THE COMPOSITION OF GOVERNMENT SPENDING AND ECONOMIC GROWTH IN LATIN AMERICAN COUNTRIES

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Introduction

From a theoretical point of view, there are two main approaches regarding the effects of government spending on economic growth. Within the neoclassical framework (Solow, 1956; Swan, 1956), government spending, and public policy in general, has no role in determining the long-run economic growth rate, since this is determined by the exogenous population growth and technological progress rates.

On the other hand, in some endogenous growth models developed mainly since the early 1990s, such as Easterly (1990), Barro (1990), Barro and Sala-i-Martin (1992, and 2004), Cashin (1995), Bajo-Rubio (2001), and Milbourne *et al.* (2003), fiscal policy affects the long-term growth rate through decisions on either taxes or expenditures. This happens because some types of both of them can affect decisions by private firms about investing in human capital, knowledge or research and development, which constitute the engine of growth within the endogenous growth framework (Romer 1986, 1990; Lucas, 1988; Grossman and Helpman, 1991; and Aghion and Howitt, 1992; among others). Moreover, government spending on public goods and other goods with positive externalities are particularly important as they can lead to higher economic growth rates (Hemming *et al*., 2002: 9).

Empirical studies tend to reject the prediction of neoclassical models that fiscal policy cannot affect growth in the long run. Government spending, particularly capital spending, has been found to be growth promoting in the literature. For instance, in a study based specifically on the United States during the 1949-1985 period, Aschauer (1989) finds that military public investment and public consumption have little effect on private investment in equipment, while infrastructure capital stock, what he calls 'core' infrastructure (streets, highways, airports, mass transport, sewers, and water systems, etc.) has a strong positive effect on the return rate of private capital and the level of output. In the same direction, Easterly and Rebelo (1993) find that investment in transport and communications is consistently correlated with growth using a cross-section of 100 countries for the 1970-1988 period, and a panel of annual data for 28 countries for the same period. Haque and Kim (2003) draw the same conclusion for a sample of 15 developing countries over the period 1970-1987. Odedokun (1997) and Shioji (2001) obtain a similar result as they find that infrastructural public investment promotes economic growth. Furthermore, several studies find that countries with high shares of total public investment tend to grow quickly (Landau, 1983; Aschauer, 1989; Knight *et al*., 1993; Cashin, 1995; Nazmi and Ramirez, 1997; Kocherlakota and Yi, 1997; Kneller *et al.*, 1999; Gupta *et al.*, 2002; Clements *et al.*, 2003; Ramirez and Nazmi, 2003).

On the basis of the above, the importance of analysing growth effects of various components of government spending rather than the total is evident. Effects vary across those different components. In this line, some recent literature analyses the effect of different components of public spending on economic growth (see, i.e., Devarajan *et al.*, 1996; Odedokun, 2001; Devarajan *et al.*, 2001; and Ramirez and Nazmi, 2003).

Regarding theoretical models about the influence of public spending on growth, some of them such as Barro (1990), Cashin (1995), Bajo-Rubio (2000), and Milbourne *et al*. (2003) predict that a positive effect is expected to be found in countries where the size of government is smaller than a certain threshold, and a negative one in countries where the size of government is bigger than that. Therefore, since generally speaking, with few exceptions, one finds very large public sectors only in developed countries (DCs), studies evaluating the impact of public expenditure on growth should analyse DCs and less developed countries (LDCs) separately. Besides, practically all studies on the topic published before 1997 do not control for all the relevant fiscal variables, in other words, they do not include the government budget constraint (GBC). Nevertheless, some recent research has shown that it is easy to draw wrong conclusions when some elements of the GBC are excluded from a growth regression.

On the basis of the discussion above, this research aims to identify the effects of different components of government spending on the per capita economic growth rate in a set of Latin American Countries (LACs) over the period 1975 – 2000.

The results show a positive and statistically significant effect of government spending on transport and communications. On the other hand, the effect of the other categories of government spending on the basis of a functional classification is statistically insignificant. Therefore, it is possible to conclude that government spending composition does matter for growth in the set of LACs considered here.

The study is organised into five sections. The first one introduces the study. Section 2 reviews relevant literature about economic growth and presents some general aspects of the relationship between economic growth and fiscal policy within the endogenous growth framework. Section 3 introduces a theoretical framework of the study, while the next one corresponds to the empirical work based on a set of LACs. Finally, section 5 draws some conclusions and policy recommendations.

2. A literature review

Researchers have been interested in studying economic growth and its determinants for a very long time. Growth models have been classified in the literature into two broad categories: those built on the basis of the neoclassical one (Solow, 1956; Swan, 1956), and those known as endogenous growth models (Romer 1986, 1990; Lucas, 1988; Grossman and Helpman, 1991; and Aghion and Howitt, 1992; among others).

Within the neoclassical framework, government policy, and particularly fiscal policy, which is the focus of this study, has no role in determining the long-run economic growth rate, since this is determined by the exogenous population growth and technological progress rates. On the other hand, in the endogenous growth framework, the engine of growth is human capital, knowledge, or technology. Accumulation of any of these three variables takes place according to a conscious decision by private agents in the economy. This allows fiscal policy to have an impact on the long-run growth rate through either some taxes or some types of government expenditure being able to affect decisions by private firms about investing in human capital, knowledge or research and development. In this regard, it is important to mention that public goods play a crucial role as they can bring about changes in the long-run growth rate through different channels.

Empirical studies tend to reject the prediction of neoclassical models that fiscal policy cannot affect growth in the long run. However, the results are far from conclusive. In particular, with regard to the effects of government spending on growth, several studies analyse the growth effects of either total government spending or its components. For example, Landau (1983), Kormendi and Menguirre (1985), Ram (1986), Aschauer (1989), Barro (1990, 1991), Levine and Renelt (1992), Easterly and Rebelo (1993), Cashin (1995), Devarajan *et al.* (1996), Mendoza *et al.* (1997), Nazmi and Ramirez (1997), Odedokun (1997, 2001), Tanzi and Zee (1997), Kneller *et al.* (1999), Bleaney *et al.* (2001), Devarajan *et al.* (2001), Gemmel (2001), Shioji (2001), Feehan and Matsumoto (2002), Gupta *et al.* (2002), Bose *et al.* (2003), Clements *et al.* (2003), Fan and Rao (2003), Haque and Kim (2003), Milbourne *et al.* (2003), Ramirez and Nazmi (2003), Barro and Sala-i-Martin (2004), among others. The results of these studies are often contradictory depending on the assumptions made, the methodology used, the country or set of countries studied, and so on. On the one hand, public expenditure can displace private investment (crowding-out effect), and on the other hand, public expenditure can encourage private investment, and therefore economic growth.

Government capital spending has been found to be growth promoting in some empirical work. For instance, in a study based specifically on the United States during the 1949-1985 period, Aschauer (1989) finds that military public investment and public consumption have little effect on private investment in equipment, while infrastructure capital stock, what he calls 'core' infrastructure (streets, highways, airports, mass transport, sewers, and water systems, etc.) has a strong positive effect on the return rate of private capital and the level of output. In the same direction, Easterly and Rebelo (1993) find that investment in transport and communications is consistently correlated with growth using a cross-section of 100 countries for the 1970-1988 period, and a panel of annual data for 28 countries for the same period. Haque and Kim (2003) draw the same conclusion for a sample of 15 developing countries over the period 1970-1987. Odedokun (1997) and Shioji (2001) obtain a similar result as they find that infrastructural public investment promotes economic growth. Odedokun concentrates on a sample of 48 developing countries during the period 1970-1990, while the latter study focuses on 48 states in the United States over the period 1963-1997, and on 46 Japan's prefectures during the 1955-1999 period. Furthermore, several studies find that countries with high shares of total public investment tend to grow quickly (Landau, 1983; Aschauer, 1989; Knight *et al*., 1993; Cashin, 1995; Nazmi and Ramirez, 1997; Kocherlakota and Yi, 1997; Kneller *et al.*, 1999; Gupta *et al.*, 2002; Clements *et al.*, 2003; Ramirez and Nazmi, 2003).

