

# Foreign Aid and Recipient Government Behavior in Nicaragua

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**Abstract**—Fiscal policy in low-income countries plays a key role in helping to make the development process effective. Foreign aid is central to that policy, because it represents one of the main sources of revenue in many less developed countries. Understanding the way in which aid flows can influence fiscal variables has emerged as an important issue in recent debates over the effectiveness of aid and the formulation of fiscal policy. This paper develops and estimates a fiscal response model with anticipated aid, being Nicaragua the case study selected. The principal assumption is that some aid can be anticipated by the recipient government in its budgetary plans. The model estimation suggests that aid is mainly used to deal with the debt problem and to reduce borrowing, and has little impact on investment. The results also present different responses according to the various types of aid (grants and loans).

**Index Terms**—Fiscal response, aid effectiveness, Nicaragua.

## I. INTRODUCTION

The channels through which aid can affect less developed countries (LDCs) are complex and are influenced by very heterogeneous factors, notable among which is the role played by the recipient government responsible for taking political decisions, such as those on fiscal policy. The fact that aid inflows are more volatile than other sources of financing such as tax revenue, can cause difficulties when formulating the fiscal policy [1]-[4]. In this context, it is pertinent to analyze the impact of aid on the fiscal behavior of LDCs, especially those with low-incomes for which aid is a significant source of financing.

The use of aid inflows by recipient governments has been investigated fundamentally through fiscal response models. Following the seminal paper of Heller [5], variations on his initial model have been drawn up in an attempt to adapt it to the realities of LDCs and the available data and econometric techniques [5]-[9], [11]-[16]. The purpose of this paper is to contribute to this literature through the theoretical and empirical development of a fiscal response model with anticipated aid, which uses Nicaragua as a case study. The unique history of this country –military dictatorship, Sandinista revolution, civil war and transition to democracy over hardly two decades– along with exceptional amounts of foreign aid receipts, underlines the importance of Nicaragua as a case study. Furthermore, the scant empirical research available in this country justifies the need to examine this field in greater depth [17], [18].

When donors make their decisions over the concession of aid, they are able to select the amount of aid to be allocated

and the time period for its transfer, and they may even decide not to fulfill their aid commitments. In this context, the recipient governments wield no influence over the aid allocated, but they can take it into account when preparing their budgetary plans. This is the basic assumption of the model proposed by White [18]. Contrary to the more generalized assumption that all aid is unanticipated, this model considers that aid is an exogenous variable part of which may be anticipated by recipient governments, which can therefore influence their budgetary planning. This assumption enriches the investigation and was chosen as the foundation for the theoretical and the empirical research.

In order to adapt the aforementioned model to the research undertaken in Nicaragua, it was broadened and improved through four contributions. In the first place, a new endogenous variable was incorporated in the utility function of the recipient government: the variable on the payment of external public debt. The incorporation of this new variable is justified by its importance for the majority of LDCs that are recipients of aid and particularly for Nicaragua, a country that is characterized by a high level of external public debt. In second place, the variable ‘total aid’ was disaggregated into its two principal components: grants and loans. The hypothesis underlying this distinction is based on differences in the fiscal behavior of the government according to whether or not the funds received will have to be repaid. Finally, two improvements were made to the definition of the target equations set by the recipient government, by taking account of explanatory variables identified in economic theory and the need to include expectations to model government anticipation of part of the aid. The theoretical model resulting from the incorporation of the four above-mentioned contributions was used to simulate three scenarios of aid increase that the recipient government might have to face. These scenarios were drawn up by considering the presence or absence of aid increase expectations held by the government, as well as the fulfillment or non-fulfillment of aid commitments on the part of the donors.

The remainder of this paper is structured as follows. Section II presents the theoretical model on the basis of which the three scenarios of aid increase are established. Section III justifies the database and the estimation method, following which it discusses the econometric results obtained for each of the three scenarios. Section IV ends the paper with the summary of the main findings and the conclusions.

## II. THEORETICAL MODEL

This section presents the theoretical model used in the research. After specifying the model (section A), three theoretical scenarios for the fiscal government behavior are derived (section B). As previously justified, the model

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analyzed the impact of total aid as well as each of the two different types of aid allocated. In order to examine the specific fiscal effects of each type of aid, three versions of the theoretical model were developed. For the sake of simplicity, only the version corresponding to the impact of total aid is included in this section.

