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INEQUALITY, AID AND GROWTH: MACROECONOMIC IMPACT OF AID GRANTS AND LOANS IN LATIN AMERICA AND THE CARIBBEAN

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Aid effectiveness in Latin America and the Caribbean (LAC) has been little studied, despite the fact that it is the developing region receiving foreign aid with the highest per capita income and inequality levels. This paper uses a growth regression model to analyze the impact of Official Development Assistance (ODA) in LAC. We evaluate ODA effectiveness in relation to the growth rate of an 'inequality-adjusted GDP per capita' in order to precisely define the desired impact of aid in a region with high levels of inequality. The estimation produces three main results: aid is effective, in aggregated terms, once we deal with the effect of income inequalities; the impact of concessional loans seems to be greater than the impact of grants; and, aid may be more effective in less corrupt countries.

JEL classification codes: F35, O19, I30, C5
Key words: aid effectiveness, Latin America and the Caribbean (LAC), economic growth, inequality, aid grants, concessional loans, Official Development Assistance (ODA)

I. Introduction

Economic research has paid significant attention to the connection between foreign aid for development and economic growth. Since the 1960s several development economists, starting with Paul Rosenstein-Rodan and Hollis Chenery, have claimed that the effectiveness of public international development policies — so-

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called Official Development Assistance, ODA — should be evaluated in terms of the stimulus finally exerted on the developing countries' growth rate of per capita income. Nevertheless, after more than 50 years of research it is still debatable to conclude that ODA stimulates growth in aggregate terms. In contrast with previous studies, this paper deals with three issues that have been insufficiently considered in the aid effectiveness literature:

Firstly, the majority of aid-effectiveness studies have analyzed the whole group of developing countries, paying limited attention to the analysis of regional experiences. Specifically, aid impact in Latin America and the Caribbean (LAC) — the developing region with the highest per capita income, but also with the highest inequality levels among those which receive aid — has been little studied, and it has only been pointed out that this region is an outlier in the general models of aid effectiveness.[1]

Secondly, preceding studies have analyzed the impact of aid on recipient countries' GDP per capita growth rate. However, this method involves a 'target problem', which has not been previously considered in the literature: it is not possible to distinguish if aid benefits the income growth of the relatively richer or poorer citizens, precisely when the latter citizens are, indeed, the target population of aid policies.[2] In this context, the intra-national distribution of foreign aid should help to reduce income inequalities. This is the reason why we evaluate aid-effectiveness in terms of the growth rate of the GDP per capita for the population with lower incomes, which we call the 'inequality-adjusted GDP per capita'.

Thirdly, previous studies have analyzed the aggregate ODA impact, thus neglecting the fact that different aid modalities may have dissimilar impacts on growth. In contrast, we disaggregate into ODA grants and ODA loans, and analyze the financial characteristics and productive incentives that may affect their potential impact on growth.

All in all, this article aims to analyze the impacts of ODA grants and loans on the inequality-adjusted rate of growth of LAC countries' income per capita during

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[1] In practice, numerous studies include regional dummies (frequently LAC and Sub-Saharan Africa) as a control for their lack of fit to the general model (such as Lensink and White 2001; Kosack 2002; Burnside and Dollar 2004; and Ekanayake and Chatrna 2010). Few studies have run regressions for the restricted sample of LAC countries (e.g., Griffin and Enos 1970; and Campbell 1999).

[2] This distinction is particularly relevant for LAC countries, which register the highest levels of inequality among developing countries. According to the World Bank's (2005) *World Development Report on Equity and Development*, LAC's Gini coefficient was estimated to be around 53, well above the coefficients of Sub-Saharan Africa (45), East Asia and the Pacific (39), North Africa and the Middle East (39), South Asia (39), and Europe and Central Asia (34).

the period 1992–2007. The second section briefly reviews the recent economic literature on aid effectiveness. The third section proposes an analytical model of aid impact on growth, adapted to the peculiarities of the American region, and based on growth theory. The fourth section presents the results obtained from the estimation of the ODA's impact model. The last section summarizes the main conclusions of this piece of research and suggests some economic policies that may increase the effectiveness of aid disbursed to LAC.

II. Recent studies on aggregate aid effectiveness

Aid impact on growth has been studied since the 1960s, generating, by 2013, a prolific literature.[3] These empirical analyses have used different growth models in order to answer the question of whether aid promotes growth. Aid effectiveness falls within the broader debate of the forces that promote growth, understanding that aid may contribute, among other factors, to the economic progress of the developing world. Provided that none of the theoretical models proposed to-date perfectly explains the process of economic growth, the theoretical foundation of the aid-growth connection is still debatable.

The most recent generation of research has produced relevant progress both in the definition of the theoretical and empirical frameworks. On one hand, most of the studies include the recent advances in growth theory. As an alternative to the models used in the first studies of aid effectiveness (Harrod-Domar model, Chenery-Strout two-gaps model, and Solow-Swan neoclassical model), modern endogenous growth equations are used, emphasizing a multiplicity of variables beyond physical capital, such as innovation, human capital, social capital, and institutions. Besides the direct impact of aid on growth, some studies have also considered that aid impact depends on recipient countries' circumstances, identifying non-linear relations between aid and growth.

On the other hand, econometric estimation is increasingly incorporating four notable advances: i) access to richer statistical information; ii) use of panel data; iii) consideration of the endogeneity of aid (and of other explanatory variables); and iv) modeling of non-linear aid-growth relations (due to aid decreasing marginal returns and conditional relations between aid and other explanatory variables).