Government consumption spending, in turn, has been labelled in the published literature as a factor affecting the utility function of households rather than the private production function (Barro, 1981; Finn, 1998; and Linnemann and Schabert, 2004; among others). Furthermore, increases in consumption spending are likely to reduce growth rate given that in order to finance them higher taxes must be introduced, which have a negative effect on investment decisions by the private sector and therefore on economic growth. Thus, with regard to government consumption spending, Landau (1983), Barro (1991), and Barro and Sala-i-Martin (1995, 1999) conclude that countries with high shares of this spending in their GDP grow slower than others; while Kormendi and Menguirre (1985), Nazmi and Ramirez (1997), Mosley (2000), Kneller *et al.* (1999), Bleaney *et al.* (2001), and Bose *et al.* (2003), in turn, find that there is no effect of government consumption spending on the economic growth rate.

Results of the empirical literature are far from conclusive and it seems they depend on various aspects such as methods or techniques used, assumptions, country or set of countries analysed, and so on. In addition, the importance of analysing growth effects of various components of government expenditure rather than the total is evident, since the effects vary across those different components. Some recent studies analyse the effect of different components of public spending on economic growth (see, i.e., Devarajan *et al.*, 1996; Odedokun, 2001; Devarajan *et al.*, 2001; and Ramirez and Nazmi, 2003). However, a common characteristic of these studies that has been criticised lately relates to the fact that none of them includes the GBC; therefore, the results can be affected by omitted variables bias. It is necessary to include the GBC, given that government decisions on spending are not independent from those on revenues, but are interdependent. Kneller *et al.* (1999) demonstrate that there are substantial changes in coefficient sign, magnitude and significance when some elements are omitted from the budget constraint, and how easy it is to reach incorrect conclusions by mis-specifying the regression equation.

Theoretical models on the relationship between government spending and economic growth such as Barro (1990), Cashin (1995), Bajo-Rubio (2000), and Milbourne *et al*. (2003) predict that a positive effect is expected to be found in countries where the size of government is smaller than a certain threshold, and a negative one in countries where the size of government is bigger than that. Therefore, since generally speaking, with few exceptions, one finds very large public sectors only in developed countries (DCs), studies evaluating the impact of public expenditure on growth should analyse DCs and less developed countries (LDCs) separately. In addition, the composition of public expenditure also differs between DCs and LDCs. The various programmes that have been associated in theoretical work as having positive growth effects (infrastructure, schooling and R&D subsidies) typically amount to less than 20 percent of public expenditure in OECD countries, whilst they typically amount to more than half of public spending in LDCs (Folster and Henrekson, 2001: 1503).

3. Theoretical framework

In spite of various theoretical advances of endogenous growth models, their particular characteristics, especially those related to the presence of exactly constant returns to scale in the key production processes (i.e. human capital in Lucas (1988), and knowledge in

Romer (1990)), require very specific values of parameters, which makes their empirical tests rather difficult. Therefore, the use a neoclassical model augmented with some of the key variables in endogenous growth models seems to be a better option to study the determinants of growth.

Thus a number of empirical studies have introduced different modifications to the neoclassical Solow model aiming at highlighting the role of a (some) factor(s) in explaining growth. For example, the influential study by Mankiw et al. (1992) (MRW) emphasises the importance of adding human capital to the Solow model. Nonneman and Vanhoudt (1996) introduce a further augmentation of the model by including accumulation of technological know-how through R&D. Islam (1995) and Caselli et al. (1996) examine whether or not the results of the augmented Solow model obtained by MRW using cross-section regressions change by using different techniques, namely panel data and a generalised method of moments (GMM), respectively. Barro (1990), Cashin (1995), Bajo-Rubio (2001), and Milbourne et al. (2003), in turn, allow for the government to affect the production function within the Solow model framework.

This paper is more in line with the latter set of studies since its general purpose, as already mentioned, is to determine the effects of different components of government spending on economic growth in a set of LACs in a period spanning from 1975 to 2000. To achieve this goal, a theoretical model built on the basis of the literature above mentioned in now introduced.

A strand of the growth literature that stresses that government spending can affect economic growth was discussed in the previous section. To evaluate empirically if that is the case, a theoretical framework is needed. Thus, by considering first the role of public capital into the production function, that framework is developed. The model is basically a variation of the augmented Solow model introduced by MRW (1992). It includes different categories of public capital as additional inputs in the assumed Cobb-Douglas production function as follows:

$$Y = K(t)^{\alpha} H(t)^{\beta} \left[\frac{G_1(t)}{K(t)}\right]^{\gamma_1} \cdots \left[\frac{G_m(t)}{K(t)}\right]^{\gamma_m} (A(t)L(t))^{1-\alpha-\beta-\sum_{i=1}^{m}\gamma_i}, \qquad (1)$$

where Y is output, K is the stock of private physical capital, H is the stock of human capital, G_i is the stock of government capital of type i, L is labour force, and A is a labour-augmenting technological factor. Returns to scale are assumed to be constant, and L and A to grow exogenously at rates *n* and *r* so that

$$L(t) = L(0)e^{nt}$$
$$A(t) = A(0)e^{rt}$$

This model allows for congestion of services provided by public capital as in Barro and Sala-i-Martin (1992), given that many public services, such as those that come from government capital infrastructure are subject to congestion. For a given level of each type of government capital stock, G_i, the quantity of public services available to each producer declines as other producers congest the facilities by increasing their stocks of private physical capital K.

Let a constant fraction of private output be saved and invested, and another one be devoted to human capital investment, which are denoted by s_K and s_H, respectively. Besides, let constant shares in the public budget, $s_{G1},\dots, s_{Gm}$, be invested in the different types of public capital. The model assumes that accumulation of reproducible factors goes according to the following equations:

$$\dot{K} = s_K(1-\tau)Y - \delta K$$
$$\dot{H} = s_H(1-\tau)Y - \delta H$$
$$\dot{G}_i = s_{G_i}\tau Y - \delta G_i, \forall i = 1,\dots, m \qquad (2)$$

where δ is the depreciation rate, which for simplicity is assumed to be common to every category of capital stock and constant over time, and τ is the size of the public sector, that is the share of the public budget in total output.

Defining output and the stocks of capital per unit of effective labour as $y = Y/AL$, $k = K/AL$, $h = H/AL$, $g_1 = G_1/AL$,…, $g_m = G_m/AL$, the dynamic equations for k, h, and gi are given by

$$\dot{k} = s_K(1-\tau)y - (n+r+\delta)k$$
$$\dot{h} = s_H(1-\tau)y - (n+r+\delta)h$$
$$\dot{g}_i = s_{G_i}\tau y - (n+r+\delta)g_i \qquad (3)$$

By equating all the three equations to zero, we get the steady-state values of k, h, and each g_i. Replacing these values into the production function, and taking logs, yields an equation for the steady state value of income per worker as:

$$\ln\left[\frac{Y(t)}{L(t)}\right]^* = \ln A(0) + rt + \frac{\alpha - \sum_{i=1}^m \gamma_i}{1-\alpha-\beta-\sum_{i=1}^m \gamma_i}\left[\ln s_K - \ln(n+r+\delta)\right] +$$
$$\frac{\beta}{1-\alpha-\beta-\sum_{i=1}^m \gamma_i}\left[\ln s_H - \ln(n+r+\delta)\right] + \frac{\gamma_1}{1-\alpha-\beta-\sum_{i=1}^m \gamma_i}\left[\ln s_{G_1} - \ln(n+r+\delta)\right]$$
$$+\cdots+ \frac{\gamma_m}{1-\alpha-\beta-\sum_{i=1}^m \gamma_i}\left[\ln s_{G_m} - \ln(n+r+\delta)\right] + \frac{\sum_{i=1}^m \gamma_i}{1-\alpha-\beta-\sum_{i=1}^m \gamma_i}\ln\tau +$$
$$\frac{\alpha+\beta-\sum_{i=1}^m \gamma_i}{1-\alpha-\beta-\sum_{i=1}^m \gamma_i}\ln(1-\tau) \qquad (4)$$

