U = f(E, D, R, A, B) \tag{1}$$

where $E$ is government total domestic expenditure, which includes public investment and government consumption expenditure (expenditure on health, education, etc.), $D$ is public debt servicing, $R$ is government revenue (tax, non-tax and other recurrent domestic revenue), excluding grants, $A$ is foreign aid disbursements (grants and *gross* aid loans) and $B$ is *gross* borrowing from all other sources.

Following the standard approach in the fiscal response literature, utility function (1) is written as a quadratic loss function which assumes that decision-makers set annual targets for each expenditure and revenue variable and consciously strive to achieve these targets:

$$U = \alpha_0 - \frac{\alpha_1}{2}(E - E^*)^2 - \frac{\alpha_2}{2}(D - D^*)^2 - \frac{\alpha_3}{2}(R - R^*)^2 - \frac{\alpha_4}{2}(A - A^*)^2 - \frac{\alpha_5}{2}(B - B^*)^2 \quad (2)$$

where the starred variables represent exogenous targets and $\alpha_i > 0, \ \forall\, i = 1, \ldots, 5$. All other variables in (2), which represent actual expenditures or revenues, are treated as endogenous, including aid. Utility function (2), as defined above, implies that each year the government sets its targets for $E$, $D$, $R$, $A$, and $B$ and maximises its utility by trying to achieve these targets and any deviation from these targets results in a loss in utility. It follows that (2) reaches a maximum at $\alpha_0$. A fuller discussion of the general form of (2) can be found in Binh and McGillivray (1993) and Franco-Rodriguez *et al.* (1998).

The public sector decision-maker is then assumed to maximise utility function (2) subject to the following budget constraints:

$$E+D = R+A+B \tag{3}$$

$$D \leq \rho_1 R+\rho_2 A+\rho_3 B \tag{4}$$

where $\rho_1$, $\rho_2$, and $\rho_3$, are the proportions of government revenue, aid, and borrowing allocated to debt servicing, respectively. The constraint Equation (3) states that total domestic expenditure plus expenditure from debt servicing equal revenue plus aid transfers plus borrowing from other sources. This is the government's overall budget constraint which must always hold. The rationale for the inequality written in (4) is that there are *external* constraints that limit the manner in which the public sector in developing countries allocates revenues. The actions of donors or domestic interests cause the values of the $\rho$s in (4) to be imposed on those involved in setting targets and allocating revenue, with there being no guarantee that targets can be met even though revenues may satisfy (3) (Franco-Rodriguez *et al.*, 1998). In other words, on the assumption that (4) is binding (the possible value of $D$ is upper bound), these external constraints prevent the attainment of $\alpha_0$ because at least one expenditure target cannot be met. The analysis in this paper is premised on this assumption. If (4) is not binding the government is able to reach its expenditure targets, utility is maximised subject to (3) only and the government can attain $\alpha_0$ if revenues are sufficient.

As is tradition in practically all fiscal response studies it is assumed *ex ante* that targeted domestic borrowing $B^*$ is equal to zero. The rationale for this assumption is that borrowing is expensive compared to other form of revenues; and therefore governments would try not to borrow if they could. Maximising (2) subject to (3) and (4) with $B^* = 0$ yields the following system of structural equations:

$$\begin{aligned} E = {} & (1-\rho_1)\beta_1 E^* + (1-\rho_1)\beta_2 D^* \\ & +(1-\rho_1)[1-(1-\rho_1)\beta_1 - \rho_1\beta_2]R \\ & +[(1-\rho_2)-(1-\rho_1)(1-\rho_2)\beta_1 - (1-\rho_1)\rho_2\beta_2]A \\ & +[(1-\rho_3)-(1-\rho_1)(1-\rho_3)\beta_1 - (1-\rho_1)\rho_3\beta_2]B \end{aligned} \tag{5}$$

$$\begin{aligned} D = {} & \rho_1\beta_1 E^* + \rho_1\beta_2 D^* + \rho_1[1-(1-\rho_1)\beta_1 - \rho_1\beta_2]R \\ & +[\rho_2 - \rho_1(1-\rho_2)\beta_1 - \rho_1\rho_2\beta_2]A \\ & +[\rho_3 - \rho_1(1-\rho_3)\beta_1 - \rho_1\rho_3\beta_2]B \end{aligned} \tag{6}$$