[3] See, among others, the recent reviews of McGillivray et al. (2006) and Tezanos (2010), and the meta-analysis carried out by Doucouliagos and Paldam (2008).

The procedure for estimating the growth equation emulates that developed by Barro's studies on growth factors, in which theory suggests the explanatory variables, but the selection is to a great extent determined by information availability.[4] The estimated models have the following general expression:

$$G_{i,t} = \alpha_1 + \alpha_2 \log y_{i,t_0} + \beta_1 A_{i,t} + \beta_2 A_{i,t}^2 + \sum_{l=1}^{L} \gamma_l R_{i,t} + \prod_{\substack{k=1 \\ l=1}}^{K,L} \phi_{k,l} R_{i,t} A_{i,t} + \sum_{k=1}^{K} \lambda_k X_{i,t} + u_{i,t} \quad , \qquad (1)$$

where $G_{i,t}$ is the GDP per capita growth rate of country i between years t_0 and t; $y_{i,t0}$ the initial GPD per capital; $A_{i,t}$ is aid (percentage of national income) in year t; $R_{i,t}$ is a vector of aid-conditioning variables; and $X_{i,t}$ is a vector of other growth explanatory variables.

This line of research was boosted by the studies carried out by Burnside and Dollar (2000 and 2004), who were pioneers in considering the existence of a series of circumstances, specific to each developing country, that determine the aid impact. Burnside and Dollar claimed that developing countries' growth depends positively on the quality of their economic policies, and not on the amount of aid received. Moreover, the interrelation between both variables (the interactive parameter ϕ in equation 1) revealed that aid was effective when there were sound policies, a result that was interpreted as an absolutely essential aid-effectiveness condition. Nevertheless, Burnside and Dollar's thesis on sound policies has been strongly criticized.[5]

The most recent aid-effectiveness studies continue to test the existence of different aid impact determinants, not all of them in relation to the recipients' characteristics, but also in relation to the donors' managing procedures. On one hand, these studies suggest — still tentatively — that aid may be especially effective in four circumstances related to the characteristics of the recipient economies: 1) when countries have sound institutions, in a broad sense: rule of law and respect for civil and political rights (Burnside and Dollar 2004); stability of the political system (Chauvet and Guillaumont 2004); democracy (Svensson 1999; Kosack 2002); and government effectiveness and control of corruption (Tezanos et al. 2009); 2) when countries suffer from adverse shocks, such as climate (Guillaumont and Chauvet 2001) and trade shocks (Chauvet and Guillaumont 2004; Collier and

[4] See, for example, Barro (1991). In the case of the aid effectiveness literature it is not infrequent to find studies that estimate the equations without first discussing the theoretical foundation of the model.

[5] For example, the meta-analysis carried out by Doucouliagos and Paldam (2008) concludes that the aid-policies' interactive term is close to zero.

Goderis 2009);[6] 3) when countries suffer from structural disadvantages, such as their geographic location within the tropics (Dalgaard et al. 2004); and, 4) during post-conflict periods (Collier and Hoeffler 2004).

On the other hand, some studies point out that donors' managing procedures also determine the impact of aid on growth. Three detrimental procedures are, other things being equal: 1) aid volatility (Lensink and Morrissey 2000; Bulir and Hamann 2008; Hudson and Mosley 2008; Tezanos et al. 2009); 2) donors' insufficient coordination, which generates problems of 'aid-fragmentation' (Djankov et al. 2009: Tezanos et al. 2009); and, 3) the preponderance of foreign interest — not always in accord with development goals — in the geographical allocation of aid (Minoiu and Reddy 2010).

All in all, aid effectiveness studies do not offer an irrefutable conclusion, although only a few studies categorically claim that aid has been ineffective (for example, Boone 1996; Rajan and Subramanian 2008), the majority of the studies reveal a positive impact of aid on growth — either under certain circumstances, or with no determinants. To a certain extent, the lack of consensus stems from the existence of several factors that limit the evaluation of aid effectiveness. Seven relevant factors are (Tezanos 2010): 1) the endogenous nature of aid, which complicates the estimation and limits the validity of the results; 2) the fungibility of aid, which implies a certain capacity of discretional management for recipient countries; 3) the preponderance of donors' foreign interests in the geographical allocation of aid, which sometimes contradict the officially stated development goals (Tezanos 2008); 4) aid may generate adverse macroeconomic effects that counteract its positive impact on growth (for example, Dutch disease, absorption capacity problems, alteration of the recipient governments' fiscal incentives, or deterioration of the institutional quality); 5) the studies only test the observable impact of aid, but it is not possible to test the counterfactual situation to see what would have happened if aid had not been disbursed; 6) aid impact varies over time, thus it is necessary to analyze periods that are coherent with international political and economic circumstances; and, 7) estimations are not robust enough, to a large extent, because aid is not a critical factor for growth (for the majority of developing countries it accounts for a limited source of financing) and because aid flows are very heterogeneous and thus it is probable that different modalities — grants, loans, emergency aid, debt relief, technical assistance, and so forth — have different impacts on growth.

[6] Although these shocks negatively affect economic growth, in these contexts aid softens their adverse effects.

III. Aid macroeconomic effectiveness in LAC: model specification

We now set out an analytical model of the potential impact mechanisms of aid on inequality-adjusted growth, distinguishing between two main aid modalities: grants and concessional loans. The aim is to evaluate the macroeconomic impact of aid in LAC, and not to estimate a growth model for this region. However, in order to accurately capture the aid-growth relation it is necessary to draw a broader framework of growth, incorporating its main forces and limiting factors; otherwise, estimations will be biased due to the omission of relevant explanatory variables and due to the insufficient explanatory capacity of the model. Unlike other empirical works, we specifically analyze the case of LAC, understanding that more general approaches do not consider the peculiarities of each region's growth dynamics.