This equation shows how steady state per worker income depends on population growth, technological change rate, accumulation of private and government physical capital, accumulation of human capital, the size of the public sector, and depreciation rate. The assumption that all countries are in their steady state can be a very strong one, particularly to the set of LACs analysed in this study. However, this assumption can be relaxed and thus an equation describing out of steady state behaviour can be obtained. Let $\tilde{y}^*$ be the steady state level of income per worker, and $\tilde{y}(t)$ be its actual value at any time t. Following MRW (1992) and Barro and Sala-i-Martin (1995), approximating around the steady state of the speed of convergence is given by

$$\frac{d\ln\tilde{y}(t)}{dt} = \lambda\left[\ln\tilde{y}^* - \ln\tilde{y}(t)\right], \qquad (5)$$

where $\lambda = (n+r+\delta)(1-\alpha-\gamma)$ is the convergence rate,

$$\gamma = \sum_{i=1}^{m}\gamma_i .$$

Equation (5) implies that

$$\ln\tilde{y}(t) = (1-e^{-\lambda t})\ln\tilde{y}^* + e^{-\lambda t}\ln\tilde{y}(0), \qquad (6)$$

where $\tilde{y}(0)$ is income per worker at some initial date. Subtracting $\ln\tilde{y}(0)$ from both sides,

$$\ln\tilde{y}(t) - \ln\tilde{y}(0) = (1-e^{-\lambda t})\ln\tilde{y}^* - (1-e^{-\lambda t})\ln\tilde{y}(0). \qquad (7)$$

Finally, substituting for $\tilde{y}^* = \left[\frac{Y(t)}{L(t)}\right]^*$ from equation (4), the equation for the growth rate of output per worker is given by:

$$\begin{aligned}
\ln\tilde{y}(t) - \ln\tilde{y}(0) = {} & (1-e^{-\lambda t})\ln A(0) + rt + (1-e^{-\lambda t})\Big\{\frac{\alpha-\gamma}{1-\alpha-\beta-\gamma}\left[\ln s_K - \ln(n+r+\delta)\right] + \\
& \frac{\beta}{1-\alpha-\beta-\gamma}\left[\ln s_H - \ln(n+r+\delta)\right] + \frac{\gamma_1}{1-\alpha-\beta-\gamma}\left[\ln s_{G_1} - \ln(n+r+\delta)\right] \\
& + \cdots + \frac{\gamma_m}{1-\alpha-\beta-\gamma}\left[\ln s_{G_m} - \ln(n+r+\delta)\right] + \frac{\gamma}{1-\alpha-\beta-\gamma}\ln\tau + \\
& \frac{\alpha+\beta-\gamma}{1-\alpha-\beta-\gamma}\ln(1-\tau)\Big\} - (1-e^{-\lambda t})\ln\tilde{y}(0)
\end{aligned} \qquad (8)$$

This equation shows the per worker growth rate between periods zero and t as a function of the following investment ratios adjusted by the factor (n+r+δ): private investment in physical capital (s_K), investment in human capital (s_H), and each of the m categories of public investment ($s_{G1},\ldots, s_{Gm}$), the size of the public sector (τ), and the initial income per worker ($\tilde{y}(0)$). This equation can now be estimated. The resulting estimates would be restricted or constrained since the coefficient of each of the investment ratios mentioned before is restricted to be equal and opposite to that of the factor (n+r+δ). However, this restriction can be relaxed so that equation (8) would be given by

$$\ln \tilde{y}(t) - \ln \tilde{y}(0) = rt + (1 - e^{-\lambda t}) \Big[\ln A(0) + \frac{\alpha - \gamma}{1-\alpha-\beta-\gamma} \ln s_K + \frac{\beta}{1-\alpha-\beta-\gamma} \ln s_H + \frac{\gamma_1}{1-\alpha-\beta-\gamma} \ln s_{G_1} + \cdots + \frac{\gamma_m}{1-\alpha-\beta-\gamma} \ln s_{G_m} + \frac{\gamma}{1-\alpha-\beta-\gamma} \ln \tau + \frac{\alpha+\beta-\gamma}{1-\alpha-\beta-\gamma} \ln (1-\tau) - \frac{\alpha+\beta-\gamma}{1-\alpha-\beta-\gamma} \ln (n+r+\delta) - \ln \tilde{y}(0) \Big] \quad (9)$$

This equation corresponds to the unrestricted version of the model since the factor (n+r+δ) has been separated out becoming so an additional explanatory variable.

The restricted and unrestricted equations (8) and (9) constitute the basis of the theoretical framework of this study since they allow one to achieve its general purpose, which is to estimate the growth effects of various components of government spending in a set of LACs over the period 1975 - 2000.

4. Estimation of a growth model with government spending

In the previous section we discussed the theoretical framework of the study by introducing two versions of a growth model, namely a restricted and an unrestricted one (equations 8 and 9, respectively). On the basis of such a framework, the present section aims to estimate the more appropriate version of the model for the set of 12 LACs mentioned above. To carry out this task, it is necessary to take into account that the dependent variable should be per worker GDP growth rate as those equations come from a production function with labour force as one of the inputs. However, most of the empirical literature on economic growth uses per capita growth rate as the dependent variable in the model (i.e., Islam, 1995; Caselli et al., 1996; Easterly et al., 1997; Barro and Sala-i-Martin, 1995, 2004). Among the few studies that use per worker GDP instead, is that by Mankiw et al. (1992).

To be able to compare the results of this study with most of the existing literature, the study follows the common approach by using the per capita GDP growth rate as the dependent variable in the model. In addition, the results obtained by doing so are more in line with the literature.

All the analysis of the data in the study is carried out using Stata software, version 8.2 (Stata Corporation). Before proceeding with estimation, it is necessary to recall the importance of including the government budget constraint (GBC) in any study evaluating the role of public expenditure on growth like the present one. Moreover, in accordance with the literature, other explanatory variables should also be included in the model in equations (8) or (9). For instance, terms of trade shocks (TOT) control for the effects of external sector activities. The inclusion of the ratio of broad money supply (M2) to GDP controls for financial deepening, while international trade intensity ratio (OPEN) does the same for the degree of a country's openness. Inflation rate (INFL) is used as a measure of macroeconomic stability. Finally, black market premium (BMP) captures distortions in the foreign market.

However, the approach taken here for estimation of the various versions of the model does not start with a general model that comes from the existing economic growth literature. That model includes the different variables that pertain to the GBC and a set of control ones along with the various concepts considered in the augmented Solow model in MRW (1992). This means that the number of explanatory variables is fourteen or more, depending on whether government expenditure is disaggregated or not.

The number of Latin American countries for which disaggregated government spending data were obtained in order to carry out this study is 12 at most. Thus, it is not possible to consider all the explanatory variables simultaneously in the model because of the increasing number of instruments implied by the technique used here, namely, the first-differenced GMM Arellano and Bond estimator. Recall that within this framework, the number of instruments increases with the number of explanatory variables included in the model.

Therefore, a different approach is taken here. The starting point in the estimation process is the unrestricted version of the growth model. The set of explanatory variables is added with the other components of the GBC, that is, public spending other than investment, the different concepts of government revenue, and fiscal balance. As stated before, this has to be considered in the estimation given that government decisions on spending are not independent from those on revenues, but interdependent. Nevertheless, most of the literature does not include explicitly the GBC.

It is vital to note that many of the possible omitted variables in the growth regression may be correlated with government investment. Among these variables, we can mention rule of law, geographic factors, climate, ethnic fractionalisation, or colonial history. Nevertheless, they change little and slowly over time. Therefore, by using the generalized method of moments (GMM) estimator that differences the growth equation, we can at least be sure that the estimated coefficients on government spending or its components are not simply picking up a correlation with these omitted 'time-invariant' characteristics1.

This study focuses on the direction and the significance of the effects of the explanatory variables on the per capita economic growth rate more than on the magnitudes of point

[1] This point is made by Dollar and Kraay (2004: F38) with respect to international trade.

estimates because magnitudes are very sensitive to the different econometric techniques as discussed later and it is hard to decide which of them to use.

Moreover, quality of data is not optimal for most of the developing countries considered in the study, which might bring about unreliable results from quantitative analysis in terms of point estimates. For instance, regarding quality of the data on developing countries, Maddala and Wu (2000) point out:

> *"Once we go beyond developed nations, the data are of very poor quality (and in many cases non-existent). As discussed in Srinivasan (1994, 1995), most of the data are constructed by interpolation and extrapolation. Summers and Heston extrapolated from benchmark countries (which varied from 16 in 1970 to 56 in 1985) to other countries and also from benchmark years (1970, 1975, 1980, 1985)".*
>
> (Maddala and Wu, 2000: 641)

In this regard, it is important to mention that some checks for consistency and reliability of the data were made. They suggested that the data used here is broadly reliable.

