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Public Expenditure, Taxation and Economic Growth:

Empirical Evidence from Latin America

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A ellas, porque sin ellas nada tendría sentido. Gracias por su dulce compañía, por su vibrante energía, por ser mi inspiración, y por ser mi razón de ser cada día. Gracias por su apoyo. Gracias por su paciencia, y sobre todo gracias por su *amor*.

Abstract

A renewed interest in the effects of fiscal policy on economic growth has surged as a result of the 2009 recession. Endogenous growth models combine these two elements together, and so this type of model presents a natural framework for the analysis of the relationship between fiscal policy and growth. This major paper tests the prediction of the endogenous growth model of Barro (1990) about the effects of government expenditure and taxation on long-run growth in Latin America. An endogenous growth model is used with a full specification of the government budget constraint to account for the biases of omitting it in empirical research. The model is applied and tested for a panel dataset of 19 Latin American countries, 1990-2010.

Key Words: Economic Growth, Government Budget Constraint, Endogenous Growth Model, Taxation, Expenditures.

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Introduction

The question this paper addresses is whether there is a significant effect of fiscal policy on the long-run growth rate of per capita income - economic growth - for Latin America. By linking these two concepts together, growth models are the natural theoretical framework to address this question. Neoclassical growth models and endogenous growth models provide quite distinct theoretical responses for the subject of inquiry. Neoclassical growth models diminish the role of government in the economy, and so any of its actions as to influence long-run growth. Nonetheless, endogenous growth models provide a far more important role for government fiscal policy and its impact on the economy. Given the theoretical predictions of endogenous growth models, one of them is used in this paper to try to shed some light in the questions of interest.

This major paper builds on previous economic growth studies by testing a theoretical endogenous growth model with a specific methodology on a non-traditional government data set. A considerable amount of knowledge of endogenous models is based on evidence from the developed world. Consequently, the paper pioneers in testing the predictions of the Barro (1990) endogenous growth model and providing evidence from a specific developing world region: Latin America, from 1990 to 2010. In this economic region, governments have a considerable share in the economy, which *a priori* suggests that fiscal policy could actually have a considerable effect on long run

growth for this given set of countries. The main data set, which contains the primary fiscal operation for Latin American governments, comes from the Commission for Latin America and the Caribbean (ECLAC). [1]

Under the current analysis, the assumption is that fiscal structure has a role in promoting economic growth is based on the findings of Kneller *et al*. (1999). The authors estimated the impact of fiscal policy on growth in an empirical setup for a group of developed countries. The latter analysis advanced an innovative approach to the economic growth literature by explicitly taking into account a full government budget constraint for growth regressions, which allows avoiding estimate biases. Similar empirical setups were also recently used by Bleaney *et al.* (2001), Muinelo-Gallo and Roca-Sagalés (2011), and Gemmell *et al.* (2013), just to name a few.

The Latin American region is constituted of an economically assorted country set. These countries vary significantly among themselves in economic approaches and sizes, despite sharing a similar language and to some extent a similar culture. Yet, the ideological economic approaches go from directed economies to liberal and globalized ones. The latter are appealing characteristics of a region mistakenly thought to be economically homogeneous. Nevertheless, some particular features are shared in the region, such as being the most democratic, financially and economically open, but at the same time one of the most socially unequal developing regions in the world (Rojas-Suarez).

[1] ECLAC is a regional commission of the United Nations. ECLAC was created in 1948 to advance the economic development of Latin America.

In a world environment of fiscal austerity, it is important to understand what elements of fiscal policy actually have a real economic impact in order to make more informed spending and taxing decisions. A new challenge lying ahead for states worldwide, especially for governments in Latin America, is the need to explore innovative ways to spend either less or the same but in more efficient and effective ways to enhance economic growth and improve the overall conditions of their populations. Technological innovation might provide some answers to the growth questions; nevertheless, the way governments in Latin America participate in the economy requires also new innovative approaches such fiscal reallocation or using taxation as a tool for economic growth and socio-economic improvement.

Also, the results from the current analysis constitute further supportive evidence for endogenous growth models. It was found that productive government spending enhances economic growth. Meanwhile, the effect of distortionary taxation and other sources of revenue decrease growth. The results imply fiscal resource reallocation, as a tentative answer to the growth question, with greater focus on expenditures that are proven to have a positive effect on growth and greater emphasis on the reduction of growth detrimental taxation elements. The results of the analysis could potentially help governments make more informed expenditure and taxation decisions to enhance growth.

The current analysis of growth is mainly based on the use of gross domestic product (GDP) per capita, and this element is used as a measure of economic outcome. Broadly accepted in economics, the GDP per capita measure is thought to be a reliable proxy of the economic outcome of an average citizen in any given country, which allows

creating a link between theory, empirical analysis and economic policy. However, GDP per capita alone must not be the only measure of economic growth, as its shortcomings have been documented: it cannot alone reflect complex socio-economic environments at regional and national levels. For that reason, the conclusions drawn from these results necessarily require to be part of a broader and synchronized socio-economic policy strategy, including other indicators and measures of the social well-being.

Finally, the paper is structured as follows. The literature review section provides an overview of the findings of relevant endogenous growth models findings. The theory section introduces the key elements and the rationale behind the Barro (1990) growth model. Section 5 presents the main characteristics of the data used. The results are presented in section 6, and the last section discusses some conclusions drawn from the findings.

Literature Review

The existing literature on economic growth and fiscal policy is relatively extensive. Its popularity boomed during the decade of the 80's, and then lost momentum. The neoclassical approach and other models, which minimize the government role in economic activity, displaced interest in the analysis of fiscal-growth effects. However, the most recent global economic recession, in 2009, brought back some interest to the question, since many states around the world had no option but to intervene more significantly in the economic activity of their countries to avoid a potential economic catastrophe.