In this respect, although LAC countries have important differences, there are some common elements — apart from their cultural roots — that characterize the regional growth process. Three factors are especially important. First, high levels of inequality. Specifically interpersonal inequalities have created a 'development blockade' since the colonial period (Domínguez 2009), and they have tended to be accentuated during the 20th century, especially in the last three decades, as a consequence of greater integration in the world economy and the reduction of governments' participation in the economy (Ocampo 2004; Milanovic and Muñoz de Bustillo 2008). Second, informal institutions. The structural change in the real economy has modified the interaction mechanisms among economic agents, consolidating the informal institutions. These institutions are associated with problems of employment quality, negative externalities in terms of insecurity and conflicts, and a limited capacity of the state to drive the growth process. Third, interdependence. On one hand, external economic shocks (trade and financial) have generated balance of payments deficits that reveal the structural shortcomings of LAC economies, and limit the efforts to promote exports with greater value added (specially in terms of innovation and human capital) and overcome the dependence on natural resources. On the other hand, there are new challenges of environmental interdependence, especially in relation to the effects of climate change.

A. An analytical model of aid impact on growth

We run a growth regression model for analyzing the potential mechanisms of aid impact on LAC countries' economic growth. This model follows the pioneer ap-

proach of Barro (1991), which assumes that the rate of growth of per capita income, $G_{i,t}$, of country i, between years t_0 and t, depends on its initial per capita income, y_{i,t_0}, and a vector of explanatory variables, $X_{i,t}$, that determine the steady state according to the following equation:

$$G_{i,t} = \alpha_i + \beta y_{i,t_0} + \delta X_{i,t} + u_{i,t} \quad , \tag{2}$$

where α_i is the fixed effect of country i. The parameter β shows the existence of conditional convergence among LAC countries (the so-called β-convergence, provided that $\beta < 0$). The parameter δ indicates the joint effect of those factors that explain long term economic growth.

Obviously, the key element for the explanatory power of the model depends on the composition of the growth vector $X_{i,t}$, which — in order to capture the aid-growth relation — we define, for each i and t, as:

$$X_{i,t} = \delta_1 A^G_{i,t} + \delta_2 A^L_{i,t} + \delta_3 R_{i,t} A_{i,t} - \delta_4 D_{i,t} + \delta_5 Z_{i,t} + e_{i,t} \quad , \tag{3}$$

where $A^G_{i,t}$ and $A^L_{i,t}$ are the two main modalities of aid: grants and concessional loans, respectively (both expressed as a percentage of national income); $A_{i,t}$ is aggregate aid (percentage of national income); $R_{i,t}$ is a vector of variables related to the characteristics of the recipient economies that determine the aid impact; $D_{i,t}$ is a vector of variables related to the donors' managing procedures that determine the aid impact; $Z_{i,t}$ is a vector of other growth explanatory variables; and $e_{i,t}$ is the residual term. Consequently, the first four parameters of equation (3) explain the aid-growth relation: δ_1 captures the elasticity between aid grants and growth, δ_2 captures the elasticity between aid loans and growth, and δ_3 and δ_4 capture the potential aid impact factors on growth.

Therefore, the model does not assume equal growth impact coefficients of aid grants and aid loans (i.e., $\delta_1 \neq \delta_2$). On one hand, aid grants are financially more convenient for recipient economies as they do not generate external debt; however, the probability of investing these concessional resources into unproductive activities is higher, as they do not need to be refunded. On the other hand, aid loans generate debt, but they also exert a positive incentive to productively invest the resources in order to be able to meet the future repayment obligations. Specifically, the impact of aid grants will be positive ($\delta_1 > 0$) if their stimulus on growth compensates the negative effect on productive incentives. Similarly, the impact of

aid loans will be positive ($\delta_2 > 0$) if their stimulus on growth compensates the debt burden's negative effect.

Finally, the estimation of δ_1 and δ_2 will allow us to compare the potential impacts of aid loans and grants and, thus, guide the choice of the optimal distribution of resources between these two aid modalities. This is a notable issue for middle income economies such as LAC, as they receive important amounts of aid loans. Two aspects make these countries especially appropriate for receiving concessional loans. Firstly, their greater capacity for repayment in comparison with lower income economies; and, secondly, their still fragile integration into the international capital market. Nevertheless, it should be remembered that LAC countries have a long record of debt unsustainability problems, sometimes contributed to by the concession of official loans, although the multilateral debt relief initiatives are currently helping to reduce their debt burden.[7]

Moreover, the parameter δ_3 captures the interactivity between aid and other characteristics of the recipient economies that positively influence the effectiveness of aid. Thus, the vector $R_{i,t}$ can be expressed as a function of several factors (such as governance, economic shocks and structural advantages) that have a directly proportional relationship with the impact of aid.

The parameter δ_4 captures the effect that donors' (unsound) managing procedures exert on recipient countries' pace of growth; these procedures constitute, in the end, intrinsic characteristics of aid flows that limit their impact. This is 'aid volatility', which penalizes growth in four possible ways (Tezanos 2010): 1) amplifying the recessive economic cycles, especially if aid is a pro-cyclical variable and decreases in recessive contexts; 2) distorting investment decisions, especially when the uncertainty of aid biases investment to the short term and encourages the partial substitution of investment for consumption; 3) dislocating recipient governments' fiscal performance, especially in those countries where aid directly finances the public budget, as it happens to a large extent in LAC;[8] and, 4) generating exchange rate fluctuations that tend to appreciate the local currency (when there is an inflow of foreign currencies, such is the case of ODA), which undermines export competitiveness and worsens the 'Dutch disease'.