Estimation process of the role of government spending starts by disaggregating it into just two economic components (section 4.1), namely current and capital spending from the Government Finance Statistics – International Monetary Fund (GFS - IMF). Section 4.2 analyses the effect of government spending by using an alternative measure for capital government expenditure from the World Bank's *Global Development Network* database and from Everhart and Sumlinski (2001), instead of the data from the GFS - IMF. The results of these last two scenarios should be the same; however, they are not as seen later. Section 4.3 considers a functional classification of government spending and estimates the growth effects of three different components of it. Those components are: expenditures on education, health, and transport and communications. An analysis of the results on the control variables is presented in the next section before concluding in section 4.5.

4.1 Capital and current spending and economic growth[2]

In this section government spending is disaggregated into two economic categories, capital and current spending. The rationale for doing so is that a strand of the growth literature shows that investment is an important factor in explaining growth. Therefore, it is appropriate to split government spending into the two categories mentioned above in order to establish whether or not capital spending has been growth promoting in the set of countries over the period considered in the study. This type of spending could be associated

[2] In a previous exercise we evaluated the role of total government spending on growth. However, the analysis suggested that its overall impact was statistically equal to zero, which is consistent with the literature as discussed in section two. In other words, total government expenditure does not have any effect on the per capita economic growth rate in LACs in the period 1975-2000.

with the productive one that Barro (1990) assumes to be an additional input to the private production function.

The estimation process in this section concentrates just on the unrestricted version of our growth model given by equation 9 because the Wald test for the restriction in equation 8 could not be accepted at the conventional levels of significance. The restriction establishes that the coefficients of each of the investment ratios are equal and opposite of those corresponding to the factor $(n+r+\delta)$.

The set of explanatory variables in the growth model (equation 9) is added with the other components of the GBC, that is, public spending other than investment, the different concepts of government revenue, and fiscal balance. Nevertheless, due to the presence of specification problems in the model, one of the control variables, TOT, is also added in the initial regressions. By doing so, the specification problems seem to be removed.

The first three columns in Table 1 present the two-step estimator of the model. This estimator is considered because of the likely presence of heteroskedasticity across countries. In addition, the two-step Sargan test may be better for inference on model specification, which is the main objective at this stage of the estimation process.

In regression (1) all the explanatory variables are assumed to be exogenous. The results of the specification tests suggest that the model does not face specification problems. However, with respect to the assumption of exogeneity of the explanatory variables in the model, a number of studies suggests the likely presence of reverse causation of some of the explanatory variables to the per capita economic growth rate. Moreover, some of them may be better modelled as predetermined rather than exogenous. Therefore, in regression (2) all explanatory variables are assumed to be predetermined with the exceptions of TOT and the factor $(n+r+\delta)$ that are assumed to be exogenous. The results of the two specification tests give evidence of no mis-specification of the model (the p-value of the Sargan test is approximately equal to one, while the corresponding to the test of 'no second-order serial correlation' is 0.59).

As an alternative option, in column (3) fiscal variables (capital expenditure, KE, current expenditure, CE, impuestos, TAX, capital revenue, KR, grants, GR, and fiscal balance, DEF) and private investment (PI)) are assumed to be endogenous instead of predetermined. The results show that the two specification tests are passed. In other words, the model does not face specification problems. The p-value of the Sargan test is the same as in the previous scenario, while the p-value corresponding to the other specification test drops slightly from 0.59 to 0.50. These results suggest that there is no difference in assuming the fiscal variables and PI to be either predetermined or endogenous.

On the basis of the above discussion, in what follows these variables are treated as predetermined. Inference on the coefficients is not included at this stage because Arellano and Bond (1991) recommend not to use the two-step estimator for inference on coefficients, but the one-step estimator instead.

Table 1
Results on the effect of government capital and current spending on growth

Variable	GMM Two-step			One-step robust		
	All explanatory variables as exogenous (1)	Predetermined explanatory variables (2)	Fiscal variables and PI as endogenous (3)	Predetermined explanatory variables (4)	GMM Two-step Final model (5)	One-step robust Final model (6)
GDP_{-1} [c]	-1.046	-0.082	-0.992	-0.286	0.387	-0.375
	*0.387****	*0.188*	*1.116*	*0.075****	*0.756*	*0.060****
PI [c]	0.020	0.089	0.114	0.008	-0.002	0.018
	*0.005****	*0.102*	*0.145*	*0.004**	*0.019*	*0.008***
KE [c]	0.013	-0.009	0.023	0.004	-0.032	0.003
	*0.003****	*0.016*	*0.026*	*0.004*	*0.026*	*0.004*
CE [c]	0.012	-0.012	0.149	0.002	-0.036	0.005
	0.022	*0.043*	*0.245*	*0.023*	*0.099*	*0.026*
TAX [c]	-0.016	-0.067	-0.084	-0.003	0.053	-0.007
	0.013	*0.047*	*0.090*	*0.008*	*0.108*	*0.010*
KR	-0.004	0.009	-0.025	0.000	0.013	-0.001
	0.004	*0.017*	*0.037*	*0.003*	*0.021*	*0.004*
GR	-0.005	0.039	0.013	-0.001	0.035	0.000
	0.005	*0.051*	*0.011*	*0.005*	*0.051*	*0.005*
DEF	0.000	0.001	-0.006	0.000	0.006	0.000
	0.001	*0.004*	*0.009*	*0.001*	*0.007*	*0.001*
H [c]	-0.037	0.082	-0.066	-0.015	-0.039	0.006
	*0.021**	*0.239*	*0.125*	*0.023*	*0.049*	*0.008*
$n+r+\delta$ [c]	0.065	0.048	-0.050	*0.051*	0.216	0.017
	*0.024****	*0.101*	*0.253*	*0.019****	*0.226*	*0.026*
TOT	0.003	-0.001	0.002	0.002	0.001	0.002
	*0.001****	*0.003*	*0.002*	*0.001****	*0.002*	*0.001****
BMP [d]					-0.042	-0.018
					0.026	*0.003****
Constant term	0.007	-0.007	-0.003	0.005		
	*0.002****	*0.026*	*0.014*	*0.002***		
Observations	30	30	30	30	28	28
Number of countries	12	12	12	12	12	12
Wald test of joint significance	0.000	0.000	0.000	0.000	0.000	0.000
Sargan test	1.000	1.000	1.000	-	1.000	-
m1 (test of serial correlation)[e]	0.575	0.659	0.421	0.298	0.556	0.615
m2 (test of serial correlation)[f]	0.209	0.589	0.505	0.257	0.516	0.121

a Standard errors in italics

b * p<0.10; ** p<0.05; *** p<0.01.

c The variable is included in the regression as ln(variable)

d The variable is included in the regression as ln(1+variable)

e The null hypothesis is that there is no first-order autocorrelation in the first-differenced residuals

f The null hypothesis is that there is no second-order autocorrelation in the first-differenced residuals

To make inference on the coefficients, the one-step robust estimator is presented in column (4). The specification test is passed (p-value = 0.26). The statistically significant variables in the model are the lagged dependent variable (GDP_{-1}), private investment (PI), terms of trade growth (TOT), and black market premium (BMP). PI is statistically significant at the five percent level of significance, while the rest are so at the one percent level. The growth effects of all these variables are in the expected direction.

Although the results of regressions (2) and (4) suggest that the model does not have specification problems, it is necessary to control for a set of factors that can affect the per capita growth rate, as discussed before. Estimates of the coefficients of the explanatory variables that remain in the model at the end of the process are presented in the columns (5) and (6), the two-step and the robust one-step estimators, respectively. Following the results in regression (4), all right-hand side variables are assumed to be predetermined with the exceptions of TOT and the factor ($n+r+\delta$) that are treated as exogenous. The p-value of the Sargan test for the two-step estimator is approximately equal to unity, which means that there is not enough evidence to reject the null hypothesis that the over-identifying restrictions are valid. The other specification test is also passed (p-value = 0.52), which suggest that the final model in this section is 'well specified'.