Yet, governments' resources are limited, and even the richest countries applied austerity measures once growth resumed. With a renewed interest and econometric techniques available for reserchers, new knowledge and further willingness to understanding fiscal policy impact on economic growth is re-emerging. Mainly, under in a worldwide context of sluggish economic recovery, which threatens to leave behind millions of citizens in Latin America and around the world, the quest for economic growth is fundamental.

Yet, the empirical fiscal- growth literature varies greatly in quality with fewer robust than non-rubust results (Gemmell, 2001). There is a lack of consensus on theoretical and empirical grounds about the direction of the impact that public expenditures have on growth (Devarajan *et al.*, 1996). Econometric specifications, inadequate attention to theory and changing methodologies are some of the main sources of these results in the field. Nevertheless, Gemmell (2001) presents a comprehenve classification of the empirical evidence that contributes to contextualize the evolution of the overall evidence.

According to Gemmell (2001), the empirical fiscal-growth literature could essentially be divided into three different generations of models. The reference point to create this classification is the milestone model of Barro (1990), althought this is far from being a chronological organization. The essential characteristics that establish the generation of a study is whether they take into account a complete specification of the government budget constraint or not, and the econometric technique used for testing.

Fundamentally, the models that pre-date the Barro model belong to the first generation, but some exceptions exist. This family of models is characterized by the use of limited data and *ad hoc* econometric specifications. The linear restriction implied by the government budget constraint is overall ignored in these studies (Kneller *et al.*, 1999). Not suprisingly, the results issued from this generation are both non-robust and hardly comparable. Kneller *et al.* (1999) present in a discussion papper a broad literature summary of empirical studies that belong to the first generation classification.

Further, the second generation of models involves predictions of both neoclassical and endogenous growth models in theoretical bounds. However, the main shortcoming of these models is the lack of a connection between theory and empirical approaches, typically using cross-section econometrics to link fiscal policy and economic growth. In general, this generation of models tests the properties of taxes or public expenditures on economic growth, disregarding the importance of fully specifying the government budget constraint and accounting for time impacts. Kneller *et al.* (2011) and Gemmell and Au (2013) present an extensive compilation of various authors whose work falls under the second generation category.

The third generation of models is characterized by the inclusion of the government budget constraint in the analysis of fiscal effect on economic growth. They also allow, according to theory, for potential growth differences due to different fiscal structures (Gemmell and Au, 2013). In econometric terms, the third generation of models relies on modern time series or panel techniques, providing not suprisingly more robust empirical evidence. Also, the third generation of models provides futher options depending on the intertemporal effects of interest to researchers. In terms of time, the

enquiry into the effects of fiscal policy contrasts and identifies the long-run and the short-run effects. Studies of short-run effects have been concerned with temporary fiscal policy shocks; for that reason, the use of time series approaches has been adopted to uncover these effects.

On the other hand, long-run studies focus on the identification of permanent output and growth rate changes, provided a fiscal policy changes, and thus the panel approach has been more suitable for this type of research. Panel data provides advantages over specific time series and cross-section techniques for the study of long-run effects by allowing more efficient parameter estimates, uncovering dynamic relationships and identifying otherwise unidentified patterns (Benos, 2009). A more infrequent type of analysis combines panel data with time series to analyse short and long-run effects of the fiscal policy on economic growth. This is the case of the analysis of Romero-Avila and Strauch (2007) and Gemmell *et al.* (2013).

Long run economic growth is of key interest for the current study, and the analysis of empirical evidence from this time perspective is privileged. In 1999, Kneller *et al.* presented an analysis that provided a milestone methodology to diagnose the fiscal-growth relation by emphasizing the key role of fully specifying the government budget constraint. The results from a panel data of 22 OECD countries demonstrates that ignoring a full budget speficication leads to substantial biases. Further, the analysis presents favorable evidence for the predictions of the endogenous growth model of Barro (1990).

Mainly, Kneller *et al.* (1999) find growth-enhancing productive government expenditures and growth-detrimental non-productive expenditures. For instance, government spending on transport and communications results to be productive and to enhance economic growth, while expenditures on recreation are non-productive. On the other hand, they find that distortionary taxes reduce economic growth, while non-distortionary taxes barely affect it. For example, taxes on property and taxes on domestic goods are distortionary and non-distoritonary, respectively. Miller and Russek (1997), Muinelo-Gallo and Roca-Sagalés (2011) and Gemmell *et al.* (2011) find similar results for the endogenous growth model in a full budget constraint specification setting. Nevertheless, Gemmell *et al.* (2011) extend their analysis by revealing the persistence in time of fiscal changes. In fact, the study finds supporting evidence for the endogenous growth model assumption that some fiscal variables have transitory effects, while others have persistent growth effects. Equally, while analysing different instruments of fiscal policy on economic growth and income inequality, Muinelo-Gallo and Roca-Sagalés (2011) find that public investment reduces inequality without harming long run growth.

Although several papers have contributed to the fiscal-growth field, just a few have taken into account the systematic biases to the parameters due to the lack of fully identifying the government budget constraint and the associated financing assumptions (Kneller *et al.*, 1999). This fact has been the major problem of most of the existing evidence, and even today many studies continue to ignore the importance of the government budget constraint (Kneller and Misch, 2011). In particular, almost all fiscal growth regressions for developing economies fail to adequately deal with the

government budget constraint, casting doubt on the results the studies present (Gemmell, 2001). And, as Kneller *et al.* (1999) have pointed out, the evidence from incomplete specifications could lead to a serious problem of effect misinterpretation.

Moreover, another concern of the existing literature is that the provided evidence mainly comes from developed economies, and only a limited number of studies include developing countries. In fact, one of the major obstacles to test growth models for developing economies is the scarce amount of data available for governments operations, chiefly the disaggregated level of data (Bleaney *et al.*, 2001). In this sense, the existence of a regional organization such as the Economic Commission for Latin America and the Caribbean (ECLAC) has been a great advantage for this study, given that the institution provides a comprehensible compilation of data for Latin America, the economic region of interest for the current analysis.