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[7] Seven LAC countries take part in the IMF and World Bank's Highly Indebted Poor Countries (HIPC) Initiative: Bolivia, Dominica, Granada, Guyana, Honduras, Nicaragua and Haiti. Five of these countries (except Dominica and Granada) take part in the Inter-American Development Bank initiative for debt relief. In aggregated terms, LAC's debt services as a percentage of goods and services exports has decreased from 21% in 1990 to 8% in 2008 (World Bank 2009), which means that the region is on track for meeting the 8.12 target of the Millennium Development

[8] See the empirical study of Gozalo (2007) for the case of Central American countries.

Finally, δ_5 measures the impact of other growth relevant factors of LAC economies, such as governance, human capital, economic shocks, social stability and natural endowment. It should be pointed out that two of these factors (governance and economic shocks) are simultaneously aid impact determinants and growth endogenous factors.

B. Econometric procedure

The model of aid impact on growth defined by equations (2) and (3) is estimated according to the following panel data regression model:

$$G_{i,t} = \beta y_{i,t_0} + \delta X_{i,t} + v_{i,t} \quad , \tag{4}$$

where the error term ($v_{i,t}$) is the addition of three orthogonal components: the fixed effects related to each country (α_i), the fixed effects related to each period (α_t), and the idiosyncratic effect ($u_{i,t}$), i.e., $v_{i,t} = \alpha_i + \alpha_t + u_{i,t}$ and $E[\alpha_i] = E[\alpha_t] = E[u_{i,t}] = E[\alpha_i \alpha_t u_{i,t}] = 0$.

However, the aid variable is not strictly exogenous (i.e., it is correlated with past or actual realizations of the error term) because its geographical allocation is negatively related with the paces of growth of the partners' countries. Similarly, some of the $Z_{i,t}$ vector variables (governance, economic shocks and initial per capita income) may not be strictly exogenous, either because they have a double sense of causation with the dependent variable (for instance, the growth-governability relationship), or because they are related to other explanatory variables (such as aid and economic shocks, to the extent that the latter usually attracts greater aid flows).

In order to solve this endogeneity problem we apply a consistent estimation method which takes into account fixed effects and endogenous independent variables. This is the case of the dynamic regression models with panel data, estimated by the *generalized method of moments* (GMM).[9] The advantage of the

[9] The GMM approach is particularly suitable for panel data estimations when: i) the number of periods, T, is small and the number of cross section units, N, is large; ii) there are non-strictly exogenous regressors; iii) there are fixed effects; and iv) there are heteroscedasticity and autocorrelation within each country's data but not among different countries' data. According to Roodman (2009: 15), GMM estimations are part of a '[...] broader historical trend in econometric practice toward estimators that make fewer assumptions about the underlying data-generating process and use more complex techniques to isolate useful information'.

GMM is the use of internal instruments, which may include lagged values of the non-exogenous regressors, leading to an improvement in the estimation results.[10]In particular, we use the *system* GMM proposed by Arellano and Bover (1995) and Blundell and Bond (1998), instead of the *difference* GMM proposed initially by Arellano and Bond (1991),[11] as the former allows the use of more instruments and, consequently, improves the efficiency of the estimation.[12]

The model is estimated by the econometric software STATA, with four additional commands that optimize the estimation:[13] 1) White's standard errors, which are robust to arbitrary heteroscedasticity for the same country;[14] 2) small sample correction for the covariance matrix estimation; 3) restriction of the matrix of instruments, creating an instrument for each variable and lag distance, rather than an instrument for each period, variable and lag distance, so, in small sample sizes (like ours), it reduces the bias that stems from the fact that the number of instruments approaches (or exceeds) the number of observations; and, 4) two-step estimations, applying Windmeijer's finite samples correction in order to eliminate standard error biases. Finally, in order to check the validity of the instruments matrix in levels, Sargan and Hansen hypothesis tests are carried out, as well as the Arellano-Bond test for autocorrelation of the idiosyncratic effect (if this kind of autocorrelation exists, the use of lagged values as instruments will be invalidated).

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[10] Aid has been usually instrumented by variables that are related to donors' geographical allocation patterns, either using recipients' needs variables (assuming that aid is distributed in accordance with altruistic development criteria), or other variables relating to donors' foreign policy interests (assuming that these interests determine the aid allocation). In both cases, the procedure becomes problematic, since, until now, the proposed instruments are neither specifically correlated with the instrumented variables (and, therefore, the instruments are not 'ideal'), nor perfectly orthogonal to the dependent variable (for example, recipients' needs variables are not strictly exogenous in relation to the rate of growth). In addition, donors' foreign policy interests do not properly explain the geographical allocation of multilateral flows (which are considered in this study).

[11] Other studies on aid effectiveness have estimated dynamic panels using the GMM. See, for example, Hansen and Tarp (2001), Dalgraad et al. (2004), Clemens et al. (2004), Chauvet and Guillaumont (2004), Roodman (2007), Djankov et al. (2009) and Tezanos et al. (2009).

[12] Simulation exercises by Kiviet (1995), Blundell and Bond (1998) and Hsiao et al. (1999) show that the estimators obtained by the difference GMM are biased on finite samples for two reasons: first, due to the presence of autocorrelation in the error terms with finite samples and many moment conditions, and secondly, because whenever the coefficient of the autoregressive variable is very close to 1 (that is, the series are highly persistent or near a unit root process), the parameter cannot be identified using the moment conditions for equations in first differences. In these cases, the simulations show that the difference GMM provides biased downwards estimators, especially when T is small (Blundell and Bond, 1998).