$$\begin{aligned} R = {} & \beta_1 E^* + \beta_2 D^* + [1-(1-\rho_1)\beta_1 - \rho_1\beta_2]R^* \\ & -[(1-\rho_2)\beta_1 + \rho_2\beta_2]A \\ & -[(1-\rho_3)\beta_1 + \rho_3\beta_2]B \end{aligned} \tag{7}$$

$$\begin{aligned} A = {} & \beta_3 E^* + \beta_4 D^* - [(1-\rho_1)\beta_3 + \rho_1\beta_4]R \\ & +[1-(1-\rho_2)\beta_3 - \rho_2\beta_4]A^* \\ & -[(1-\rho_3)\beta_3 + \rho_3\beta_4]B \end{aligned} \tag{8}$$

$$\begin{aligned} B = {} & \beta_5 E^* + \beta_6 D^* - [(1-\rho_1)\beta_5 + \rho_1\beta_6]R \\ & -[(1-\rho_2)\beta_5 + \rho_2\beta_6]A \end{aligned} \tag{9}$$

where

$$\beta_1 = \frac{\alpha_1(1-\rho_1)}{\theta_1}; \beta_2 = \frac{\alpha_2\rho_1}{\theta_1}; \beta_3 = \frac{\alpha_1(1-\rho_2)}{\theta_2}; \beta_4 = \frac{\alpha_2\rho_2}{\theta_2}; \beta_5 = \frac{\alpha_1(1-\rho_3)}{\theta_3};$$
$$\beta_6 = \frac{\alpha_2\rho_3}{\theta_3}$$

$$\theta_1 = \alpha_1(1-\rho_1)^2 + \alpha_2\rho_1^2 + \alpha_3;$$
$$\theta_2 = \alpha_1(1-\rho_2)^2 + \alpha_2\rho_2^2 + \alpha_4$$
$$\theta_3 = \alpha_1(1-\rho_3)^2 + \alpha_2\rho_3^2 + \alpha_5$$

To obtain the reduced form equations, where each endogenous variable in (2) is expressed in terms of the exogenous variables represented by the target variables, the system of structural equations (5)–(9) is solved through. This leads to the following equations:

$$E = \delta_1 E^* + \delta_2 D^* + \delta_3 R^* + \delta_4 A^* \quad (10)$$

$$D = \delta_5 E^* + \delta_6 D^* + \delta_7 R^* + \delta_8 A^* \quad (11)$$

$$R = \delta_9 E^* + \delta_{10} D^* + \delta_{11} R^* + \delta_{12} A^* \quad (12)$$

$$A = \delta_{13} E^* + \delta_{14} D^* + \delta_{15} R^* + \delta_{16} A^* \quad (13)$$

$$B = \delta_{17} E^* + \delta_{18} D^* + \delta_{19} R^* + \delta_{20} A^* \quad (14)$$

where the δs are combination of ρs and βs not reported here.[12]

[1] In McGillivray and Ouattara (forthcoming) these parameters are combination of $\rho$s and $\alpha$s, although the $\alpha$s are not estimated.
[2] These sets of parameters can be obtained from the author.

## 3. EMPIRICAL STRATEGY AND DATA ISSUES

*3.1 Empirical Strategy*

The estimation strategy adopted in this paper follows four main steps. First, as with most previous fiscal response studies, we start by approximating the target variables. Obtaining these targets has been one of the main problems faced by this literature over the years. The tradition in the literature has been to approximate these targets by combining economic theory and econometric analysis (e.g. cointegration techniques). In the present context we used a relatively new cointegration technique known as the auto-regressive distributed lag (ARDL) bounds approach proposed by Pesaran *et al*., (2001). The advantage of this technique, compared to the standard Johansen maximum likelihood approach which requires the variables to be integrated of order one, is that it can be implemented irrespective of whether the variables in the model are I(0) or I(1). This implies that I(0) variables can enter the cointegration space, unlike in the Johansen (1988) technique. The other advantage of this technique is that it is suitable for testing long run relationship in the context of developing that are known to have short data span. Due to space limitation the main steps in the ARDL procedure will not be presented here[3].

In approximating the targets we assume that the target for government total domestic expenditure ($E^*$) is a function of GDP, Private investment (Ip) and the terms of trade (TOT). The target for debt service ($D^*$) is assumed to be dependent on the debt

[3] For exposition of this technique refers to Pesaran *et al*., (2001) and studies by Bahmani-Oskooee (2001), Karfakis (2002), Ouattara (2004), among others.

stock (DBST) and on export revenues (X). The target for government revenue ($R^*$) is dependent on of income GDP, export revenues and import revenues (M).