Finally, taking into account all these elements introduced above, this paper contributes to the economic growth literature by accounting for a complete government budget constraint for a specific set of developing countries, by providing evidence on fiscal-growth from outside the traditional OECD set of countries and by using a public policy endogenous growth model. The current approach allows a specific answer to the question of whether the composition of fiscal policy - expenditure and revenue - in Latin America has a significant effect on the long-run economic growth of the region.

Theory

The pioneering paper of Barro (1990) presented a growth model different from the neoclassical model to understand the role of the government intervention, including

both government expenditures and revenues. In the neoclassical growth model, fiscal policy affects the incentives to invest, as it alters in principle the equilibrium capital-output ratio, and so the output path but not the long-run growth rate. The role of fiscal policy in the neoclassical growth model only impacts the path to the steady-state, which is only driven by exogenous elements such as population growth and technological progress. A main concern with the theory is that it hardly explains how technological process happens, as it occurs outside the model (Reyes and Sawyer, 2011).

Yet, the endogenous growth model innovates by allowing fiscal policy to affect the steady-state growth rate and the output path (Bleaney *et al.*, 2001). The latter feature represents the main novelty of the model, as it allows growth to come from within the model. In fact, the model predicts that the effect expenditures have on growth depends directly on their financing element, which allows endogenous growth models to rely less on exogenous elements to generate long-term growth (Barro, 1990). In this sense, the empirical macroeconomic analysis with the endogenous growth model is less restrictive than with neoclassical growth models about the role governments play in growth and in the overall economic activity. This is also the main hypothesis that will be tested with a data set for Latin America.

As outlined in the following table, Barro's endogenous growth model classifies budget elements into four main fiscal policy instruments. On the expenditure side, spending is catalogued into productive and unproductive expenditures, while taxes are divided into distortionary and non-distortionary. Although in principle this classification in simple, in practice, it is the subject of debate because different budget elements could be included in these four categories.

In the economic growth context, all those levies that diminish the incentives of agents to invest in both human and physical capital and thus create a distortion in the steady-state growth rate, are classified as distortionary taxes. In contrast, non-distortionary taxes have no significant effect on the growth rate because they do not affect investment incentives, given the implicit nature of the agent's utility function (Kneller *et al.*, 1999). On the expenditure side, growth is assumed to be incremented in the long run by all expenditures that positively influence the marginal product of private capital (Benos). Following this logic, unproductive expenditures have no effect on the steady-state growth rate.

Furthermore, as mentioned above the growth effect of public expenditures depends on its implicit financing element. Barro's (1990) model foresees a positive effect on growth rates if productive expenditures are financed by non-distortionary taxes. On the other hand, if productive expenditures are financed by distortionary taxes the growth effect is conditioned by the government size. If the size of the government is small, productive expenditures are expected to produce a positive effect on growth. Nevertheless, a negative impact is anticipated for a large government, even if the expenditures are considered to be productive. At relatively high levels of taxation, the distortionary effects of taxes would dominate. The main predictions of this simple endogenous growth model are summarized in Table 1.

Formally, the model includes a simple economy of n producers of output (y). The production function is a standard Cobb-Douglas, and everyone produces the same product according to the following equation:

$$y = Ak^{1-\propto}g^{\propto} \quad (1)$$

Table 1. Predicted Long-Run Growth Effects of Fiscal Policy in the Barro Model (1990)

		Financing Element	
		Taxes	
		Distortionary	Non-distortionary
Public Expenditure	Productive	Positive (Negative) at low (high) government size	Positive
	Unproductive	Negative	Zero

Source: Gemmell and Au (2013).

The private capital is represented by *k,* and *g* accounts for the public capital which is the share of government spending considered to be productive. The government raises its income with two types of taxes, an output tax τ which is both proportional and distortionary, and a lump-sum tax which is non-distortionary *L*. Public expenditures pay for some services that enter directly into the representative individual utility function. In this sense, the spending side of the budget is composed of both productive (*g*) and unproductive (*C*) expenses. The budget is not balanced in each period; thus, an adjustment element (*b*) is included to account for the public deficits and surpluses.

$$ng + C + b = L + \tau ny \quad (2)$$

The long-run growth rate of this model, as Barro and Sala-I-Martin (1992) proved in the case of a isoelastic utility function, is the following:

$$\varphi = \lambda(1-\tau)(1-\alpha)A^{1/(1-\alpha)}(g/y)^{\alpha/(1-\alpha)} - \mu \quad (3)$$

Theoretically, μ and λ represent constants in the utility function. Further, in the current setting a government expenditure increase in public capital (*g*) enters positively in (3), which drives an increase in the growth rate.

Kneller *et al.*(1999) proposed an empirical approach to test this model. Mainly, they argue that a common empirical specification issue is the incomplete specification of the government budget, which leads to systemic parameters biases. This comes from the fact that the government budget is a closed system; thus, any budget items omitted in the estimating equation become the implicit financing component of those elements included in the budget (Gemmell *et al.*, 2013). Kneller *et al.* (1999) demonstrated that partial studies, those that only include one side of government budget constraint, produced biased parameter estimates, given the nature of government budget as a closed system. In this case, the included elements absorb the effect of omitted elements. The proposed way to correct this issue is by including both expenditures and revenues of the budget constraint in the empirical specification, as in the theoretical model.

In addition, it is advised to omit from the regression those elements that theory suggests have null growth effects. Eliminating non-null components of the government

budget constraint could significantly affect the interpretation of regression parameters in a growth analysis, and this holds for both revenue or expenditure elements. In other words, it is key to recognise that estimated coefficients are impacted by implicit and explicit financing elements of the budget constraint. First of all, let φ_{it} represent the growth rate of real GDP per capita in country *i* at time *t* (an endogenous variable). The national economic growth rate is affected by two types of elements, fiscal and non-fiscal variables. For exogenous variables, let X_{it} represent all fiscal variables, and Y_{it} all non-fiscal variables in the following equation:

$$\varphi_{it} = \alpha + \sum_{h=1}^{k} \beta_i Y_{it}^h + \sum_{j=1}^{m} \gamma_j X_{it}^j + u_{it}, \quad (4)$$

where *k* indexes the vector of non-fiscal variables and *m* the vector of fiscal variables.