### A. Model Specification

Following the standard approach in the fiscal response literature, a model was developed assuming that public sector decision makers act in a rational manner. The model is focused on the decision that an aid recipient government has to take when allocating public financing from three sources –government revenue, non-aid borrowing and foreign aid– among three categories of government expenditure –investment, consumption and external debt payment–. This decision is taken through the resolution of an optimization problem in which the government maximizes a utility function subject to a budgetary constraint.

The utility function (U) of the aid recipient government is represented as a quadratic loss function with non-linear terms, in which the government sets a series of targets for the public variables, such that the utility decreases when these variables deviate from their targets. This utility function is expressed as follows:

$$U = -\left(\frac{\alpha_1}{2}\right)(I_g - I_g^*)^2 - \left(\frac{\alpha_2}{2}\right)(T - T^*)^2 - \left(\frac{\alpha_3}{2}\right)(G - G^*)^2 - \left(\frac{\alpha_4}{2}\right)(B - B^*)^2 - \left(\frac{\alpha_5}{2}\right)(D_p - D_p^*)^2 \quad (1)$$

where,  $I_g$  = capital government expenditure or government investment;  $T$  = tax and non-tax government revenue;  $G$  = recurrent government expenditure or government consumption;  $B$  = non-aid borrowing;  $D_p$  = external public debt payment. The asterisks denote the targets set by the recipient government for its public variables. The parameters  $\alpha_i$  are defined as greater than zero ( $\alpha_i > 0$  for all of  $i$ ). These parameters represent the relative weight that the government attaches to the convergence of the public variables with their respective targets. The model assumes that the utility function is symmetrical, that is, the government faces utility loss regardless of whether the targets are over or undershot.

The recipient government has to maximize the utility function subject to the following budgetary constraint:

$$I_g + G + D_p = T + B + A \quad (2)$$

where all the variables except  $A$ , denote the respective public variables presented earlier in the utility function equation. Variable  $A$  represents total foreign aid disbursed to the government. The underlying assumption of this budgetary constraint is that the government maintains a budgetary balance, that is, all of the government expenditure must be financed by government revenue, non-aid borrowing and aid inflows.

$$L = -\left(\frac{\alpha_1}{2}\right)(I_g - I_g^*)^2 - \left(\frac{\alpha_2}{2}\right)(T - T^*)^2 - \left(\frac{\alpha_3}{2}\right)(G - G^*)^2 - \left(\frac{\alpha_4}{2}\right)(B - B^*)^2 - \left(\frac{\alpha_5}{2}\right)(D_p - D_p^*)^2 + \lambda(I_g + G + D_p - T - B - A) \quad (3)$$

The Lagrangean is applied to solve the problem of maximization that confronts the government. Supposing that  $\lambda$  is the Lagrange multiplier, the following expression is obtained.

By taking the first derivatives and solving on the basis of first-order conditions, a simultaneous equation model is obtained expressing the mutual interrelation between the economic variables under consideration. This yields the following system of structural equations:

$$I_g = \left(\frac{1}{\alpha_1\phi}\right)(T^* + B^* + A - I_g^* - G^* - D_p^*) + I_g^* \quad (4)$$

$$G = \left(\frac{1}{\alpha_3\phi}\right)(T^* + B^* + A - I_g^* - G^* - D_p^*) + G^* \quad (5)$$

$$D_p = \left(\frac{1}{\alpha_5\phi}\right)(T^* + B^* + A - I_g^* - G^* - D_p^*) + D_p^* \quad (6)$$

$$T = -\left(\frac{1}{\alpha_2\phi}\right)(T^* + B^* + A - I_g^* - G^* - D_p^*) + T^* \quad (7)$$

$$B = -\left(\frac{1}{\alpha_4\phi}\right)(T^* + B^* + A - I_g^* - G^* - D_p^*) + B^* \quad (8)$$

where, 
$$\phi = \frac{1}{\alpha_1} + \frac{1}{\alpha_2} + \frac{1}{\alpha_3} + \frac{1}{\alpha_4} + \frac{1}{\alpha_5}$$

The parameters of the structural equations solely express the direct effect of each explanatory variable on the dependent variable. In order to capture both the direct and the indirect effect –i.e. the total effect– of aid on the fiscal behavior of the recipient government, it is necessary to obtain the reduced form equations. With this aim in mind, the targets for the public variables in the structural equations are defined.