Inference on the estimates is based on the robust one-step estimator in column (6). The variables that are statistically significant in the model are GDP_{-1}, PI, TOT, and BMP. The first three variables were also statistically significant in regression (4). It follows that the results on significance of these variables in that regression are robust to the inclusion of the other control variables. However, the only statistically significant one among them is BMP. Thus, this variable is the only additional one in regressions (5) and (6). Besides, the point estimates are more precise now, given that PI is statistically significant at the five percent level of significance while the other three before-mentioned variables are so at the one percent level of significance. All the significant estimated coefficients in the model have the expected sign from the theory. Thus, the effects of $GDP_{-1}$and BMP are negative whereas the effects of PI and TOT are positive. It is important to state that the effects of the focus variables in this section on the per capita economic growth rate, namely government capital and current expenditures, are positive but statistically insignificant.

To sum up, this section has found that neither government capital nor current spending have a statistically significant effect on economic growth in LACs during the period 1975-2000.

The insignificant effect of capital government spending on the per capita economic growth rate has been reported in other studies, such as Barro (1991) for a wide cross-country sample, and Devarajan et al. (2001) for a set of 28 African countries.

4.2 Public investment and economic growth

This section analyses the model presented in the previous one considering data on government capital spending from another source, namely the World Bank's Global Development Network database (from 1975 to 1998), updated to year 2000 with data from Everhart and Sumlinski (2001), instead of the data from the GFS - IMF used before. Thus, the variable from the World Bank and Everhart and Sumlinski will be called government investment (GI) and used as an explanatory variable in the growth model instead of KE. It is important to explain that these two variables, KE and GI, are not the same, since KE includes capital expenditures of just central governments, while the variable GI includes KE along with public investment undertaken by state-owned enterprises (henceforth SOEs).

The starting point for estimation is the same growth model used in the last section but with the other components of the GBC and TOT added as explanatory variables. The first three columns in Table 2 correspond to the two-step estimator of the model. As in the previous section, in regression (1) all the explanatory variables are assumed to be exogenous, while in regression (2) all these variables are assumed to be predetermined with the exceptions of TOT and the factor ($n+r+\delta$) that are assumed to be exogenous. In turn, regression (3) assumes the fiscal variables and private investment to be endogenous instead of predetermined. The results of the specification tests suggest that it is preferable to model the fiscal variables and private investment as predetermined rather than either exogenous or endogenous.

Bearing in mind that Arellano and Bond (1991) recommend using the one-step robust estimator to make inference on the coefficients, it is presented in column (4). The specification test of 'no second-order autocorrelation in the first-differenced residuals' is passed (p-value = 0.79). The statistically significant variables in the model are now the lagged dependent variable (GDP-1), adjusted population growth rate ($n+r+\delta$), terms of trade growth rate (TOT), and the constant term. The growth effects of all the three variables are significant at the five percent level of significance while the constant term is just marginally significant at the ten percent level. The direction of the effects of GDP-1 and TOT is the expected one from theory, while the corresponding to the factor ($n+r+\delta$) is not. The estimated effect of this factor is positive contrary to what is expected.

Although the results of regressions (2) and (4) suggest that the model does not have specification problems, some control variables must be included in the regression. Therefore, the same procedure used before is followed with the objective of controlling for some factors that can affect per capita growth rate according to the literature.

Thus, the GMM two-step and the robust one-step estimators that include only the control variables that remain in the model at the end of the process are reported in columns (5) and (6), respectively. The results of the specification tests of the two step estimator suggest that there is not enough evidence suggesting that the final model in this section is 'mis-specified'.

Table 2
Results on the effects of public investment and current spending on growth

Variable	GMM Two-step			One-step robust		
	All explanatory variables as exogenous (1)	Predetermined explanatory variables (2)	Fiscal variables and PI as endogenous (3)	Predetermined explanatory variables (4)	GMM Two-step Final model (5)	One-step robust Final model (6)
GDP_{-1} [c]	-0.119	2.966	-0.928	-0.306	-0.086	-0.437
	0.150	*2.196*	*0.270****	*0.086****	*0.249*	*0.076****
PI [c]	0.014	-0.074	0.023	0.006	-0.046	0.021
	*0.005****	*0.059*	*0.036*	*0.004*	*0.045*	*0.009***
GI [c]	0.010	-0.014	0.066	0.008	-0.035	0.010
	*0.004***	*0.030*	*0.028***	*0.005*	*0.048*	*0.006*
CE [c]	0.016	0.240	0.029	0.007	0.024	0.017
	0.019	*0.160*	*0.058*	*0.020*	*0.083*	*0.025*
TAX [c]	-0.010	-0.254	-0.030	-0.005	-0.053	-0.023
	0.012	*0.163*	*0.041*	*0.010*	*0.109*	*0.012**
KR	-0.002	-0.077	-0.009	-0.001	-0.003	-0.004
	0.002	*0.048*	*0.012*	*0.003*	*0.020*	*0.004*
GR	0.001	-0.136	-0.019	0.000	0.003	0.000
	0.004	*0.081**	*0.015*	*0.005*	*0.005*	*0.004*
DEF	-0.001	-0.030	0.001	0.000	0.000	0.000
	0.001	*0.020*	*0.003*	*0.001*	*0.009*	*0.001*
H [c]	-0.019	-1.939	0.009	0.015	-0.044	0.042
	0.017	*1.184*	*0.071*	*0.021*	*0.139*	*0.016****
$n+r+\delta$ [c]	0.072	0.554	-0.123	0.057	0.117	0.023
	*0.024****	*0.393*	*0.122*	*0.017****	*0.130*	*0.020*
TOT	0.002	0.014	0.006	0.002	0.001	0.003
	*0.001****	*0.006***	*0.002****	*0.001****	*0.001*	*0.001****
BMP [d]					-0.048	-0.019
					0.041	*0.004****
Constant term	0.006	0.166	0.011	0.004		
	*0.003***	*0.097**	*0.006**	*0.003**		
Observations	29	29	29	29	27	27
Number of countries	12	12	12	12	12	12
Wald test of joint significance	0.000	0.000	0.000	0.000	0.000	0.000
Sargan test	0.996	1.000	1.000	-	1.000	-
m1 (test of serial correlation)[e]	0.954	0.556	0.421	0.225	0.983	0.155
m2 (test of serial correlation)f	0.168	0.605	0.104	0.786	0.183	0.172

a Standard errors in italics

b * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

c The variable is included in the regression as ln(variable)

d The variable is included in the regression as ln(1+variable)

e The null hypothesis is that there is no first-order autocorrelation in the first-differenced residuals
f The null hypothesis is that there is no second-order autocorrelation in the first-differenced residuals

The results of the robust one-step estimator in column (6) are now used for inference on the coefficients. They show that two out the three variables that are statistically significant in the initial model are also significant in the final model (GDP_{-1} and TOT). The direction of the effects of these variables is the same in both models. On the other hand, the factor $(n+r+\delta)$ is not statistically significant any more. Along with the two first variables, others have become statistically significant in the model, namely private investment (PI), tax revenue (TAX), and the proxy for human capital (H). The growth effects of these additional variables have the expected direction from economic theory. Thus, the effects of PI and H are positive while that of TAX is negative. One of the additional control variables tried in the model is statistically significant, namely BMP. It enters the model with a negative sign as expected. With respect to the fiscal variables, the results suggest that on the expenditure side, both GI and CE have a positive effect on the per capita economic growth rate although it is statistically insignificant at the conventional levels of significance. It is important to see that the point estimate of the effect of government investment is approximately half of that corresponding to private investment. On the revenue side in turn, the growth effects of tax and capital revenue are negative, while the effect of grants is positive as expected. Finally, the per capita growth rate is invariant to changes in fiscal deficit.

Like in the last section, the impact of each of the two components of government spending considered here is positive though statistically insignificant. The point estimate of GI is 0.01, which is smaller than the estimates obtained by Ramirez and Nazmi (2003) for nine Latin American countries, Clements et al. (2003) for forty low-income countries, and Gupta et al. (2002) for 39 developing countries. Estimates in those studies vary from 0.056 in the first study to 0.808 in the last one.