Moreover, every element of the budget constraint is required to be accounted for (expenditures, revenues, and deficits and surpluses). Hence, it could be implied that the following fiscal identity holds:

$$\sum_{j=1}^{m} X_{it}^j = 0, \quad (5)$$

In practical econometrics, adding all the budget elements to the regression equation would imply perfect collinearity.[2] For that reason, one element of the budget constraint must be omitted. Theoretically, it is assumed that the financing element is the omitted one; hence, equation (4) must be modified as follows:

$$\varphi_{it} = \alpha + \sum_{h=1}^{k} \beta_i Y_{it}^h + \sum_{j=1}^{m-1} \gamma_j X_{it}^j + \gamma_m X_{it}^m + u_{it} \quad (6)$$

[2] Perfect collinearity or multicollinearity happens when two or more independent variables in a regression model are highly correlated, and one element could be easily predicted from the others.

Further, equation (5) can also be re-expressed as:

$$X_{it}^{m} = -\sum_{j=1}^{m-1} X_{it}^{j} . \quad (7)$$

Equation (5) indicates that the sum of all revenues and expenditures equal zero. Therefore, any element in the budget constraint can be re-expressed in terms of remaining components, as equation (7) shows.

Further, in order to avoid multicollinearity, equation (7) is substituted into equation (6), and the resulting equation is the equation of interest:

$$\varphi_{it} = \alpha + \sum_{h=1}^{k} \beta_i Y_{it}^{h} + \sum_{j=1}^{m-1} (\gamma_j - \gamma_m) X_{it}^{j} + u_{it}. \quad (8)$$

Kneller *et al.*(1999) remark that the coefficient of X_{jt} needs to be interpreted as $(\gamma_j - \gamma_m)$ instead of γ_j. Moreover, Bleaney et al. (2001) note that "the correct intepretation of the coefficient on each element of the government budget is as the effect of a unit change in the relevant variable *offset by a unit change in the element omitted from the regression (or some mix of the omitted elements, if there is more than one)." Page 40.*

As Kneller *et al.* (1999) suggest, precise estimates of the fiscal variables require in this context a regression spefication process with sequential phases. First, for an initial regression, it is necessary to exclude from the budget one element that theory suggests has an insignificant effect on growth, either an unproductive expenditure element or a non-distortionary tax. Formally, this implies that $\gamma_j = 0$ for that specific element. Second, the coeficient of another element that theory suggests is neutral

should be tested (e.g., an expense if in the first case a revenue is chosen, and vice versa). Third, if the neutrality hypothesis is not rejected, the next step requires doing a regression excluding both elements. The last regression of this process allows for more precise estimates, given that the implicit financing elements are taken into account.

Metodology

Testing the model's theoretical prediction for Latin American countries required a panel data approach. The model allows assessing the effect of government expenditure on economic growth in Latin America. Economic growth in this particular model is assumed to be driven by two types of variables: fiscal and non-fiscal variables. Non-fiscal variables account for the control set in the model, but they are also growth determinants, although their role under the current analysis is secondary. Special interest is paid to the effect of fiscal variables and their effect on long run economic growth.

As the seminal endogenous growth paper of Barro (1990) prescribes, the government budget fiscal variables have to be, in practice, aggregated into their theoretical classification. The main categories contain expenditures as productive or unproductive, and revenues as distortionary and non-distortionary. The other two categories are unproductive expenditures and other revenues for the government. The last fiscal variable in the model corresponds to the government deficit. A detailed exposure of this classification used for this analysis can be found in table 2. First, government policy is assumed to be exogenous, as in practice its effects are easier to assess under this assumption (Barro, 1990). Further, the tax classification follows the

work of Kneller *et al.* (1999), while the expenditure classification borrows from the latter and Muinelo-Gallo and Roca-Sagalés (2011) and Devarajan *et al.* (1996) due to data availability. Thus, the variables are aggregated from their funtional to their theoretical classification.

The choice of theoretical classification is far from being a concensus in economics, but the approach of Barro (1990) is the main reference of this paper. In general, taxes increase the transactions costs and create some sort of behavioural or monetary distortion for both consumers and firms. The debate about the theoretical classification is beyond this paper's scope. Hence, this paper builds on what other authors have previously outlined on this subject, even if other positions in terms of the fiscal classification for the endogenous growth model exist. For instance, Benos (2009) argues that if theory is roughly clear about tax classification, it is less so about government spending. Given this argument, Benos (2009) does not impose any categorization on the government spending data in his models, and the author allows the estimation to classify spending according to its impact.

On the other hand, Kneller *et al.* (1999) treat income and capital taxes as distortionary, since they reduce investment returns. Although in theory taxes on consumption goods may have an effect on the work-leisure decision, they do not disturb investment choices (Kneller *et al.*, 1999). Thus, they are classified as non-distortionary taxes. All those elements that do not fall into any of these categories are classified as other revenues, which is shown on Table 2. As stated above, the tax classification for this analysis follows the latter approach.

Equally important, expenditures are organised and aggregated according to their contribution to increasing capital by Kneller *et al.* (1999). Expenditures that augment capital formation are treated as productive expenditures and vice versa. In addition to the activities that directly enter the production function, Barro (1990) considers that productive government spending should include all resources devoted to property rights enforcement (e.g., military spending, property protection, etc.). A priori, it is only expected that productive expenditures would have a positive impact on economic growth, but this is not the case for unproductive spending. Public expenditures that do not fall into these categories are added together in the other expenditures variable. As displayed on Table 2, the current analysis uses the expenditure treatment advanced by Muinelo-Gallo and Roca-Sagalés (2011) and Devarajan *et al.* (1996) due to data availability.