[13] We use STATA's xtabond2 command developed by Roodman (2009).

[14] That is, it is assumed that observations are independent among countries, but the errors of one country are not necessarily independent over time.

C. Variables

The choice of the proxies tries to maximize the availability of data (consequently, we reduce the data selection bias that stems from a non-random omission of information)[15] and to avoid redundant information (that may cause multicollinearity). The Appendix shows the variables' description and data sources (Table A1), and their descriptive statistics (Table A2).

The data selected includes the 32 LAC countries which were ODA recipients between 1992 and 2007, according to Development Assistance Committee (DAC) directives. However, 12 of them were finally excluded from the analysis due to lack of data.[16] Hence, we use a panel dataset that includes a sample of 20 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.

Literature on aid effectiveness has often used panel data sets in which most of the variables are averaged over four consecutive years. This is an alternative procedure to that proposed by Barro (with longer periods), which entails an "attribution problem" of the aid impact.[17] Ultimately, the length of the periods has not been empirically justified and is, therefore, arbitrary. However, the choice of four-year periods is the most commonly used because it maximizes the temporal dimension of the sample, so it is the one we choose in this research. Regarding the period of study, 1992-2007, we analyze an 'era' that is coherent with LAC's political and economic conditions (Ocampo, 2009), ending just before the start of the latest international economic crisis. During this period, the neoliberal economic model is consolidated in LAC — after the 1980s 'lost decade' has been

[15] The poorest countries often lack statistical information, so their exclusion could systematically bias estimations. Therefore, it is important to use a set of explanatory variables widely available in these countries

[16] All these countries have population of less than one million, most of them are islands (Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, San Cristobal and Nieves, Santa Lucia, San Vicente and the Grenadines and Surinam), and countries with little availability of statistical information (Cuba and Trinidad and Tobago).

[17] As Clemens et al. (2004: 10) explained, any evaluation of a policy intervention faces a trade-off between comprehensiveness and attribution: "A long-run analysis captures long-run effects but cannot confidently attribute those effects to the intervention because so many other changes can occur in the interim. A short-run analysis can be more confident of attribution but is less likely to have captured the full effect". However, they ended up using four-year periods for their analysis and tried to solve the attribution problem by means of disaggregating the aid modalities that may impact over this period (what they called the "short-impact aid").

overcome — in a context that combines world economic growth with episodes of strong financial shocks.

In terms of the dependent variable, aid effectiveness studies have usually employed the growth rate of GDP per capita as the dependent variable. This method allows the testing of the effectiveness of the aggregate resources, but it involves a 'target problem', which has not been previously considered in the literature: it is not possible to distinguish which part of the aggregate aid impact benefits the growth rate of those citizens with higher incomes, and which part favors the progress of those people with lower incomes (precisely when the latter citizens are, indeed, the target population of co-operation policies).

Given the strong income disparities within LAC countries, we evaluate ODA effectiveness in relation to the growth rate of the GDP per capita within the population with income lower or equal than that of the ninth decile.[18] The 'inequality-adjusted GDP per capita' ($y_{i,t}^{IA}$) is calculated by means of the following expression (Domínguez 2009):

$$y_{i,t}^{IA} = \sum_{k=1}^{9} d_{i,t}^{k} \frac{Y_{i,t}}{0.9 N_{i,t}} \tag{5}$$

where $d_{i,t}^{k}$ is the income share of the *k*th decile of the population of country *i* in year *t*, $Y_{i,t}$ is the overall GDP, and $N_{i,t}$ is population. Finally, the $y_{i,t}^{IA}$ levels are used for computing the corresponding average growth rates of each four-year period.

The choice of this dependent variable provides a more accurate and restrictive definition of effectiveness, such that, in the hypothetical case that aid 'effectively' contributes to increase income, but just the income of the wealthiest 10% of the population, our analysis will reveal a scenario of aid ineffectiveness. This distinction is particularly relevant for LAC countries, which register the highest levels of inequality among developing countries, as revealed by the fact that the richest 10% of the population holds, on average, 34.5% of the regional income.[19]

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[18] It should be pointed out that the election of this income percentile is arbitrary. A more precise definition of the income percentile will require a micro analysis of the income distribution within each recipient country, and different percentiles may be used for each country. Furthermore, there is no international consensus on the income (or inequality) threshold for identifying the within-country's target population of foreign aid. In the end, for reasons of simplicity, we use deciles as this data is widely available among LAC countries, and it offers a reasonable and wide macro definition of the target population (including low and middle income citizens). We tested the sensitivity of the regression results using quartiles and had similar significant results.

[19] Calculations made using geometric means based on ECLA (2009) for the 20 countries in the sample.

Therefore, the US$ 7,418 of GDP per capita in the LAC countries in 2008 are reduced to the exiguous US$ 5,331 of inequality-adjusted GDP per capita. In this context, international aid should help to reduce such intra-national disparities.

As of independent variables, we measure the β-convergence by means of the natural logarithm of the GDP per capita in the initial year of each four-year period. Aid flows are analyzed using the ODA net disbursements reported by bilateral donors (DAC countries and those countries that are not DAC members but do report data to this Committee) and multilateral donors.[20] For this aggregate amount, we distinguish between ODA grants and ODA net loans.[21]

In relation to the variables that determine the eventual impact of aid in recipient countries (see variable $R_{i,t}$ in equation 3), we use one proxy to analyze its interactive effect with aid: the institutional quality of recipient countries, assuming that aid is more effective in countries with good policies and institutions.[22] Specifically, in this study we use the *control of corruption* variable of the *Worldwide Governance Indicators* developed by Kaufmann et al. (2009)[23] in order to test the hypothesis that high levels of corruption undermines the effectiveness of aid — and, as pointed out by Robinson (1998), weakens public support for aid in donor countries.