In the second step of the estimation process, the non-linear three stage least square (NL3SLS) technique is used to estimate the system of structural equations (5)-(9). This method is appropriate because the structural and reduced form equations are non-linear in parameters and because of simultaneity between some of the left and right hand side variables.[45] In this stage of the estimation process we derive the estimates of the $\rho$s and $\beta$s and their associated standard errors. In the third stage, we go beyond computing the estimate of the impact coefficients of the structural equations, as done by previous studies, to provide the standard errors and p-values associated with these impact coefficients. In the final stage, we compute the estimates of the parameters of the reduced form equations and provide the relevant standard errors and p-values.[6]

*3.2 Data*

The basic data, for Senegal, used in this paper draws from different sources and covers the period 1970-2000. Data on total domestic expenditure is the sum of public investment and government consumption (which includes expenditure on health and education). Data on public investment (as % GDP) obtained from the World Bank Global Development Network (macro time series) for the period 1970-1994 and then extended

[4] A N3SLS is preferred to a N2SLS technique because one would expect cross-equation correlations in the error terms.

[5] In the context of time series data the standard practice is to use cointegration analysis to overcome the problem of unit root. However, the issue of unit root and cointegration in the context of non-linear systems estimation remains unexplored by the econometric literature. In other words, there is no evidence to suggest that using the NL3SLS leads to spurious regressions results if the data is non-stationary.

[6] Different techniques have been used to derive these estimates. For example, McGillivray (2000 and 2002) used simulations, whilst McGillivray and Ouattara (forthcoming), Mavrotas and Ouattara (2003) solved the estimated system of structural equations to obtain these reduced-form equations. However, neither of these two approaches provides us with the statistical significance of the impact coefficients.

with public investment data from the IMF (Senegal: Statistical Appendix, June 2003) for the period 1995-2000, whilst government consumption (as % GDP) data comes from the World Bank World Development Indicators 2003 (WDI 2003). Debt service (% GDP) data is obtained from the WDI 2003 for the period 1974-2000[7] and supplemented with IMF data for the period 1970-73. Data on government revenue (% GDP) comes from the WDI 2003 for the 1970-1987 and 1996-2000 period, and from the IMF (Senegal: Statistical Appendix, various years) for the 1988-1995 period. Data on export and import revenues (as % GDP), Debt stock (% GDP) and GDP has been obtained from the WDI 2003.

With regard to data on borrowing (B) and aid (A), most previous studies have used aid figures from the OECD (the donor measure of aid) and some studies (see Franco-Rodriguez-Rodriguez, 1998; Franco-Rodriguez, 2000; McGillivray, 2000; MgGillivray and Ouattara, forthcoming; Mavrotas and Ouattara, 2003) have derived borrowing as a residual from constraint (3). This results in two problems. Firstly, as correctly remarked by McGillivray and Morrissey (2001), donors' measure of aid is not the amount going through the recipient budget. In other words, using aid figures from the donors' viewpoint would tend to overestimate the fiscal effects of aid. Secondly, borrowing figures derived as a residual from constraint (3) are very often negative and do not correspond to actual borrowing of the country, for which the data exists. To address these problems, we use borrowing figures (private borrowing) from the World Bank Global Development Finance 2002 (GDF 2002), which we express in percentage of GDP. Then we derive aid (% GDP) figures from constraint (3) as (E+D)-(R+B). The derived

[7] We have converted debt service data expressed in percentage of export revenues into percentage of GDP using information on export revenues as a percentage of GDP, which is reported in the WDI 2003.

figures are lower than aid figures obtained from the OECD database, as a plot (not shown here) suggested.[8]

## 4. EMPIRICAL RESULTS

### *4.1 Approximation of Target Variables and Statistics*

Table (1) summarises results related to the approximation of the target variables using the ARDL bounds cointegration approach. The Schwarz Bayesian Criterion was used for this purpose. These relationships are then used to compute the target variables for each year. The computed target values were expressed in percentage of GDP to be consistent with the other variables. The target for aid, as pointed above, is the commitment values. In Table (2) we provide summary statistics of all the variables used in the estimations. A quick glance at these statistics shows that our estimated targets are quite close to the actual values.

Table (1) Approximation of the Target Variables (SBC Criteria)

| | E* | D* | R* |
|---|---|---|---|
| Constant | 121.24 | 18.11 | -34.81** |
| GDP | 0.23*** | --- | 0.15*** |
| Ip | -0.62*** | --- | --- |
| TOT | -0.40 | --- | --- |
| X | --- | 0.01*** | 0.43*** |
| M | --- | --- | 0.44*** |
| DBST | --- | 0.06 | |

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

[8] The correlation coefficient between our aid figure and that of the OECD is around 0.77 in the case of Senegal.