Further, two sets of control variables are used to test the model under different perspectives. The pragmatic rationale for the inclusion of control variables sets is that they reduce the specification error bias. On the theoretical side, economic growth is not only driven by fiscal expenditure, but also by many other factors. Following the traditional model of Kneller *et al.* (1999), or model 1 in this case, the initial GDP per capita, investment ratio and labour force growth are included in the first set of control variables. The second set of control varibles is an extention of the traditional model and it differs by including the rule of law index (proxy for property protection) and the human capital index (a proxy for the human capital in each country). Both indexes are expected to have a positive impact on growth.

In equation (8), u_{it} represents the error term, which includes the effects of the omitted variables. This econometric analysis assumes that the omitted variables are independent of the endogenous fiscal and non-fiscal variables, and they are independently identically distributed. Equally, the error term in each period is assumed to be uncorrelated with the independent variables under the OLS and panel approaches. Miller and Russek (1997) identify that omitted variables in a panel regression fit into three types: country-varying time-invariant, time-varying country-invariant, and country and time varying variables.

According to the proposed methodology of Kneller *et al.* (1999), five different forms of the regression were considered for each model: pooled OLS, one-way fixed country effects (dummies) by OLS, one-way random country effects (dummies) by GLS, and two-way country and time fixed and random effects. Nevertheless, the estimation of equation (8) using the Ordinary Least Square (OLS) method disregarding either country fixed effects or time fixed effects leads to serious practical and interpretation mistakes (Miller and Russek, 1997). Not surprisingly, the issue arises as the unobservable country or time specific variables correlate with the explanatory variables. In general, many country specific elements might influence per capita growth, and so a simple pooled regression could bias the coefficient estimates (Devarajan *et al.*, 1996). For this reason, although the regression with pooled OLS was explored, its results are not analysed but only reported in the annex, as they could lead to inaccurate interpretations of the results.

Table 2. Theoretical aggregates of Fiscal Policy.

Theoretical Classification	Functional Classification
Distortionary Taxation	Taxes on income, profits and capital gains
	Taxes on property
	Social contributions
Non-Distortionary Taxation	General taxes on goods and services
	Taxes on specific goods and services
Other Revenues	Taxes on international trade and transactions
	Other taxes
	Non-tax revenue
	Capital revenue
	Grants
Productive Expenditures	Acquisition of fixed capital assets
	Capital transfers
Unproductive Expenditures	Wages and salaries
	Purchases of goods and services
	Interest payments
	Subsidies and other current transfers
Other Expenditures	Other expenditures
Government Surplus/Deficit	Total Revenues minus total outlays

Even if, initially, this study emulated the work of Kneller *et al.* (1999) in creating a series of regressions, the main results are based on an equation that includes country and time fixed effects (or dummies) to control for heterogeneity and time effects. The second approach, where robusteness is checked, includes a series of new control variables (human capital, rule of the law) which are traditionally set as common growth determinants. The first pooled OLS model is discarded given that not doing so could lead to errouneous results. Also, not including either fixed or random effects no longer allows for the possibility to control for cross-country heterogeneity and period specific factors. Differences in the preliminary level of efficiency are often reflected in the unobserved country specific effects, while productivity changes for countries are accounted for by the period specific effects (Muinelo-Gallo and Roca-Sagalés, 2011).

Special emphasis is placed on equations with fixed effects. Three criteria were used to select the best model: the *Hausman test*, the log-likehood function and the adjusted R^2. *Hausman test* rejects the null hypothesis of no correlation between the error term and individual fixed effects, providing empirical evidence in favor of the fixed effects models.[3] The empircal results are based on the regressions with highest adjusted R^2 and log-likehood function. Hence, the model selection and specification are based on both theoretical and statistical arguments.

As described above, two explanatory variables have to be removed from equation (8) where theory indicates a null effect on growth. The empirical testing helped identify whether these variables are neutral according to the theoretical assumptions. Finding evidence of neutrality allows one to legitimately removing the

[3] Chi-square statistic calculated for the Hausman test was 21.8 and probability of 0.005.

variables. Namely, the non-distortionary taxation variable (on the income side) and the unproductive spending variable (on the expenditure side) are compared against each other as previously mentioned. First, one is removed from equation (8) to test the statistical significance of the other variable. By switching variables the same examination is performed. If evidence that they nullify each other is found, then both null variables are discarded from the equation. The growth regression is run a third time, and this equation casts the sign and impact effects, as prescribed by the methodology. Therefore, the remaining parameters of included fiscal variables could be interpreted as the *ceteris paribus* impact of the included fiscal variables.

Finally, the results from these equations are then compared to previous panel data studies for result assessment. Caution is suggested since the comparison mainly implies a set of studies for OECD countries against a set of developing countries in the light of the current endogenous growth model. Although some similarities are expected in the results, the analysis might provide new evidence proper to developing countries, provided that fiscal policy effects are somehow divergent between developed and developing country growth regressions (Miller and Russek, 1997).

Data Description

The main data set used in the present study comes from the Economic Commission for Latin America and the Caribbean (ECLAC) statistical database. The data set of fiscal variables, for the period 1990-2010, covers 19 Latin American countries.[4] The data for government, employment and income growth come from the

[4] The complete list of countries is located in the Appendix A.

Government Finance Statistics, Government Operations of the ECLAC's Economic Indicators and Statistics data base. The investment ratios and Human Capital Index per capita come from Penn World Table, International Comparisons of Production.[5] The rule of law comes from the Worldwide Governance Indicators (WGI).[6] The original data sets contain annual information.