Moreover, the variables related to the donors' managing procedures that determine the aid impact ($D_{i,t}$) are proxied by means of the *volatility of aid*, which is calculated as the ratio of the variation coefficient of aid and the variation coefficient of tax revenue (both expressed as percentages of GDP).[24] Thus, a ratio greater than one means that the volatility of aid is higher than that of tax revenue.

In relation to the vector of other growth explanatory variables ($Z_{i,t}$), we use six additional proxies. 1) Institutional quality, which has a positive impact on economic growth (Kaufmann and Kraay, 2002; Alonso and Garcimartín, 2010). Again we use the *control of corruption* variable previously described. As

[20] In accordance with DAC's criteria, ODA consists of grants and loans that meet the following four conditions: i) are disbursed to developing countries, ii) are granted by the official sector, iii) their main objective is the promotion of economic growth and welfare, and iv) in the case of loans, they are granted on concessional financial terms, with a grant element of at least 25%.

[21] ODA net loans are negative when loan repayments are greater than loan disbursements. This is actually the case for 48 out of 80 observations of the sample.

[22] See literature review in Section II.

[23] These indicators are constructed using the methodology of unobserved components and their distribution is centred on zero and has a dispersion of approximately ±2.5.

[24] Bulir and Hamann (2008) used the ratio of variances instead of the ratio of variation coefficients. Nevertheless, the use of variation coefficients re-scales the standard deviations, which allows the homogeneous comparison between dispersions of aid and tax revenues.

Myrdal (1968) warned, corruption can seriously hinder the development process; moreover, the negative effect of corruption on growth increases with the level of corruption (Bardhan 1997).[25] 2) Human capital, assuming a positive contribution to growth (Lucas 1988; De la Fuente and Doménech 2006). This variable is proxied by the geometric average of the *combined gross enrolment ratio for primary, secondary and tertiary schools*. 3) Trade shocks, which negatively affect economic growth (Rodrik 1999), are proxied through the *terms of trade volatility*. 4) Macroeconomic instability, which penalizes economic growth (Kormendi and Meguire 1985; Fischer 1993; Easterly 1993). As Fischer (1993) explained, the inflation rate can be considered as the best single indicator of macroeconomic policies (followed by the budget balance), as it captures the Government's ability to manage the economy. Therefore, we proxy macroeconomic instability by means of the *inflation rate*. 5) The endowment of natural resources, which we assume that adversely affects the growth rate as predicted by the hypothesis of the "natural resource curse".[26] We proxy this variable by the *primary energy production*. 6) Social instability, which negatively affects growth (Barro 1991; Rodrik 1999), is proxied by the *homicide rate*.

Since aid, initial per capita income, corruption, economic shocks and interaction between aid and corruption are not strictly exogenous variables, the estimation of the model requires the inclusion of one instrument for each variable. Nevertheless, expanding the number of instruments may lead to inefficient estimations, thus we apply the rule of thumb proposed by Roodman (2008 and 2009) of limiting the number of instruments in order not to exceed the number of countries. Since our analysis includes 20 countries, it is not econometrically possible to estimate the complete growth model defined by equations (2) and (3). So as to reduce the effects of this constraint, we estimate several reduced-form equations in which the model is reformulated by successive substitutions of a variable (specifically, that whose estimated coefficient turns out to be less statistically significant). This procedure enables us to assess, alternatively, the impact of four variables: aid volatility, human capital, homicides and primary energy production.[27]

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[25] See Bardhan (1997) for a clear review on the literature of corruption.

[26] See the book edited by Lederman and Maloney (2006) for a complete review of the debate of the "natural resource curse".

[27] In the end, the main practical constraint of limiting the analysis to a reduced sample of 20 LAC countries (instead of the whole sample of developing countries, such as in previous aid-effectiveness studies) is the reduction of the degrees of freedom of the estimation, which prevents us from including a more comprehensive set of explanatory variables and limits the accuracy of the estimates.

The model estimation includes time dummies in order to reduce the degree of autocorrelation among countries and the error idiosyncratic term, which leads to robust estimators (Roodman 2009).

IV. Main results on aid macroeconomic effectiveness in LAC

In aggregate terms, aid seems to have had in general a significant impact on the rate of growth of the inequality-adjusted GDP per capita of LAC countries during the period 1992–2007 (see the first four columns in Table 1). Both signs of the estimated coefficients of ODA grants and ODA loans are positive and statistically significant, just like the interaction between aid and the control of corruption.[28]