Table (2) Summary Statistics of the Dataset

| Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| E | 19.89 | 2.33 | 16 | 26.24 |
| D | 4.38 | 1.90 | 1.35 | 7.6 |
| R | 17.80 | 1.92 | 14.9 | 24.35 |
| A | 4.98 | 2.64 | 0.55 | 10.28 |
| B | 1.49 | 1.90 | 0.00 | 6.93 |
| E* | 17.59 | 1.34 | 13.99 | 19.84 |
| D* | 3.441 | 1.62 | 0.84 | 5.72 |
| R* | 17.04 | 2.20 | 12.30 | 22.99 |
| A* | 12.68 | 3.96 | 5.54 | 20.33 |
| GDP | 3332.16 | 1563.82 | 869.61 | 6027.44 |
| IP | 9.44 | 2.18 | 5.79 | 15.3 |
| TOT | 107.27 | 6.20 | 93.89 | 116.33 |
| DBST | 60.37 | 28.39 | 14.83 | 100.44 |
| X | 30.25 | 5.18 | 22.16 | 42.05 |
| M | 38.69 | 6.64 | 29.12 | 52.83 |

*4.2 Main Results*

Results obtained from estimating the structural parameters are shown in Table (3). As can be seen from this table, $\rho_1$, $\rho_2$ and $\rho_3$ are all within their theoretical range. Also, the estimates of the $\beta$s parameters are all positive as expected.[9] As such, the econometric estimates satisfy the theoretical model and one can confidently interpret the results. The estimates of the constraint equation parameters, $\rho_1$, $\rho_2$ and $\rho_3$ are, respectively, 0.14, 0.41 and 0.00.[10] These results indicate that 14 per cent of government revenue and 41 per cent

[9] See McGillivray and Ouattara (forthcoming) and Mavrotas and Ouattara (2003) for a detail discussion.
[10] When we used aid data from the OECD (donor's measure) instead of our own measure these coefficients were respectively 0.14, 0.38, and 0.00. This implies that the argument by McGillivray and Morrissey (2001) that donor's measure (of aid) over estimates the fiscal of aid is not justified on empirical ground.

of aid disbursements are used for debt repayments in the context of Senegal, whilst all borrowing is used to finance domestic expenditure. This implies that around 20 percent of government resources are devoted to debt servicing in Senegal. This partly explains why the government has to borrow, elsewhere, to finance domestic expenditure. The finding, with respect to aid, corroborates results by McGillivray and Ouattara (forthcoming), who found that more than 60 per cent of aid disbursements are used for debt repayments in the case of Côte d'Ivoire, and Pack and Pack (1993) who found that around 88 cents per dollar of aid are used for debt servicing in the Dominican Republic. The finding regarding borrowing is consistent with the results of McGillivray and Ouattara (forthcoming) for Côte d'Ivoire where all borrowing is, also, used to finance domestic expenditure. A Wald test rejects the hypothesis that the given set of parameters in Table (3) are jointly zero at the 1 percent level.

Table (3) Estimates of the Structural Parameters

| Parameters | Estimates | Standard Errors |
|---|---|---|
| $\rho_1$ | 0.14*** | 0.02 |
| $\rho_2$ | 0.41*** | 0.07 |
| $\rho_3$ | 0.00 | 0.00 |
| $\beta_1$ | 1.28*** | 0.14 |
| $\beta_2$ | 0.10 | 0.19 |
| $\beta_3$ | 2.02*** | 0.68 |
| $\beta_4$ | 0.18 | 0.23 |
| $\beta_5$ | 0.01 | 0.05 |
| $\beta_6$ | 1.88** | 0.77 |

*Notes: *** and ** represents significance at the 1 percent and 5 percent levels, respectively. Wald test for the null Hypothesis that the given set of Parameters are jointly zero: P-value = 0.00*

Table (4) presents results related to the estimates of the parameters of the structural equations. As pointed out earlier, the main problem with the existing literature is that we have no way to ascertain the statistical significance of the estimates of the impact coefficients of the structural equations and, consequently, those of the reduced form equations. Studies such as McGillivray (2002), McGillivray and Ouattara (forthcoming), and Mavrotas and Ouattara (2003) have partially attempted to address this issue by restricting to zero any $\rho$s or $\beta$s (in Table (3)) that are statistically insignificant in the computation of the impact coefficients of the structural equations. However, their methodology could not tell us if the resulting estimates of the impact coefficients are significant or not, in statistical terms. Moreover, the problem with restricting some of the estimated parameters to zero is that we are not using the true values of the parameters (i.e. those derived by the estimation process) to compute the impacts coefficients associated with the structural equations. In this paper, we overcome the problem by using the true values of the parameters and then we derive the standard errors as well as the p-values associated with each of the impact coefficients. Results of interest are presented in Table (4).