The original data is classified according to their functional classification. Table 2 shows the original functional classification. Some statistical treatments are fundamental to ensure a comparable analysis. Following Kneller *et al.* (1999) and according to the common practice, functional variables were added together according to the theoretical classification. Also, the data have been transformed to discard business cycle effects. Annual series from the explanatory variables are transformed into five-year averages for each variable to build new data panels for each country and help to focus on the structural relationship of interest and compensate for limited data availability. Fiscal figures are expressed as the ratio of the value of the variable and GDP, except where stated. The pragmatic advantages of this transformation are that it allows for a straight comparison of results and extension of the empirical evidence. The economic logic of this transformation is to capture the long-run effects by eliminating the short-run effects of fiscal policy. Further, the growth rate (dependent variable) is calculated in two steps: first, five-year averages of annual series of per capita GDP were taken; second, the

[5] It is based on years of schooling (Barro and Lee, 2012) and returns to education (Psacharopoulos, 1994).
[6] This is a dataset summarizing the views on the quality of governance provided by a large number of enterprise, citizen and expert survey respondents in industrial and developing countries.

dependent variable is calculated as the log-difference between *t* and *t-1* for each country.[7]

Table 3 presents key statistical information from the data set. The time span is not consistent for all countries; for instance, the fiscal information for Brazil and Cuba is only available from 1995 to 2010. For all countries, fiscal information comes from central government data bases compilation, except for Bolivia where it comes from the general government due to data availability, given its political and government organization. From the country sample, it can be observed that in 20 years the region grew annually on average of 2.2% per capita. During the 1990s, the region experienced a slower per capita growth pace of around 1.7% per annum, while in the 2000s, the average economic growth was characterized by an annual increase of 2.6%.

Thinking of Latin America as a homogeneous economic region may be misleading. The region includes growth champions such as Chile (3.8%) and Panama (3.7%), and countries that barely increased the average income of their citizens in twenty years such as Paraguay (0.8%) and Venezuela (0.95). In terms of fiscal variables, even if, on average, the region levies more duties in the form of non-distortionary taxes, the major expenditure accounts for the non-productive category. In Latin America, the average country collects a higher percentage of revenue from non-distortionary taxes than any other source. Non-distortionary taxation represents 6.8 %, while the average distortionary taxation only accounts for 5.7 % of GDP.

[7] First: $T_t = (t_1 + \cdots + t_5)/5$. Second: $\varphi_t = \log(T_t) - \log(T_{t-1})$

On the other hand, according to the current categorization, the average non-productive expenditure is 4 times greater than the average productive expenditure in the region. The data indicates that running deficits in the region is the rule instead of the exception. However running continuous surpluses for two decades, Chile is the exception within this set of countries. In addition to this, the region data set has significant variation for emerging economies in terms of GDP per capita. In 2010, eight of the 19 countries had a GDP per capita above $ 5,000 USD, which represents a middle income by international standards. The range of the rest of the region is in the vicinity of low-income countries. Further, in a region where population is close to 530 million, Latin America's workforce increased at a 2.74 % average over the last two decades.

Table 3. Summary of Descriptive statistics

Variable	Mean	Standard Deviation	Min	(Country)	Max	(Country)
GDP P.C. Growth (% P.A.)	2.17	2.12	-7.36	Cuba	6.80	Chile
Labor Force P.C. Growth (% P.A.)	2.74	0.89	0.13	Cuba	4.51	Ecuador
Investment Ratio	18.98	3.62	8.91	Cuba	27.33	Honduras
INITIAL P.C. GDP(2005 US DOLLARS)	3313.64	1732.42	846.17	Bolivia	7805.94	Mexico
Deficit/Surplus	-1.73	1.62	-6.37	Bolivia	2.92	Chile
Distortionary Taxation	5.60	2.69	2.41	Uruguay	15.90	Brazil
Non-Distortionary Taxation	6.83	3.07	2.33	Venezuela	18.44	Cuba
Other Revenues	4.96	3.89	0.01	Colombia	24.11	Costa Rica
Productive Expenditure	3.38	2.08	0.06	Brazil	10.99	Argentina
Non-Productive Expenditure	14.29	3.61	6.08	Dom. Rep.	22.49	Uruguay
Other Expenditures	1.22	3.12	0.00	Uruguay	19.76	Cuba

Note. Quantities are expressed as percentage of GDP, except where stated.

Empirical Results

This section introduces the estimations of the endogenous growth model specifications. The empirical analysis focuses on the links between various fiscal components and economic growth in Latin America. Table 4 summarizes the results of the study, which starts from the principle that by including a full specification of the government budget constraint in the growth regression, the effects of fiscal components on economic growth can be assessed.

Column 1 does not include non-distortionary taxation, which is in this case the implicit financing element. The second column uses the non-productive expenditure variable as the financing element, which is also omitted in this specification. Respecting the assumption of the Barro (1990) model and Kneller *et al.* (1999) methodology, these variables have an insignificant and similar coefficient. These results entail that the hypothesis of a zero coefficient is not rejected by the data. Hence, the third column excludes both variables from the regression. The interpretation of the results is drawn from this column. Finally, the interpretation of fiscal parameter has to be done with caution, provided that neutral growth elements from the budget constraint are omitted, this implies an almost net growth effect of included variables on long term economic growth (Gemmell *et al.*, 2013).

Non fiscal policy variables (control variables)

First, the results concerning control variables are discussed. The results from the growth regression reveal that the initial GDP per capita has a significant negative coefficient. This result is a sign of conditional convergence of the growth rates over the period of study in the region.[8] The magnitude of the coefficient estimates are smaller than those reported by Kneller *et al.* (1999), which implies that the region is closer to a steady state, than the set of developed countries used by the authors, under the given production capacity. Yet, the latter also supports the initial assumption about a decidedly heterogeneous economic region. A negative sign is also consistent with the results from Barro (1990), Kneller *et al.* (1999), Muinelo-Gallo and Roca-Sagalés (2011)

[8] *"Conditional convergence applies when the growth rate of an economy is positively related to the distance between the economy's level of income and its own steady state"* (Barro and Sala-i-Martin, 2004). In other words, the growth rate of each economy declines as it approaches its own steady state.

and Benos (2009). For the investment ratio, Kneller *et al.* (1999) find an implausibly negative and non significant coefficient, whereas the results display an equally negative and significant coefficient. However, investment ratio, which is a control variable and a productive element (growth enabler), might turn out to be unproductive if there is excess of it (Devarajan *et al*., 1996). Further in the model regression, the country and time dummies are collectively significant, possibly hintting that the variable may be absorbing the effect of omitted non-fiscal variables.[9] On the other hand, Miller and Russek (1997), Benos (2009), and Levine and Renelt (1992) find a postively significant coefficient for investment. In priciple investment is expected to be productive, yet too much of it may not necessarily produce the expected results, especially if it exceeds the relative capacity of a economy in development.