Table 1. Aid impact on economic growth. LAC countries. 1992-2007

Dependent variable	*inequality adjusted GDPpc growth rate*				*GDPpc growth rate*			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
ineq.adjusted GDPpc	**0.3659**	0.2881	**0.4480**	0.5693				
	(0.002)	(0.456)	(0.001)	(0.156)				
GDPpc					**0.4155**	0.6151	**0.6810**	0.6401
					(0.009)	(0.258)	(0.001)	(0.189)
aid grants	**0.2800**	**0.2575**	0.2019	**0.3313**	0.1271	0.1161	0.1049	0.1300
	(0.08)	(0.031)	(0.18)	(0.096)	(0.240)	(0.191)	(0.238)	(0.208)
aid loans	**0.4413**	**0.4256**	**0.3843**	**0.5110**	0.2392	**0.3321**	**0.3169**	**0.3559**
	(0.017)	(0.018)	(0.042)	(0.027)	(0.147)	(0.009)	(0.042)	(0.004)
aid × control corruption	**0.3914**	**0.3619**	**0.3461**	**0.4737**	0.1610	**0.1943**	**0.2060**	**0.2134**
	(0.03)	(0.035)	(0.082)	(0.033)	(0.3)	(0.072)	(0.093)	(0.042)
terms of trade volatility	-0.0002	-0.0063	-0.0086	-0.0002	-0.0065	0.0080	0.0076	0.0113
	(0.97)	(0.941)	(0.919)	(0.97)	(0.747)	(0.796)	(0.847)	(0.684)
control of corruption	-1.1031	-1.0567	-0.9258	-1.7886	-0.2368	-1.4130	-1.3978	**-1.4513**
	(0.359)	(0.378)	(0.524)	(0.201)	(0.828)	(0.176)	(0.168)	(0.047)
inflation	**-0.0920**	**-0.0947**	**-0.0862**	**-0.8598**	**-0.1122**	**-0.2687**	**-0.2381**	**-0.2926**
	(0.07)	(0.049)	(0.057)	(0.068)	(0.02)	(0.006)	(0.018)	(0.006)
volatility of aid	0.0008				-0.0065			
	(0.96)				(0.747)			

[28] Only in column 3 aid grants are not significant, when the homicide rate is included in the regression.

Table 1. (continued) Aid impact on economic growth. LAC countries. 1992-2007

Dependent variable	*inequality adjusted GDPpc growth rate*					*GDPpc growth rate*		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
human capital		0.0114				0.0090		
		(0.787)				(0.893)		
homicide rate			-0.0167				-0.0148	
			(0.404)				(0.188)	
primary energy production				-1.8950				0.0670
				(0.558)				(0.883)
Post-estimation tests (p-values)								
F(10, 20)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sargan	0.584	0.511	0.500	0.522	0.405	0.826	0.723	0.847
Hansen	0.428	0.438	0.386	0.420	0.321	0.705	0.506	0.676
Arellano-Bond AR(1)	0.004	0.006	0.006	0.004	0.002	0.011	0.009	0.017
Arellano-Bond AR(2)	0.430	0.521	0.470	0.437	0.927	0.660	0.689	0.663

Note: Number of observations = 78. It is not a balanced panel because Jamaica is not included in two periods (1992-1995 and 1996-1999) due to the lack of data in the variable *terms of trade volatility*; Number of groups (countries) = 20; Number of periods: 4 (1992-1995, 1996-1999, 2000-2003 and 2004-2007); Obs. per group: min = 2 average = 3.9 max = 4; Number of instruments = 20; Instruments for level equations: *aid grants*, *aid loans* and *control of corruption*: 2 and 3 lags (endogenous variables) and *GDPpc*, *aid* × *control of corruption*, *terms of trade volatility*: 2 lags (endogenous variables). Panel data regressions, system GMM, two-step estimations, White's (heteroskedasticity-adjusted) robust errors, Windmeijer correction for finite samples, and instrument matrix collapsed. We include time dummies in all regressions (not reported). Statistically significant coefficients in bold (p-values are shown within parentheses). See Table A1 for a description of the variables.

More precisely, according to our estimations, a 1% increase in ODA grants have raised the inequality-adjusted growth rate by around 0.28 percentage points, and an equivalent increase in ODA loans had a greater impact on growth (with an average coefficient of 0.44). This growth impact of loans suggests that (other things being equal) the debt burden's negative effect is compensated by their positive effect on growth. Similarly, aid grants' effectiveness suggests that (other things being equal) their stimulus on development compensates the negative effect that grants may have on productive incentives. In turn, these results can be understood as an argument supporting the use of both concessional resources in a middle income region such as LAC, despite its long record of debt unsustainability problems.

Regarding the characteristics of the recipient economies that determine aid impact, the interaction between aggregate aid and control of corruption reveals a positive and statistically significant effect, suggesting that aid may be more effective in less corrupt countries (with an average growth elasticity of 0.4).

In relation to other growth explanatory variables, inflation exerts a negative and statistically significant effect on the overall rate of growth. On average, a 1% increase in the inflation rate has decreased the growth rate by around -0.27 percentage points.[29] This result confirms the hypothesis that high inflation episodes in LAC reveal a loss of control of the economy by the national Governments, thus damaging the pace of growth.

When we relaxed the more restrictive definition of aid effectiveness and evaluated ODA impact on the GDP per capita growth of the overall Latin American population (right side of Table 1), we obtained different results from those previously commented on. In this case, the p-values associated with the aid estimated coefficients (ODA grants and loans) increase and the estimated coefficients decrease; in three out of four equations aid loans remain statistically significant (with an average estimated coefficient of 0.31) and aid loans become statistically non-significant. Furthermore, the estimated coefficient of the interaction term between aid and control of corruption turns to be statistically non-significant in one of the equations. The fact that the analysis clearly points out the effectiveness of aid in relation to the rate of growth of the inequality-adjusted GDP per capita, but not for the regular GDP per capita, suggests that aid may be effectively concentrated in those Latin American citizens with lower incomes (within each country), which reflects a progressive 'within countries' distribution of aid. Furthermore, the estimated inflation coefficient continues to be negative and statistically significant.