Economic theory provides the basis for identifying the set of explanatory variables to be taken into account in the definition of the targets. Moreover, the inclusion of expectations is used for modeling that part of the aid can be anticipated by the government when drawing up its budgetary planning. The expected levels of these explanatory variables are expressed as lagged values, with the exception of the expected level of government revenue and of aid. The expected value for government revenue coincides with its target, whereas the expected value for aid is captured by the aid commitments. The target equations for the public variables are expressed as follows:

1) The target for government investment ( $I_g^*$ ) is modeled as depending on the expected levels of national income ( $Y^e$ ), private investment ( $I_p^e$ ) and foreign aid ( $A^e$ ):

$$I_g^* = \beta_0 + \beta_1 Y^e + \beta_2 I_p^e + \beta_3 A^e \quad (9)$$

2) The target for government consumption ( $G^*$ ) is determined by the prior level of government consumption ( $G_{t-1}$ ) and by the expected supply of resources available to finance it, in other words, by the expected level of

government revenue ( $T^e$ ) and the aid inflows expected by the government ( $A^e$ ):

$$G^* = \mu_0 + \mu_1 G_{t-1} + \mu_2 T^e + \mu_3 A^e \quad (10)$$

3) The target for the payment of external public debt ( $D_p^*$ ) is expressed as a function of the expected stock of external public debt ( $D_s^e$ ) and –as for the target set for government consumption– the expected supply of financial resources, in other words, the expected level of government revenue ( $T^e$ ) and of aid ( $A^e$ ):

$$D_p^* = \varepsilon_0 + \varepsilon_1 D_s^e + \varepsilon_2 T^e + \varepsilon_3 A^e \quad (11)$$

4) The target for government revenue ( $T^*$ ) is determined by the expected levels of national income ( $Y^e$ ), imports ( $M^e$ ) and foreign aid ( $A^e$ ):

$$T^* = \delta_0 + \delta_1 Y^e + \delta_2 M^e + \delta_3 A^e \quad (12)$$

5) The target for non-aid borrowing ( $B^*$ ) is established as a residual variable on the basis of the targets set for the other public variables ( $I_g^*$ ,  $G^*$ ,  $D_p^*$  and  $T^*$ ) and the expected value of the aid ( $A^e$ ):

$$B^* = I_g^* + G^* + D_p^* - T^* - A^e \quad (13)$$

Given that the recipient government plans to balance its budget, this formulation maintains the internal consistency of the targets, in other words, it makes possible to satisfy the budgetary constraint.

Substituting the targets of the public variables in the structural equations by expressions (9) to (13) that define them, the reduced form equations of the model are obtained as follows:

$$I_g = \beta_0 + \beta_1 Y^e + \beta_2 I_p^e + \left(\frac{1}{\alpha_1 \phi}\right) A + \left(\beta_3 - \frac{1}{\alpha_1 \phi}\right) A^e \quad (14)$$

$$G = \mu_0 + \mu_2 \delta_0 + \mu_1 G_{t-1} + \mu_2 \delta_1 Y^e + \mu_2 \delta_2 M^e + \left(\frac{1}{\alpha_5 \phi}\right) A + \left(\mu_3 + \mu_2 \delta_3 - \frac{1}{\alpha_5 \phi}\right) A^e \quad (15)$$

$$D_p = \varepsilon_0 + \varepsilon_2 \delta_0 + \varepsilon_1 D_s^e + \varepsilon_2 \delta_1 Y^e + \varepsilon_2 \delta_2 M^e + \left(\frac{1}{\alpha_5 \phi}\right) A + \left(\varepsilon_3 + \varepsilon_2 \delta_3 - \frac{1}{\alpha_5 \phi}\right) A^e \quad (16)$$

$$T = \delta_0 + \delta_1 Y^e + \delta_2 M^e - \left(\frac{1}{\alpha_2 \phi}\right) A + \left(\delta_3 + \frac{1}{\alpha_2 \phi}\right) A^e \quad (17)$$

$$B = \mu_0 + \beta_0 + \varepsilon_0 + (\mu_2 + \varepsilon_2 - 1) \delta_0 + \mu_1 G_{t-1} + (\mu_2 + \varepsilon_2 - 1) \delta_1 Y^e + (\mu_2 + \varepsilon_2 - 1) \delta_2 M^e + \beta_1 Y^e + \beta_2 I_p^e + \varepsilon_1 D_s^e - \left(\frac{1}{\alpha_4 \phi}\right) A + \left\{ \mu_3 + \mu_2 \delta_3 + \beta_3 + \varepsilon_2 \delta_3 + \varepsilon_3 - \delta_3 - 1 + \frac{1}{\alpha_4 \phi} \right\} A^e \quad (18)$$

These five equations clearly show that the total impact of aid on the public variables of expenditure, revenue and borrowing will depend on the aid expectations of the recipient government. This is so, because the model considers the possibility that the budgetary plans of the

government include the availability of aid to finance government expenditure and/or to influence government revenue and borrowing.