Futher, labour force growth has consistently a negative but insignificant coefficient for growth. This result matches the finding of Miller and Russek (1997). When real output growth aligns at less than one-to-one with the labor force growth, a negative sign for the coefficient is common across empirical studies (Miller and Russek, 1997). This is to say that if the number of people available in the labour force grows at a faster pace than the economy, the relationship between this element is therefore negative. Essentially, this is the case for this set of countries, as it can be observed on Table 3.

The fiscal policy variables

[9] The F-statistic to test time and country dummies is 4.9.

Yet, the key elements of interest are the fiscal components and their impact on economic growth for this set of countries. The signs of the coefficients of budget elements in Table 4 are, overall, theoretically consistent. First, the productive expenditure variable has a positive significant coefficient (0.51). This empirical result reinforces the notion that public investment, captured by the productive variable under the current definition, can be considered to be a productive spending that contributes to long term growth. In other words, the expenditure increase of one percentage point of GDP on productive expenditures would produce an increase the growth rate by 0.51 percentage points. The latter result is comparable with the findings of Muinelo-Gallo and Roca-Sagalés (2011). Futher, the coefficient of other expenditures variable is also positive, statistically significant (0.66), and somewhat larger that the coefficient of productive expenditure. Both results match the findings of Kneller *et al.* (1999) and Bleaney *et al*.(2001) who also report that what seems to be a strong effect, which is diminished under an annual based panel analysis. The larger magnitudes found for Latin America may be signaling a more important place for governments spending than in the developed world. However, the effect of productive expenditures differs from the finding of Devarajan *et al.* (1996), who found that for a pool of developing countries productive expenditures have a negative or insignificant effect on growth.

Table 4. Regression Results

Estimation technique: 5-year averages, two-way fixed effects Dependent Variable: per capita growth, 1990-2010			
Omitted fiscal variable:	Non-distortionary taxation	Non-productive expenditure	Non-distortionary taxation and non-productive expenditure
Initial GDP p.c.	-0.001*	-0.001*	-0.001*
	(0.0001)	(0.0001)	(0.0001)
Investment ratio	-0.36*	-0.35*	-0.35*
	(0.07)	(0.07)	(0.07)
Labor force growth	0.03	-0.08	-0.01
	(0.31)	(0.34)	(0.32)
Deficit/Surplus	-0.06	0.23	0.19
	(0.25)	(0.15)	(0.14)
Other revenues	-0.16	-0.40*	-0.31*
	(0.21)	(0.14)	(0.13)
Distortionary taxation	0.18	-0.11	-0.05
	(0.33)	(0.25)	(0.24)
Non-distortionary taxation		-0.29	
		(0.24)	
Other expenditures	0.50**	0.70*	0.66*
	(0.29)	(0.24)	(0.23)
Productive expenditure	0.32	0.60*	0.51*
	(0.27)	(0.21)	(0.20)
Non-productive expenditure	-0.26		
	(0.24)		
Adjusted R^2	0.661	0.664	0.666
No. of observations	74	74	74
Log-likehood	-62.6	-62.5	-63.3

Note: Standard Errors are in parentheses. Data are from the Government Finance Statistics, Government Operations of the ECLAC's Economic Indicators and Statistics. The definitions of variables are provided on Table 2. Observation are 5-year averages from 1990-2010. Each regression also includes time and country fixed effects (dummies). * denotes significance at 5%, and ** at 10%.

Distortionary taxes negatively affect growth but not in a significant way (-0.05), while other government revenues that include other types of levies do decrease growth

rates in a significant manner (-0.31). This means that the increase of other revenues in a percentage point of GDP reduces the growth rate by .31 percent. Both signs are theoretically consistent, while they display unexpected effect magnitudes, as distortionary taxes slightly deter growth and other revenues strongly discourage it. Yet this result might be plausible, if it is considered that Latin American governments encounter difficulties to broaden the tax base in the formal economy. Thus, increasing distortionary taxes might not necessarely affect growth, if a significant segment of the economic agents are not affected by this policy, under a strong informal economy context. On the other hand, other revenues include the taxes on international trade and transanctions and capital revenus, which are a significant source of money for governemnts in the region. Again, a difference was found between the magnitudes of coefficient estimates reported by Kneller *et al.* (1999) and the current analysis. These differences support the idea that public policy has to be targetted and based on regional reallities, since different policy recommendations could be drawn based on these two analysis for two distinct economic regions.

Finally another appealing result is the the budget surplus variable which has a insignificant positive coefficient in the regression (0.19). Kneller *et al.* (1999) report a similar result, and argue that the expected return on public current investment increased since future productive expenditure or distortionary tax cuts will be financed by anticipated deficits. Mainly, they argue that a theoretically consistent result is expected to have a positive empirical coefficient, even under the Ricardian equivalence assumption. Yet, under the current methodology, the deficit/surplus element is bounded

to finance neutral components of the government budget contraint (Bleaney *et al.*, 2001).

Robustness Testing

In this section the robustness of the results presented above is tested by introducing alternative changes to the model specification. First, following the approach undertaken by Kneller *et al.* (1999), the initial GDP is omitted from the regression to determine if the coefficients are sensitive to this specification change. Second, two new variables are included individually in the set of non-fiscal components: human capital and rule of law. This allows testing for the sensitivity of results to the choice of non-fiscal variables. The new variables are traditionally considered to have a significant effect on long term growth, and so their inclusion might have an impact on the regression results.