Regarding the other component of government spending, CE, its estimated effect on the economic growth rate is also statistically insignificant and positive. The direction of this effect is the opposite to that found in a number of other studies. Nevertheless, some authors have reported a positive growth effect of CE. For instance, Devarajan et al. (1996) find a significant positive growth effect of government consumption expenditure in a sample of 43 LDC's, while Odedokun (2001) finds the same result for government spending in wages and salaries in a sample of 103 developing countries. This kind of spending represents a considerable share of government current spending in those countries during the period analysed in the study (more than a third).

Given that GI includes KE along with investment undertaken by SOEs, it can be said that the latter investment does not have any significant effect on the per capita economic growth rate in the set of LACs during the period 1975-2000. With respect to the findings on public investment, it is appropriate to quote Toye (2000), who argues:

> *"…it has been a familiar feature of developing countries that not all government expenditures that are labelled as 'investment' do produce an adequate return. Thus,*

a shake out of potentially unproductive government investment would ceteris paribus *raise the average productivity of investment. At the same time, the productivity of public investment depends, in part, on the availability of infrastructure that is provided by public investment. An excessive shake out could therefore, have the effect of lowering the productivity of public investment, violating the* ceteris paribus *assumption".*

(Toye, 2000: 32)

This statement is supported further by the findings in next section on the effects of expenditure on transport and communications, which is associated with that on infrastructure.

In addition, there is the possibility that public investment crowds out private investment. For instance, Easterly and Schmidt-Hebbel (1993) find a negative relationship between public and private investment in Chile, Colombia and Mexico, which are countries in the set included in this study. The negative relationship could be due to the fact that public investment is concentrated in activities that substitute directly for private investment (Easterly and Schmidt-Hebbel, 1993: 229).

It follows from the above that the net effect of public investment on private investment depends on its composition. In cases where public investment is a complement to private investment, the effect would differ from that in a scenario where investment by the public sector is a substitute for that by the private sector (Serven and Solimano, 1992; Easterly and Schmidt-Hebbel, 1993).

This section and the previous one have analysed the effect of government spending on the per capita economic growth rate by disaggregating it into two economic categories, capital and current spending. The next section considers a functional classification of government spending and evaluates the role of its various components on the economic growth rate.

4.3 Functional classification of government spending and economic growth

Sections 4.1 and 4.2 suggest that none of the components of government spending has any effect on the per capita growth rate in LACs during the period 1975 - 2000. Nevertheless, it is important to point out again that a strand of the economic growth literature have identified some components of government spending as being growth promoting, particularly spending on education (Barro and Sala-i-Martin, 1995, 2004; Collins and Bosworth, 1996; Hanushek, 1995; Barro and Lee, 2001; Bleaney et al., 2001; Odedokun, 2001; among others), on health (i.e., Miller and Russek, 1997; Bleaney et al., 2001), and on transport and communications (i.e., Easterly and Rebelo, 1993; Odedokun, 2001).

There is a consensus on the positive effect of education, health and infrastructure. Therefore, if government spending on these sectors can contribute to achieve better outcomes on them, a positive effect of those expenditures on growth would be present. In this regard, Summers and Thomas (1993) argue that improvements in people's health and education bring about an increase in the preference for smaller families, which, together with better provision of family planning services, helps to deal with the population problem in many developing countries. An improvement in economic environment can be achieved by reducing heavy subsidies for higher education and increasing primary education spending, from which the returns are relatively higher. The same is expected to happen by switching spending from expensive curative health care systems to primary systems (Summers and Thomas, 1993: 245-246).

In turn, the stock of public capital and more specifically of public infrastructure has been considered an important input that promotes private production. Ashauer (1989, 1998a) and Canning (1999) are amongst several studies that analyze this topic[3]. Nevertheless, Holtz-Eakin (1994) claims that use of aggregate data does not reveal sufficiently large linkages between public sector capital and private production activities. Besides, he argues that previous findings of large, positive effects of local government capital on private sector production appear to be obtained because of the use of an inappropriately restrictive econometric framework (Holtz-Eakin, 1994: 20).

On the basis of the discussion above, the purpose of this section is to determine the effect of government spending on economic growth by disaggregating it into eight functional categories, namely expenditure on education, health, defence, social security and welfare, transport and communications, other economic affairs, public services, and other expenditures.

The growth effects of the various components of government spending are analyzed one by one due to the data availability restriction discussed section 4.1. The results show that the only component that affects the per capita growth rate is that on transport and communications. However, the results for other components that have been associated with human capital accumulation, a key factor in endogenous growth models, are also reported. They are education and health spending. Thus, this section analyses separately the effects of government spending on transport and communications, education and health.

4.3.1 Government spending on transport and communications and economic growth

The starting point for estimation is the model used in the previous sections with the difference that government spending is now disaggregated into spending on transport and communications (TC) and the remaining government expenditure (OTHER). The first column in Table 3 corresponds to the robust one-step estimator of the model. As in previous sections, the adjusted population growth rate is assumed to be exogenous while all the other right-hand side variables are assumed to be predetermined instead of strictly exogenous. The specification test is passed (p-value = 0.36). The Sargan test of the two-

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[3] Munnell (1992) presents a good summary of the empirical literature on infrastructure investment and economic growth. Gramlich (1994) offers a more recent analysis of theoretical and empirical studies on infrastructure investment.

step estimator is also passed, however due to space limitations they are not reported here4. These results suggest that the model is not mis-specified.

Table 3
Results on the effect of government spending on transport and communications on growth

Variable	GMM one-step robust estimator		
	(1)	(2)	(3)
GDP_{-1} [c]	-0.330	-0.314	-0.154
	*0.111****	*0.092****	*0.122*
PI [c]	0.006	0.006	0.009
	0.005	*0.005*	*0.004***
TC [c]	0.010	0.012	0.011
	*0.004****	*0.004****	*0.003****
OTHER [c]	-0.015	-0.015	-0.007
	0.012	*0.010*	*0.014*
GR	0.003	0.002	0.011
	0.003	*0.003*	*0.003****
TAX [c]	0.009	0.007	0.015
	0.010	*0.007*	*0.008**
DEF	0.001	0.001	0.002
	0.001	*0.001**	*0.001****
KR	-0.002	-0.001	0.004
	0.001	*0.001*	*0.001****
H [c]	0.057	0.047	0.142
	*0.016****	*0.015****	*0.028****
$n+r+\delta$ [c]	0.024	0.032	-0.020
	0.020	*0.012****	*0.020*
OPEN [c]		0.016	
		*0.006***	
M2 [c]			-0.037
			*0.009****
Observations	25	25	25
Number of countries	11	11	11
Wald test of joint significance	0.000	0.000	0.000
m1 (test of serial correlation)[e]	0.120	0.358	0.047
m2 (test of serial correlation)f	0.358	0.178	0.465

a Standard errors in italics

b * p<0.10; ** p<0.05; *** p<0.01.

c The variable is included in the regression as ln(variable)

d The variable is included in the regression as ln(1+variable)

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[4] The Sargan test of the two-step estimator was undertaken for all the models presented in the section in order to make sure that each of them does not have specification problems. Nevertheless, they are not reported here for ease to the reader and owing to space limitations.

e The null hypothesis is that there is no first-order autocorrelation in the first-differenced residuals

f The null hypothesis is that there is no second-order autocorrelation in the first-differenced residuals

The explanatory variables that are statistically significant in the regression are the lagged dependent variable (GDP_{-1}), government spending on transport and communications (TC) and the proxy for human capital (H). All are significant at the one percent level of significance and the direction of their effects is the expected one from a theoretical viewpoint, negative for GDP_{-1} and positive for TC and H.

As discussed before, it is necessary to control for different factors that can affect the growth rate according to the literature. Thus, the study tried all the control variables mentioned in section 4.1 one by one owing to the data availability restriction.

In regression (2), the measure of the degree of a country's openness (OPEN) is included. Again, the right-hand side variables are treated as predetermined instead of strictly exogenous. The specification test is passed (p-value = 0.18). The Sargan test of the two-step estimator is also passed. These results suggest that the model is not 'mis-specified'.

The three statistically significant variables in the first model are robust to the inclusion of OPEN. Besides, the adjusted population growth rate ($n+r+\delta$) and fiscal deficit (DEF) have become statistically significant. Both show a positive effect on growth. The direction of the effect of the factor ($n+r+\delta$) is contrary to the expected one. The same result has been obtained in previous sections.