### B. Scenarios

As shown by the reduced form equations of the model, the total impact of aid on the public variables of expenditure, revenue and borrowing will depend on the assumptions over the anticipated aid made by the recipient government. In accordance with these assumptions, different scenarios may be considered to which the government has to face. This section aims at simulating three scenarios of increase in aid. They are drawn up by considering the presence or absence of aid increase expectations held by the government, as well as the fulfillment or non-fulfillment of aid commitments by donors.

*Scenario 1: an anticipated increase in aid ( $dA = dA^e \neq 0$ )*

In the first scenario, the government expects an aid increase, which has been taken into account in the preparation of its budgetary plans. In this case, it is assumed that these aid expectations have coincided with the aid inflows received by the government. The reduced form equations of the model indicate that the impact of these anticipated aid inflows on the public variables is shown by the following expressions:

$$\frac{dI_g}{dA^e} = \beta_3 \quad (19)$$

$$\frac{dG}{dA^e} = \mu_3 + \mu_2 \delta_3 \quad (20)$$

$$\frac{dD_p}{dA^e} = \varepsilon_3 + \varepsilon_2 \delta_3 \quad (21)$$

$$\frac{dT}{dA^e} = \delta_3 \quad (22)$$

$$\frac{dB}{dA^e} = \mu_3 + \mu_2 \delta_3 + \beta_3 + \varepsilon_3 + \varepsilon_2 \delta_3 - \delta_3 - 1 \quad (23)$$

The effect of an anticipated increase in aid on the three components of public expenditure is determined by the parameters of aid expectations in each one of the target equations ( $\beta_3$ ,  $\mu_3$  and  $\varepsilon_3$ ) and additionally, in the cases of consumption and external debt payment, by the indirect effect of the aid on government revenue (measured by the terms  $\mu_2 \delta_3$  and  $\varepsilon_2 \delta_3$ , respectively). The total effect of aid on government revenue will depend on the weighting given to the expected aid in the target for government revenue set by the recipient government ( $\delta_3$ ).

The theoretical model considers the sign of all the parameters to be an empirical question, which has to be set through econometric research. It is reasonable to think that the parameters of aid expectations in the target equations for government expenditure will be positive, since the government will assign part of the expected aid to finance public expenditure. It is more difficult to establish a hypothesis on the sign of the remaining parameters. If the

fungibility hypothesis is accepted, then the anticipated increase in aid will lead to a rise in recurrent government expenditure and to a reduction in the tax revenue of the recipient country. However, there is no reason to assume that the aid received will necessarily substitute the tax revenue, especially in heavily indebted poor countries with stringent budgetary constraints. This question has to be empirically tested in the case study. Finally, the effect of an anticipated increase in aid on borrowing is ambiguous. Larger aid inflows will augment borrowing if the sum of the parameters ( $\mu_3 + \mu_2\delta_3 + \beta_3 + \varepsilon_3 + \varepsilon_2\delta_3 - \delta_3$ ) is greater than 1 and will diminish it if the sum is less than 1.

*Scenario 2: an unrealized anticipated increase in aid* ( $dA = 0; dA^e \neq 0$ )

As in the former scenario, it is considered that the recipient government includes aid increase expectations in its budgetary plans. However, the second scenario assumes that the government does not receive that anticipated increase in aid because donors do not meet their commitments. In this case, the effects of aid on the five public variables, derived from the reduced form equations, are as follows:

$$\frac{dI_g}{dA^e} = \beta_3 - \frac{1}{\alpha_1\phi} \quad (24)$$

$$\frac{dG}{dA^e} = \mu_3 + \mu_2\delta_3 - \frac{1}{\alpha_3\phi} \quad (25)$$

$$\frac{dD_p}{dA^e} = \varepsilon_3 + \varepsilon_2\delta_3 - \frac{1}{\alpha_5\phi} \quad (26)$$

$$\frac{dT}{dA^e} = \delta_3 + \frac{1}{\alpha_2\phi} \quad (27)$$

$$\frac{dB}{dA^e} = \mu_3 + \mu_2\delta_3 + \beta_3 + \varepsilon_3 + \varepsilon_2\delta_3 - \delta_3 - 1 + \frac{1}{\alpha_4\phi} \quad (28)$$

The results indicate that an unrealized anticipated increase in aid has an ambiguous impact on the public variables, which can only be determined through empirical estimation. It is reasonable to assume that the anticipated increase in aid will lead to an expansion of the three expenditure variables in the budgetary plans. If the anticipated increase in aid is not disbursed, this planned expansion may be constrained and therefore, the total effect on government expenditure may not be precisely identified. Similarly, the effect on variables for revenue and borrowing is unclear, as the budgetary plans of the government for these two variables included a certain amount of aid that has not been received. This situation will force the government to seek alternative sources of financing and, in principle, the total effect on the two variables can not be determined. If the budgeted expenditure is not reduced, it is reasonable to expect that the impact of an unrealized anticipated increase in aid will lead to an increase in taxes and/or borrowing.