As far as the direct impacts are concerned, the results in Table (4) show that foreign aid flows have a positive and significant effect on debt servicing in Senegal. Aid, however, does not appear to exert a statistically significant impact on total domestic expenditure. Turning to government revenue, the results show that this variable is affected negatively by aid flows. The estimated coefficient is highly significant in statistical term. With regard to borrowing, the results indicate that it is affected positively and highly significantly by aid flows.

Table (4) Direct Incremental Impacts

| Impact | Mechanism | Estimates | Std errors | p-value |
|---|---|---|---|---|
| A on D | $[\rho_2 - \rho_1(1-\rho_2)\beta_1 - \rho_1\rho_2\beta_2]$ | 0.29 | 0.11 | 0.01 |
| A on E | $[(1-\rho_2) - (1-\rho_1)(1-\rho_2)\beta_1 - (1-\rho_1)\rho_2\beta_2]$ | -0.09 | 0.13 | 0.46 |
| A on R | $-[(1-\rho_2)\beta_1 + \rho_2\beta_2]$ | -0.80 | 0.18 | 0.00 |
| A on B | $-[(1-\rho_2)\beta_5 + \rho_2\beta_6]$ | 0.19 | 0.04 | 0.00 |
| B on D | $[\rho_3 - \rho_1(1-\rho_3)\beta_1 - \rho_1\rho_3\beta_2]$ | -0.18 | 0.04 | 0.00 |
| B on E | $[(1-\rho_3) - (1-\rho_1)(1-\rho_3)\beta_1 - (1-\rho_1)\rho_3\beta_2]$ | -0.10 | 0.11 | 0.37 |
| B on R | $-[(1-\rho_3)\beta_3 + \rho_3\beta_4]$ | -1.28 | 0.14 | 0.00 |
| B on A | $-[(1-\rho_1)\beta_3 + \rho_1\beta_4]$ | -2.02 | 0.68 | 0.00 |
| R on E | $(1-\rho_1)[1-(1-\rho_1)\beta_1 - \rho_1\beta_2]$ | -0.10 | 0.12 | 0.40 |
| R on D | $\rho_1[1-(1-\rho_1)\beta_1 - \rho_1\beta_2]$ | -0.01 | 0.02 | 0.42 |
| R on A | $-[(1-\rho_1)\beta_3 + \rho_1\beta_4]$ | -1.77 | 0.64 | 0.01 |
| R on B | $-[(1-\rho_1)\beta_5 + \rho_1\beta_6]$ | -1.37 | 0.28 | 0.00 |
| D on E | $(1-\rho_1)\beta_2$ | 0.09 | 0.16 | 0.58 |

The fiscal response model can also be used to assess the impacts of domestic and other revenues, gross borrowing in this case, on public sector fiscal aggregates. From Table (4) it follows that the direct impact of an increase in borrowing is a negative and highly significant impact on debt servicing, government revenue and aid flows, and an insignificant impact on total government expenditure. Turning to government revenue, its direct impact on aid and borrowing is negative and highly significant, whilst its impact on

debt servicing is insignificant. Another interesting result from Table (4) is that the direct impact of debt servicing on total domestic expenditure is statistically insignificant.

As aforementioned, the results related to the structural equations only show the direct and therefore partial impacts of the right hand side variables on each endogenous variable. Total impacts, which matter for policy implications, are captured by the estimates of the reduced form equations. Table (5) shows reduced form equation parameters relating to the total impact of variables of interest. The results show that the total impact of aid flows on debt servicing is positive and marginally significant at the 10 percent level. The estimated coefficient indicates that increasing aid by one percent of GDP would result in an increase in debt servicing by 0.13 percent of GDP. Aid flows do not appear to exert a significant impact on domestic expenditure in the context of Senegal.