Regression (3) includes another of the control variables, the ratio of broad money supply to GDP (M2), instead of OPEN. As usual, it is assumed that all the explanatory variables are predetermined instead of strictly exogenous, with the only exception of the adjusted population growth rate ($n+r+\delta$) that is treated as exogenous. The results of the specification tests suggest that the model does not have specification problems.

The new variable is statistically significant at the one percent level of significance and its growth effect is negative contrary to the expected result from the literature. This effect could be capturing the negative effect of inflation. However, when this variable is included instead of M2, it was statistically insignificant though with a negative coefficient. The importance of the focus variable in this section, TC, in statistical terms, is also robust to the inclusion of M2 in the regression. So is that of H. On the other hand, GDP_{-1} becomes statistically insignificant. In other words, the presence of the so-called conditional convergence is not robust to the inclusion of M2 in the regression. The other control variables discussed in previous sections were statistically insignificant when tried separately in the model.

Coming back to the focus variable in this section, the highly significant positive growth effect of government spending on transport and communications is robust to the inclusion of the two control variables that are statistically significant in the regression. Furthermore, the point estimates are practically the same in the three scenarios. The estimated coefficient of the other focus variable, government spending other than that on transport and communications (OTHER) keeps its negative sign in all three scenarios. The point estimates do not vary considerably across the different regressions. The estimated coefficient of TC is 0.011 on average, which is in between Haque and Kim's (2003) estimate, 0.003 and Odedokun's (2001), 0.19. Easterly and Rebelo's (1993) estimates in turn, are extremely high for the various models they consider. Their estimated coefficient is 0.62 on average.

4.3.2 Government spending on education and economic growth

To estimate the effect of government spending on education on the per capita growth rate, the study follows the same procedure used in the previous section. But government spending is now disaggregated into education spending (E) and the remaining spending (OTHER). The first column in Table 4 corresponds to the one-step estimator that is robust to any presence of heteroskedasticity in the data. As usual, the factor (n+r+δ) is assumed to be exogenous while all the other explanatory variables are assumed to be predetermined instead. The specification test is passed (p-value = 0.42). The Sargan test of the two-step estimator is also passed, which suggest that the model is not 'mis-specified'.

The results show that GDP-1, GR, H and the factor (n+r+δ) are statistically significant in the model. The direction of the effects of the first three variables is as expected, negative for GDP-1 and positive for GR and H. On the other hand, the effect of the factor (n+r+δ) is positive contrary to what is expected. The estimated coefficients of the two focus variables in this section, E and OTHER, both carry a negative sign although the two variables are statistically insignificant.

Even though the results of the specification tests for this model suggest that it is not 'mis-specified', as argued previously, it is necessary to include the control variables in the model. All of them were tried one by one owing to data availability restriction.

In regression (2), the measure of the degree of a country's openness (OPEN) is included. Regression (3) includes another of the control variables, BMP, instead of OPEN, while regression (4) adds M2 to the regression instead. The assumptions on endogeneity / exogeneity of the right-hand side variables are the same as in the last section in all three regressions. The specification test of 'no second order serial autocorrelation in the first-differenced residuals' is passed for the three models (the p-values are 0.30, 0.19 and 0.92, respectively). The Sargan test of the two-step estimator is also passed for all, which suggest that each of the three models does not have specification problems. The results show that OPEN, BMP and M2, when included separately in regressions (2), (3) and (4), respectively, all are statistically significant at the conventional levels of significance. The direction of the effect of the two first variables is consistent with the literature, positive for OPEN and negative for BMP. The estimated effect of M2 in turn, is negative, that is, in the opposite direction to what is expected. This result was found and commented in previous sections.

The estimated effects of the two components of government spending in this section are statistically insignificant in the three regressions. The point estimate of the coefficient of E does not vary considerably across the regressions and has a negative sign in all. The estimated coefficient of OTHER in turn, shows more variation, it has a negative sign in regressions (2) and (3) and becomes positive in the latter regression. However, as stated above, it is statistically insignificant in all three regressions.

Table 4
Results on the effect of government spending on education on growth

Variable	GMM one-step robust estimator			
	(1)	(2)	(3)	(4)
GDP_{-1} [c]	-0.205	-0.172	-0.096	-0.026
	*0.120**	*0.108*	*0.160*	*0.130*
PI [c]	0.003	0.003	0.007	0.006
	0.005	*0.006*	*0.009*	*0.005*
E [c]	-0.007	-0.006	-0.008	-0.005
	0.012	*0.012*	*0.011*	*0.012*
OTHER [c]	-0.010	-0.008	-0.031	0.002
	0.012	*0.011*	*0.020*	*0.014*
GR	0.006	0.006	0.010	0.014
	*0.004**	*0.004**	*0.005***	*0.004****
H [c]	0.056	0.045	0.009	0.139
	*0.020****	*0.016****	*0.022*	*0.037****
TAX [c]	0.012	0.010	0.004	0.016
	0.009	*0.007*	*0.016*	*0.009**
DEF	0.001	0.001	0.002	0.001
	0.001	*0.001*	*0.002*	*0.001**
KR	0.001	0.001	0.003	0.006
	0.001	*0.001**	*0.002*	*0.001****
$n+r+\delta$ [c]	0.036	0.046	-0.015	-0.005
	*0.018***	*0.011****	*0.041*	*0.023*
OPEN [c]		0.014		
		*0.007**		
BMP [d]			-0.030	
			*0.016**	
M2 [c]				-0.037
				*0.012****
Observations	25	25	23	25
Number of countries	11	11	11	11
Wald test of joint significance	0.000	0.000	0.000	0.000
m1 (test of serial correlation)[e]	0.233	0.363	0.297	0.023
m2 (test of serial correlation)[f]	0.423	0.302	0.193	0.922

a Standard errors in italics

b * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

c The variable is included in the regression as ln(variable)

d The variable is included in the regression as ln(1+variable)

e The null hypothesis is that there is no first-order autocorrelation in the first-differenced residuals

f The null hypothesis is that there is no second-order autocorrelation in the first-differenced residuals

Two of the right-hand side variables are statistically significant across the different models, GR and H. The first variable is so in all the regressions in this section and its estimated coefficient has a positive sign in all. Estimated effect of H is positive in all the regressions and is statistically significant in all but regression (3).

4.3.3 Government spending on health and economic growth

Following the same procedure in the two previous sections, now government spending is disaggregated into health spending (HE) and the remainder (OTHER). The first column in Table 5 corresponds to the one-step estimator that is robust to any presence of heteroskedasticity in the data. Assumptions on endogeneity / exogeneity of the explanatory variables are the same as before. The results of the specification tests suggest that the model is 'well specified'. Among the explanatory variables in the model, only H and the factor $(n+r+\delta)$ are statistically significant. The direction of the effect of the first variable is positive as expected, while the effect of the factor $(n+r+\delta)$ is also positive. The latter finding is contrary to what is expected from a theoretical viewpoint. The estimated coefficients of the two focus variables in this section, HE and OTHER, carry both a negative sign although the two variables are statistically insignificant.

Since the model above does not have specification problems, it is now possible to start trying the control variables one by one owing to data availability restrictions. In regression (2), the measure of the degree of a country's openness (OPEN) is included. Regression (3) includes other of the control variables, BMP, instead of OPEN, while regression (4) adds M2 to the regression instead. The assumptions on endogeneity / exogeneity of the explanatory variables are the same as in the last section in all three regressions. The specification test of no second order serial autocorrelation in the first-differenced residuals is passed for the three models (the p-values are 0.32, 0.28 and 0.55, respectively). The Sargan test of the two-step estimator is also passed for all. These results suggest that each of the three models does not have specification problems.

As in the previous section, the results show that OPEN, BMP and M2, when included separately in regressions (2), (3) and (4), respectively, all are statistically significant. The direction of the effect of the first two variables is as expected, positive for OPEN and negative for BMP. The effect of M2 in turn, is negative contrary to what is expected. The other control variables discussed in previous sections were insignificant when included separately in the model.

The estimated effects of the two components of government spending in this section are statistically insignificant in the three regressions. The point estimate of the coefficient of HE does not vary considerably across the regressions and has a negative sign in all. The estimated coefficient of OTHER in turn, shows more variation, it has a negative sign in regressions (2) and (3) and becomes positive in the last one. However, it is statistically significant only in regression (3). It is so just marginally at the ten percent level of significance.