*Scenario 3: an unanticipated increase in aid* ( $dA \neq 0; dA^e = 0$ )

Unlike the two previous scenarios, the third contemplates the situation in which the government does not incorporate any aid increase expectation in its budgetary plans. It is assumed that the government establishes its plans without taking account of the possibility that it may receive an increase in aid. Based on the reduced form equations of the model, the expressions describing the impact of an unanticipated increase in aid on the public variables are:

$$\frac{dI_g}{dA} = \frac{1}{\alpha_1\phi} \quad (29)$$

$$\frac{dG}{dA} = \frac{1}{\alpha_3\phi} \quad (30)$$

$$\frac{dD_p}{dA} = \frac{1}{\alpha_5\phi} \quad (31)$$

$$\frac{dT}{dA} = -\frac{1}{\alpha_2\phi} \quad (32)$$

$$\frac{dB}{dA} = -\frac{1}{\alpha_4\phi} \quad (33)$$

These expressions show that an increase in unanticipated aid by the recipient government causes an expansion in the three expenditure variables and a reduction in revenue and borrowing. The intensity of the effect on each variable will be inversely proportional to its weight in the utility function of the government, which is determined by the corresponding value of the  $\alpha_i$  parameter. The effect of unanticipated aid on consumption and revenue corroborates the fungibility hypothesis. Nevertheless, the fact that fungibility only clearly appears in this latter scenario, induces to thinking that this is a product of the model rather than an obvious response by the recipient government to aid inflows.

### III. MODEL ESTIMATION

With the aim of investigating the aid impact on the fiscal behavior of the Nicaraguan government, the previous model was estimated for the three scenarios under consideration. This section details the empirical research undertaken. In the first place, the database and the estimation methodology used in the study are justified (section A). Subsequently, the econometric results obtained from the model are presented for discussion (section B); for expositional convenience, only the main findings of the empirical research are reported.

#### A. Data and Estimation Procedure

The model estimation for Nicaragua in the three scenarios required the construction of a database with fifteen variables. Faced with the impossibility of obtaining a homogeneous database from local and regional sources, it was necessary to resort to two supra-regional sources: the World Bank and the Organization for Economic Co-operation and Development's Development Assistance Committee (OECD-DAC). The data for the public variables on expenditure and revenue –capital government expenditure ( $I_g$ ), recurrent government

expenditure ( $G$ ), external public debt payment ( $D_p$ ), and total government revenue ( $T$ )— were obtained from the *World Development Indicators (WDI) Online* of the World Bank. Non-aid borrowing ( $B$ ) was calculated as a residual variable of the budgetary constraint (2) of the model.

The six aid variables were derived from data on aid disbursements and commitments provided by *International Development Statistics Online* of the OECD-DAC. The three variables that captured the aid inflows received by the Nicaraguan government—total aid ( $A$ ), grants ( $A_g$ ) and loans ( $A_l$ )— were constructed with the respective data on aid disbursements made by the donors. The three other variables that covered anticipated aid by the Nicaraguan government—total anticipated aid ( $A^e$ ), anticipated grants ( $A_g^e$ ) and anticipated loans ( $A_l^e$ )— were approximated using the data on aid commitments made by donors. Alongside the public variables and aid variables already set out, a further four variables were incorporated to estimate the targets: national income ( $Y$ ), imports ( $M$ ), the stock of external public debt ( $D_s$ ) and private investment ( $I_p$ ). The data for the first three variables were obtained from *WDI Online*. In the case of private investment, it was not possible to find a complete data series. Hence, it was decided to define it as the difference between gross fixed capital formation and public investment.

With regards the estimation of the model, it was necessary previously to arrive at an approximation of the targets in each of the scenarios. The model assumes the availability of the information on the targets for the public variables, which enables a solution to be found to the optimization problem faced by the Nicaraguan government. Unfortunately, neither the recipient government nor any of the international institutions provide such information. Thus, the approximation of the targets for each scenario was made following the proposal of Franco-Rodriguez [4], by estimating them in terms of cointegration relationships. In those cases where it was impossible to identify a cointegration relationship, an auto-regressive process was used. The model was estimated using the nonlinear three-stage least squares method, given that the equation system was simultaneous and contained cross-equation restrictions with respect to the parameters.