Table (5) Total Impacts[11]

| Impact | Estimates | Std errors | p-value |
|---|---|---|---|
| A* on D | 0.13 | 0.10 | 0.18 |
| A* on E | -0.07 | 0.08 | 0.37 |
| A* on R | -0.68 | 0.28 | 0.02 |
| A* on B | 0.18 | 0.14 | 0.20 |
| R* on A | -0.40 | 0.19 | 0.04 |
| R* on B | -0.15 | 0.05 | 0.00 |
| D* on E | -0.13 | 0.06 | 0.01 |

[11] We do not report the mechanism here due to their size.

Turning to the revenue equation, the evidence shows that aid affects negatively and significantly government revenue. Indeed, a one percent increase in aid as a percentage of GDP would lead to a 0.68 percent reduction in government revenue as a percentage of GDP. According to some studies, this result implies that aid flows discourage domestic revenue collection, which is seen as detrimental to development. However, we refrain from this view, as a reduction in taxation might not be a bad thing after all. For example, if it is targeted at the private sector then this might help stimulate private investment and thus growth and job creation. In deed, some Senegalese entrepreneurs have always complained about taxes, which they maintain are harmful to investment (Berg, 1997). If the reduction in taxation is targeted at the poor then it can be seen as an income distribution tool. Furthermore, as noticed by McGillivray and Morrissey (2001), aid flows tend to reduce government revenue because they are associated with policy reforms (such as trade liberalisation and thus tariff reductions) that reduce taxes. The evidence also shows that, in the case of Senegal, aid flows do not appear to affect significantly borrowing decisions.

The results also show that government revenue affects negatively and significantly aid flows and borrowing. In fact, increasing government revenue by one percent of GDP would result in a reduction in aid and borrowing by 0.40 and 0.15, respectively. Based on the statistical significance of the estimated coefficient of government revenue in the aid and borrowing equations it could be infer that the Senegalese government is more likely to reduce borrowing rather than aid if its revenue were to increase. This is because, as pointed out earlier, borrowing (from private market) is more "expensive" than aid. It can also be inferred from the results that the government would lower its dependence on aid and borrowing if its revenue increases. An interesting

result from Table (5) is that debt servicing appears to exert a negative and significant impact of domestic expenditure in Senegal. The coefficient of debt servicing with respect to domestic expenditure indicates that increasing debt service by one percent of GDP is associated with a reduction in domestic expenditure by 0.13 percent of GDP. Given that domestic expenditure includes public investment as well as expenditure on health and education this is worrying situation for Senegal in terms of achieving the MDGs. What is more, the results based on the respective impact of aid flows (insignificant) and debt servicing (negative and highly significant) on domestic expenditure clearly indicate that reducing the debt of Senegal would be more effective than additional aid (loans) in enhancing domestic expenditure, and thus expenditure on health and education two key ingredients of the MDGs. This argument of debt relief is further strengthened by the fact that the amount of aid Senegal received is almost equal to what the country pays in debt servicing. Another reason in favour of debt relief is that recent empirical evidence by Patillo *et al*. (2002) suggests that debt reduction affects positively economic growth by increasing the quality and quantity of domestic and foreign investment.

## 5. CONCLUSION

This paper has investigated the fiscal effects of aid flows in Senegal over the period 1970-2000. Special attention is given to the interaction between aid and debt. The paper contributes to the empirics on fiscal response modelling by deriving, for the first time, the standard errors and p-values associated with the direct as well as total impact coefficients. One important finding in this paper is that part of aid flows (41 percent) is used to finance the debt of the country. Overall, the Senegalese Government devotes around 20 percent of it resources to debt servicing. Another finding, based on the total

effects, is that debt servicing exerts a significant negative effect on domestic expenditure, whilst foreign aid does not appear to exert any significant impact on it. Furthermore, the paper found that aid flows exert a significant negative impact on government revenue; but their effect on borrowing is statistically insignificant.

The main policy implication that can be inferred from this study is that the development community have to find ways to address the debt burden on poor countries, especially if the MDGs targets were to be achieved. Any development financing or strategy that ignores this reality is likely doomed to failure. In the context of Senegal, as the evidence suggested, debt repayments absorb a relatively high share of the country's resources and impose a constraint on domestic expenditure. These resources used to finance the debt could have been utilised to mobilise the finance necessary to meet the internationally agreed development targets. Indeed, the evidence indicated that reducing debt of Senegal would be a more effective policy tool than additional aid (loans) in increasing domestic expenditure. However, debt relief is a necessary but not sufficient condition for increasing developmental expenditure. In addition, the Senegalese authorities must ensure that the resources generated from the debt relief are effectively used towards financing expenditures that are included in the MGDs and public investment, which is found to stimulate private investment in the context of Senegal (see Ouattara, 2004).

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