Table 5 (Annex B) presents the regression equation under these three scenarios. First, without Initial GDP p.c. the coefficients for all fiscal variables are similar to those displayed on Table 4. The significance of the coefficient of fiscal variables still holds with this new specification, yet not so for all remaining elements. The latter findings signal that the growth regression might not be sensitive to specification changes under this scenario, yet the explanatory power of the regression is not the same. Second, the human capital variable is not significant for economic growth. In fact, the inclusion of human capital makes the equation collapse, and the results no longer match those from table 4. Third, the rule of law coefficient is not significant for growth in the equation although it display an expected positive sign.

The remaining coefficients of the regression are barely affected in significance and sign. In the light of these results, the model provides robust results in two out of the three proposed changes, which is a strongly convincing outcome but not definitive.

In general, the coefficients obtained in the regression are both theoretically and empirically consistent. The model fits the data from Latin America, and overall it matches the results reported by other growth research. The main results signal that what has been classified as government productive expenditure has indeed a positive effect on economic growth in the region. This outcome intrinsically provides supporting evidence for the endogenous growth model of Barro (1990). Other sources of revenue have also a significant negative impact on growth. On the other hand, the result concerning distortionary taxation is not significant, as it would be expected to diminish growth appreciably. Nevertheless, this result should not be interpreted as a limitation since it coud in fact be reflecting a regional reality, given that under the current context of the informal economy, taxation could barely have an effect on growth.

Conclusions

The analysis started by asking whether fiscal policy had a significant implication for economic growth in Latin America. The theoretical framework was based on the endogenous growth model developed by Barro (1990), which allows government expenditures to enhance growth. The approach used to test the paper's hypothesis was based on the methodology developed by Kneller *et al.* (1999), which accentuates the role of a full budget constraint specification for growth studies to avoid biased estimates in growth analysis. The methodology helped establish an economic growth

model for the region, accounting for the full specification of the government budget constraint as prescribed to link the significance of fiscal policy components and economic growth.

The findings from the study have both theoretical and empirical implications. First, in theoretical terms, the analysis provides evidence that further supports the Barro (1990) endogenous growth model, given that some elements of the fiscal policy have a significant effect on growth. These findings match previous studies, especially those of Kneller *et al.* (1999). As the model predicts, government expenditures and revenues have a non-trivial influence on both the economic growth rate and output, and at the same time some are detrimental. Second, the model's results provide evidence of the significant positive effect of government expenditure on economic growth for a specific economic region: Latin America. Mainly, in the region productive expenditures and other expenditures variables have a significant positive effect, while the other revenues variable considerably diminishes economic growth. The findings suggest that a shift in the composition of public expenditure and revenue could lead to higher long term growth rates in the region.

For Latin America sluggish growth continues to be a risk in the region, which in the long term implies leaving millions of citizens behind. Latin American governments alone cannot account as the main economic growth drivers, yet they could enhance growth with a favorable economic environment, with specific growth policies. In countries where economic reforms have provided scarce results in terms of economic growth (Rojas-Suarez), the findings represent a plausible alternative answer to the growth question in Latin America. It is not necessarily true that expending more in the

same fashion would produce a different outcomes for growth, yet spending better could help attain a given growth objective.

It is clear from the evidence that governments could positively influence growth rates, as the Barro (1990) endogenous growth model predicts, and they could do so by reallocating their expenditures. This means that Latin American economies could draw a larger long term benefit from expenditure reallocation towards more productive spending, which the evidence shows to have a non-trivial effect on growth, thus increasing their economic growth. More economic growth would imply, to some extent, poverty relief and life improvement for citizens, this being the principal aim of the economic policy.

Definitely, there is no one size fits all policy advice for such a diverse political and economic region. Even if the empirical evidence is compelling and the signs of the different fiscal policy elements match the theory and what other authors have found, the impact size continues to be imprecise. Yet, the critical effect of fiscal variables on growth for Latin America was established in this study. Thus, a strategic approach with a set of policies adaptable for each particular case, including expenditure and tax reallocation, would be a more sensible way of enhancing economic growth in the region.

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Annex

Annex A

List of countries:

Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay, and Venezuela (Bolivarian Republic of).

Annex B

Table 5. Different regression specification for robustness testing.

Estimation technique: 5-year averages, two way fixed effects Dependent Variable: per capita growth			
	Model 2	Model 3	Model 4
Initial GDP p.c.	-0.002*	-0.002*	
	(0.0004)	(0.0004)	
Investment ratio	-0.11*	-0.34*	-0.40*
	(0.05)	(0.07)	(0.06)
Labor force growth	-0.36	0.05	0.24
	(0.38)	(0.35)	(0.41)
Deficit/Surplus	0.20**	0.18	0.12
	(0.12)	(0.14)	(0.14)
Other revenues	-0.11	-0.29*	-0.34*
	(0.14)	(0.12)	(0.12)
Distortionary taxation	-0.01	-0.01	0.02
	(0.18)	(0.25)	(0.24)
Non-distortionary taxation			
Other expenditures	0.29	0.59*	0.50*
	(0.47)	(0.24)	(0.22)
Productive expenditure	-0.09	0.52*	0.57*
	(0.16)	(0.20)	(0.18)
Non-productive expenditure			
Human Capital	-4.31		
	(3.11)		
Rule of law		0.45	
		(0.98)	
Adjusted R^2	0.50	0.65	0.61
No. of observations	74	74	74

Note: Standard Errors are in parentheses. Data are from the Government Finance Statistics, Government Operations of the ECLAC's Economic Indicators and Statistics. The definition of variables is displayed on Table 2. Observation are 5-year averages from 1990-2010. Each regression also includes time and country fixed effects (dummies). * denotes significance at 5%, and ** at 10%.