### B. Empirical Results

The fiscal response model was estimated to simulate the three scenarios of aid increase faced by the Nicaraguan government. Three versions of the model were estimated for each scenario to take the specific fiscal effects into account of the three types of aid under consideration: total aid, grants and loans. In this section, the results of the estimations are examined for each of the three scenarios.

#### *Scenario 1: an anticipated increase in aid ( $dA = dA^e \neq 0$ )*

The first scenario simulates the effect of an increase in aid inflows when those inflows coincide with the aid expectations of the Nicaraguan government, which have been taken into account in the preparation of its budgetary plans. Table 1 summarizes the main results of the model estimation for this scenario. The sign of the impact of an increase in anticipated aid that is received, is unaffected by the category of aid under consideration. In the three cases, the

sign remains the same. However, the magnitude of the impact differs according to the type of aid.

This empirical evidence suggests that regardless of the type of aid received, the Nicaraguan government earmarks the increase in aid to finance investment, to pay external debt and especially to reduce borrowing. Likewise, this anticipated aid does not give rise to an expansion in recurrent expenditure nor does it substitute tax revenue, which calls into question the fungibility hypothesis. With respect to the magnitude of the described effects, it tends to vary according to the modality of aid received, particularly when aid is repayable. In general, the scope of the effect of grants is similar to the effect of total aid, a reflection of the preponderance of this type of aid in the total amount of aid received by Nicaragua. However, loans are to a greater extent allocated to the payment of the external public debt and the reduction in borrowing, and they cause a larger drop in recurrent government expenditure.

TABLE I: SCENARIO 1: RESULTS OF THE FISCAL RESPONSE MODEL ESTIMATION WITH AN ANTICIPATED INCREASE IN AID

<i>Total impact of an anticipated increase in aid</i>			
$dA = dA^e \neq 0$			
	<i>Total aid (<math>A</math>)</i>	<i>Grants (<math>A_g</math>)</i>	<i>Loans (<math>A_l</math>)</i>
Capital government expenditure ( $I_g$ )	$\frac{\partial I_g}{\partial A^e} = 0,0954$	$\frac{\partial I_g}{\partial A_g^e} = 0,1214$	$\frac{\partial I_g}{\partial A_l^e} = 0,0871$
Recurrent government expenditure ( $G$ )	$\frac{\partial G}{\partial A^e} = -0,0541$	$\frac{\partial G}{\partial A_g^e} = -0,0183$	$\frac{\partial G}{\partial A_l^e} = -0,4756$
External debt payment ( $D_p$ )	$\frac{\partial D_p}{\partial A^e} = 0,1952$	$\frac{\partial D_p}{\partial A_g^e} = 0,1351$	$\frac{\partial D_p}{\partial A_l^e} = 0,2487$
Government revenue ( $T$ )	$\frac{\partial T}{\partial A^e} = 0,1665$	$\frac{\partial T}{\partial A_g^e} = 0,2332$	$\frac{\partial T}{\partial A_l^e} = 0,2792$
Borrowing ( $B$ )	$\frac{\partial B}{\partial A^e} = -0,93$	$\frac{\partial B}{\partial A_g^e} = -0,995$	$\frac{\partial B}{\partial A_l^e} = -1,4189$

Source: Calculations based on model estimation

In sum, the results indicate that when the Nicaraguan government receives an increase in aid anticipated in its budgetary plans, it uses it to respond to the serious problem of external debt and above all, as an alternative source of financing its high public deficit. Interpretation of the results with respect to other expenditure categories is more complex, as it was not possible to obtain a homogeneous time series for central government in the estimation period using separately development expenditure and non-development expenditure. In the specific case of the greater negative impact of loans on recurrent expenditure, it may be capturing part of the effects of the structural adjustment policy financed by such aid as well as the conditionality imposed by the donors.

#### *Scenario 2: an unrealized anticipated increase in aid ( $dA = 0; dA^e \neq 0$ )*

Unlike the preceding scenario, the second one simulates

the impact of an increase in aid that is anticipated by the Nicaraguan government in its budgetary plans, but which is not disbursed. For each one of the three types of aid taken into account, this scenario explores the effects of unfulfilled aid commitments made by donors. The main results of the model estimation for this scenario are given in Table 2.