Three of the explanatory variables are statistically significant across the different models, GR, H and KR. The direction of the effect of all these variables is positive as expected. GR and KR are statistically important in all the three regressions. The estimated effect of H is statistically significant in all but regression (3).

Table 5
Results on the effect of government spending on health on growth

Variable	GMM one-step robust estimator			
	(1)	(2)	(3)	(4)
GDP_{-1} [c]	-0.173	-0.164	-0.080	-0.029
	0.112	*0.096**	*0.157*	*0.098*
PI [c]	0.003	0.003	0.008	0.006
	0.006	*0.006*	*0.010*	*0.005*
HE [c]	0.000	-0.003	-0.003	-0.006
	0.005	*0.005*	*0.005*	*0.003**
OTHER [c]	-0.014	-0.008	-0.032	0.005
	0.010	*0.012*	*0.018**	*0.018*
GR	0.006	0.006	0.009	0.015
	*0.003**	*0.003***	*0.004***	*0.004****
H [c]	0.046	0.041	0.006	0.149
	*0.015****	*0.015****	*0.031*	*0.038****
TAX [c]	0.011	0.009	0.002	0.017
	0.010	*0.009*	*0.018*	*0.010**
DEF	0.001	0.001	0.002	0.001
	0.001	*0.001*	*0.001*	*0.001***
KR	0.001	0.001	0.002	0.007
	0.001	*0.001**	*0.001**	*0.001****
$n+r+\delta$ [c]	0.043	0.052	-0.008	-0.007
	*0.017***	*0.015****	*0.038*	*0.026*
OPEN [c]		0.015		
		*0.008**		
BMP [d]			-0.030	
			*0.017**	
M2 [c]				-0.041
				*0.012****
Observations	25	25	23	25
Number of countries	11	11	11	11
Wald test of joint significance	0.000	0.000	0.000	0.000
m1 (test of serial correlation)[e]	0.264	0.352	0.507	0.046
m2 (test of serial correlation)f	0.422	0.319	0.279	0.555

a Standard errors in italics

b * p<0.10; ** p<0.05; *** p<0.01.

c The variable is included in the regression as ln(variable)

d The variable is included in the regression as ln(1+variable)

e The null hypothesis is that there is no first-order autocorrelation in the first-differenced residuals

f The null hypothesis is that there is no second-order autocorrelation in the first-differenced residuals

4.3.4 Summary

Section 4.3 has evaluated the effects of different components of government spending on the basis of a functional classification on the per capita economic growth rate in a set of Latin American countries over the period 1975 - 2000. The section reports estimates of the effects of some of those components that have been identified to be growth promoting in the literature as discussed before. The results show that education and health spending do not have a statistically significant effect on growth. The only component of government spending that is statistically significant in explaining growth rate is that on transport and communications. Its estimated effect is positive and strongly significant. This result is in agreement with a number of studies mentioned in the first part of section 4.3.

The results here also suggest that economic growth is invariant to government spending on education (E) and health (H), which is contrary to earlier findings in the literature. The results of a number of studies such as Kelly (1997) are similar to ours. The author finds no effect of public spending on education and health in a sample of 73 developing and developed countries over the period 1970 – 1989. The estimated coefficients of those expenditures are negative in all the scenarios of the growth model in the study undertaken by Kelly.

Statistically insignificant estimated effects of government expenditure on education and health could be due to inefficiency in these kinds of expenditure. Perhaps they are vulnerable to rent seeking. With regard to education spending, it is argued that it is often not allocated according to a kind of consensus from the empirical literature: in economies with less than universal basic education, the rates of return to education are greatest for primary, followed by secondary and tertiary education (Gerson, 1998; Dabla-Norris and Matovu, 2002). For example, in some poor countries despite low primary school enrolments, spending per student in tertiary education can be much higher than that per student in primary education. De Gregorio and Lee (2003) in turn, argue that high education spending and lower outcomes in the sector are to a certain extent an outcome of unequal income distribution. Latin America has a more unequal income distribution than most other regions in the world. This gap cannot be closed in a short period of time. For instance, improvements in education take time to pass through to a large share of the labour force (De Gregorio and Lee, 2003: 19).

In addition, inefficiency of government spending has widely been associated in the literature with poor governance and corruption. For instance, Rajkumar and Swaroop (2002) find that an increase in government spending on primary education is likely to be more effective in increasing primary education attainment in a country with good governance. They also find that government spending on health and education is less likely to lead to better outcomes if countries have poor governance, which is, typically, a characteristic of developing countries (Rajkumar and Swaroop, 2002).

Therefore, it can be argued that the theoretically expected positive and significant effect of government spending on education and health is likely to be weakened by countries' poor governance and high levels of corruption. On the basis of this, it is not surprising to find no effect of public expenditure on health and education on economic growth for the set of LACs considered in this study. The results on the estimated effect of government spending on education are consistent with Glewwe (2002) who argues that developing countries spend hundreds of billions of dollars each year on education, and there is ample evidence that these funds are spent inefficiently.

The above discussion offers various explanations of some of the results obtained here, particularly with regard to the absence of a significant effect of government spending on education and health. In addition, it is important to recall that the study considers only the effect of contemporaneous five-year averages of different components of government expenditure on five-year averages of per capita economic growth rate and that a five-year period may not be long enough to incorporate fully some of those effects. In this respect, Gerson (1998) argues,

> *"…in the case of education it would take many years for students benefiting from increased school funding to pass through the educational system and join the labour force. Similarly, the benefits from increased spending on prenatal care may not materialize until years after the children receiving the care are born".*
>
> *(Gerson, 1998: 13)*

Therefore, it would be appropriate to include not only contemporaneous five-year averages but also lagged five-year averages of the explanatory variables. Nevertheless, that is not a feasible option to be carried out in the study given the short period covered due to availability of the data, and the small number of observations for each country in the sample. Given that the different scenarios considered here do not include such lagged effects of the explanatory variables but just the contemporaneous five-year averages, the results obtained should be taken with caution. However, it can be pointed out that despite this limitation, most of them are broadly consistent with the literature.

Finally, some concern about the stability of all of the estimations in this section must be explicitly acknowledged. This instability can be better understood by looking at the results of Levine and Renelt (1992) about the sensitivity of coefficients to regression specification. As in that study, however, the instability comes about because of the difficulty in separating out the effects of different policies, given that a country's performance depends on the whole set of macroeconomic policies it applies. In this regard, Easterly et al. (1997: 299) point out that estimated aggregate effects of policy packages are more stable than the estimated effect of each policy in isolation.

5. Concluding remarks

This study has evaluated the effect of different categories of government spending on the per capita economic growth rate in a set of LACs during the period 1975 - 2000. When government spending is disaggregated on the basis of an economic classification, the results suggest that neither government capital nor current expenditures have any impact on the per capita economic growth rate. When public investment undertaken by SOEs is added to central government's capital expenditure, the results remain the same. Both components (government investment and current expenditure) are statistically insignificant at the conventional levels of significance. Both effects remain positive. These results suggest that investment by SOEs do not have any significant effect on the per capita economic growth rate, as is the case with capital expenditure by central governments (KE). As a consequence, the aggregate measure containing both of these investments, GI, is found not to have a significant effect on economic growth in the considered set of LACs over the period 1975-2000.

On the basis of a functional classification of government spending, the results suggest a strongly significant positive effect of government spending on transport and communications. On the other hand, the other components of expenditure were found to be statistically insignificant in explaining economic growth. Thus, the study did not find the positive growth effect of public expenditure on education and health reported in the literature.

The positive effect of government spending on transport and communications is in line with the literature. Therefore, it is possible to conclude that government spending composition does matter for growth in LACs during the period 1975 - 2000.

From a policy standpoint, these findings suggest that LACs countries should increase government expenditure on transport and communications, which is closely associated with expenditure on infrastructure. However, to increase spending on these concepts, governments should also reduce those on other categories given the presence of a budget constraint. In other words, increases of public expenditure on transport and communications should be undertaken at the expenses of expenditures on other components of it that are likely not to have any effect on economic activity. A reallocation of government spending like the above-mentioned, giving more importance to more productive sectors is not only critical for boosting growth, but also for achieving more sustained fiscal adjustments (Gupta *et al*., 2004: 212).

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