An unrealized anticipated increase in total aid has a positive sign impact on all the variables, except for capital expenditure. The non-fulfillment of aid commitments forces the Nicaraguan government to cut public investment and to look for alternative sources of financing, slightly increasing tax revenue and to a greater extent, borrowing. In this way, it can continue to finance its recurrent expenditure needs and maintain its external debt payment. When grants are considered, the sign of their impact is positive for all the variables. Confronted by the loss of anticipated grants, the government chooses to finance total expenditure through a rise in tax revenue and to a lesser extent, through an increase in borrowing. The impact of an unrealized anticipated increase in loans is positive on recurrent expenditure and external debt payment, and is negative on the other variables. Faced with unfulfilled loan commitments, the government reacts by diminishing investment and increasing recurrent expenditure and external debt payment.

TABLE II: SCENARIO 2: RESULTS OF THE FISCAL RESPONSE MODEL ESTIMATION WITH AN UNREALISED ANTICIPATED INCREASE IN AID

<i>Total impact of an unrealised anticipated increase in aid</i> $dA = 0; dA^e \neq 0$			
	<i>Total aid (A)</i>	<i>Grants (A<sub>g</sub>)</i>	<i>Loans (A<sub>l</sub>)</i>
Capital government expenditure (I <sub>g</sub> )	$\frac{\partial I_g}{\partial A^e} = -0,1285$	$\frac{\partial I_g}{\partial A_g^e} = 0,5691$	$\frac{\partial I_g}{\partial A_l^e} = -0,1897$
Recurrent government expenditure (G)	$\frac{\partial G}{\partial A^e} = 0,3764$	$\frac{\partial G}{\partial A_g^e} = 0,5972$	$\frac{\partial G}{\partial A_l^e} = 0,2501$
External debt payment (D <sub>p</sub> )	$\frac{\partial D_p}{\partial A^e} = 0,3567$	$\frac{\partial D_p}{\partial A_g^e} = 0,0386$	$\frac{\partial D_p}{\partial A_l^e} = 0,3583$
Government revenue (T)	$\frac{\partial T}{\partial A^e} = 0,0288$	$\frac{\partial T}{\partial A_g^e} = 0,8013$	$\frac{\partial T}{\partial A_l^e} = -0,101$
Borrowing (B)	$\frac{\partial B}{\partial A^e} = 0,3198$	$\frac{\partial B}{\partial A_g^e} = 0,3981$	$\frac{\partial B}{\partial A_l^e} = -0,6339$

Source: Calculations based on model estimation

*Scenario 3: an unanticipated increase in aid (dA ≠ 0; dA<sup>e</sup> = 0)*

In the third and final scenario, the simulated situation is one in which the Nicaraguan government does not take account of an increase in aid inflows in its budgetary plans because it does not expect any. Nevertheless, this increase does in fact take place. Table 3 presents the main results for the model estimation with an unanticipated increase in aid. Once again, the similarity in the fiscal response of the government is confirmed for total aid and grants, whereas some differences are observed in this response for loans. The

greater importance of grants in the total of aid received by Nicaragua explains this behavioral pattern.

When the Nicaraguan government does not consider the possibility of receiving an increase in total aid, the sign of the impact of this unanticipated increase is positive on the three expenditure variables and is negative on the variables for government revenue and borrowing. The unanticipated aid inflows are earmarked for the moderate expansion of capital expenditure, recurrent expenditure and external debt payment. At the same time, the government reduces tax revenue and especially borrowing.

In short, it is observed that the impact of an unanticipated increase in total aid on the public variables is very similar to the impact of an unanticipated increase in grants. In both cases, the unanticipated aid slightly is allocated to expand the three types of public expenditure and to substitute the two alternative sources of financing (tax revenue and particularly, borrowing). In comparison to the impact of an increase in aid that is both anticipated and received (scenario 1), this latter type of impact presents an important difference: recurrent expenditure increases and tax revenue falls. In other words, this unanticipated aid is fungible. Nevertheless, when the increase in unanticipated aid takes the form of loans, the aid fungibility is not maintained. In this case, the increase in aid is not earmarked to finance recurrent expenditure nor to replace tax revenue.

The effects on capital government expenditure, external debt payment and borrowing tend to be similar, regardless of the modality of unanticipated aid that is under consideration. The signs of the effects are equal and their magnitudes only differ with unanticipated loans. A similar pattern of fiscal response by the Nicaraguan government may be seen in the three types of aid. An unanticipated increase in aid is basically allocated to reduce borrowing and to a lesser extent, to pay external debt and to augment public investment.

TABLE III: SCENARIO 3: RESULTS OF THE FISCAL RESPONSE MODEL ESTIMATION WITH AN UNANTICIPATED INCREASE IN AID

<i>Total impact of an unanticipated increase in aid</i> $dA \neq 0; dA^e = 0$			
	<i>Total aid (A)</i>	<i>Grants (A<sub>g</sub>)</i>	<i>Loans (A<sub>l</sub>)</i>
Capital government expenditure (I <sub>g</sub> )	$\frac{\partial I_g}{\partial A} = 0,07$	$\frac{\partial I_g}{\partial A_g} = 0,0602$	$\frac{\partial I_g}{\partial A_l} = 0,373$
Recurrent government expenditure (G)	$\frac{\partial G}{\partial A} = 0,0364$	$\frac{\partial G}{\partial A_g} = 0,056$	$\frac{\partial G}{\partial A_l} = -0,0738$
External debt payment (D <sub>p</sub> )	$\frac{\partial D_p}{\partial A} = 0,0709$	$\frac{\partial D_p}{\partial A_g} = 0,0702$	$\frac{\partial D_p}{\partial A_l} = 0,2681$
Government revenue (T)	$\frac{\partial T}{\partial A} = -0,0366$	$\frac{\partial T}{\partial A_g} = -0,0673$	$\frac{\partial T}{\partial A_l} = 0,2918$
Borrowing (B)	$\frac{\partial B}{\partial A} = -0,8628$	$\frac{\partial B}{\partial A_g} = -1,028$	$\frac{\partial B}{\partial A_l} = -2,3615$

Source: Calculations based on model estimation

#### IV. CONCLUSIONS

For many LDCs foreign aid constitutes one of the main sources of public finance and in consequence, is a key element in fiscal policy. Understanding the way in which aid influences the fiscal variables of recipient governments becomes an essential aspect in the debate over its effectiveness. With this objective in mind, a fiscal response model with anticipated aid was developed to simulate the fiscal effects of an increase in aid in Nicaragua. The model used is a simplification of the complex Nicaraguan reality and hence, the results of its estimation are only an approximation of the aid impact on the fiscal behavior of the government. Moreover, the results have to be cautiously interpreted, as they encompass the underlying effects of antagonistic economic models applied in the country during the estimation period.

The results of the simulations show that the aid received by the Nicaraguan government is fundamentally earmarked to pay external debt and to reduce borrowing. These two allocations are common to the scenarios for aid received regardless of the type of aid considered. The serious problems of external debt and borrowing arising from fiscal imbalance explain why a significant part of the increases in aid are dedicated to pay the external debt and to alleviate the public finance needs of the country.

In addition to contributing to pay the external debt and to fill the gap between expenditure and revenue, another potential use of the aid is the reduction of tax revenue. However, this response –quite standard in the literature– is only clearly appreciated in the scenario with an unanticipated increase in aid. According to this result, in heavily indebted poor countries with important budgetary constraints –such as Nicaragua–, it does not necessarily have to be assumed that aid will substitute tax revenue. Likewise, the reiterated criticism that aid is basically earmarked to substitute tax revenue and to finance recurrent expenditure is only confirmed when the increase in aid is not included in the budgetary plans (unanticipated aid). This empirical evidence suggests that the argument of aid fungibility in the Nicaraguan case is a product of the model assumptions.

In the case of capital government expenditure, aid inflows have a small positive impact on its financing. This positive impact disappears when the donors fail to fulfill their commitments, and the Nicaraguan government is obliged to forego public investment and look for alternative sources of financing the public deficit. This evidence indicates that the non-fulfillment of donor commitments limits the fiscal policy capacity for achieving the macroeconomic stability. With regard to the fiscal impact of the different aid modalities, the results of the simulations do not completely corroborate the hypothesis that *a priori* grants are allocated to substitute tax revenue. The increase in grants –the main type of aid received by Nicaragua– only replaces tax revenue when it is anticipated by the government.

In sum, foreign aid received by the Nicaraguan government is basically earmarked to support the stabilization function of fiscal policy. From this perspective,

aid contributes to establishing a favorable environment for economic growth in the country. Nevertheless, given that it is not possible to guarantee a sustained increase in aid inflows, it would be advisable for the Nicaraguan government to employ part of those inflows to adopt fiscal policies that broaden the tax base with the aim of guaranteeing fiscal sustainability and thus, to gradually reduce aid dependence. Likewise, greater effort on the part of donors would be recommendable to diminish the volatility of aid inflows, providing the Nicaraguan government with a stable framework in which to take its budgetary decisions.

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