Moreover, with regard to the existence of β-convergence, the eight estimated coefficients are positive, but only four of them are statistically significant. This inconclusive result suggests the possible existence of a divergence dynamic (with an estimated β parameter approximately equals 0.45). This result is due to the sluggish rate of growth of the poorest LAC countries. Thus, the gap between low and low-middle income American economies (Andean countries, Paraguay, Dominican Republic, Haiti, Jamaica and Central American countries, except Costa Rica) and upper-middle income countries (Mexico, Costa Rica, Venezuela, Brazil, Argentina, Uruguay and Chile) seems to be widening.

[29] Average estimated coefficient for the first four columns in Table 1.

Finally, we carry out a rank correlation analysis between the GDP per capita levels and the difference between grants and loans in order to better understand the characteristics of the aid (loans and grants) recipient countries. The rank analysis shows that countries with lower incomes receive a greater amount of grants in relation to loans, and, therefore, may experience lower aid impact on growth (Table 2). Supporting these results, the estimated Spearman´s rank coefficient has a negative and high value, in absolute terms, and it is statically significant in each of the studied periods.

Table 2. Spearman´s rank coefficient between GDP per capita and the difference between grants and loans in LAC. 1992-2007

1992-2007	1992-1995	1996-1999	2000-2003	2004-2007
-0,8145	-0,7188	-0,7985	-0,8827	-0,8917
(0,000)	(0,000)	(0,000)	(0,000)	(0,000)

Note: Number of observations = 80. Variables: GDP per capita and difference between ODA loans and grants. For the period 1992-2007, the statistic $t = r\Big/\sqrt{(1-r^2)}\,(n-2)$ follows a t-Student distribution with 78 degrees of freedom; the p-value is obtained by testing the alternative hypothesis $\rho < 0$. For the other periods, the p-value has been calculated considering the cut-off points of the Spearman´s rank coefficient distribution, for a sample size equal to 20 and under the null hypothesis $\rho = 0$; the p-values are within parentheses.

V. Conclusions

LAC countries are among the developing economies with highest levels of income per capita, but also the economies with highest levels of inequality. The region has taken part in the international co-operation system since its origins, receiving since 1960 a total ODA flow that amounts to 0.48% of the regional GDP. Obviously, from these limited resources it is not reasonable to expect an outstanding impact, but invested strategically they should effectively support the development strategies of these countries.

The aim of this paper is to quantify the impact that ODA has exerted on the LAC countries' pace of growth during the period 1992-2007. For this reason, we run a regression model of the aid impact on growth, adapted to the peculiarities of the region and based on modern growth theory. The model evaluates aid effectiveness in relation to the growth rate of the GDP per capita within the population with income lower than that of the ninth decile ('inequality-adjusted GDP per capita'), in order to precisely define the desired impact of aid in a region

which is characterized by high inequality levels. In contrast with other previous studies, we limit our analysis to the sample of Latin American countries in order to capture the peculiarities of their growth dynamics, and we distinguish between two aid modalities — ODA grants and ODA loans — that may have different impacts on growth.

The econometric estimation of the model points out three relevant results in relation to aggregate aid effectiveness for the period 1992-2007. Firstly, ODA has been effective in stimulating the rate of growth of the inequality-adjusted GDP per capita. Furthermore, aid impact dilutes when we consider the GDP per capita for all income deciles. This result suggests that aid has been effectively concentrated in those Latin American citizens with lower incomes (within each country), which may reflect a progressive 'within country' distribution of aid.

Secondly, the analysis suggests that ODA loans have exerted a greater stimulus on growth than ODA grants (with average estimated coefficients of 0.27 and 0.44, respectively). This result supports the use of both aid grants and loans in a middle income region such as LAC, despite its long record of debt unsustainability problems. Obviously, from this result we cannot infer that concessional loans are preferable than grants; on the contrary, grants should still be concentrated in those LAC countries with lesser repayment capacities and more restricted access to credit. But the use of concessional loans should be enhanced in those economies which offer guaranties of repayment and need resources for financing productive activities. Yet this piece of research leaves unresolved the questions about which socio-economic conditions are more appropriate for the use of loans or grants, and which kind of development activities — with potentially different growth impacts — are primarily financed by loans or grants.

Thirdly, aid seems to be more effective in countries with better mechanisms of corruption control. This result backs up the thesis of previous studies that claimed the importance of institutions for the effectiveness of aid (such as Burnside and Dollar 2004; Chauvet and Guillaumont 2004; and Tezanos et al. 2009).

All in all, this paper tries to contribute to the aid-effectiveness literature; a literature that, after 50 years of research, still offers controversial conclusions about the potential mechanisms of aid impact on growth. Actually, our study only

tests the 'macroeconomic effectiveness' of aid in relation to economic growth, and not in relation to progress in other dimensions of human development. Therefore, it should be interpreted as a partial evaluation of aid effectiveness, exclusively referred to the economic dimension of development.

Appendix

Table A1. Variables' description and information sources

Variable	Description	Sources
GDPpc growth rate	Average growth rate of the period of GDP per capita, constant prices, US $ (year 2000=100).	ECLA (2009)
inequality adjusted GDPpc growth rate	Average growth rate of the period of the GDP per capita after discounting the total income participation of 10% of the population with highest income in each country, constant prices, US $ (year 2000=100).	ECLA (2009)
GDP per capita	Natural logarithm of the GDP per capita of the initial year, constant prices, US $ (year 2000=100).	ECLA (2009)
inequality adjusted GDPpc	Natural logarithm of the GDP per capita of the initial year after discounting the total income participation of 10% of the population with highest income in each country, constant prices, US $ (year 2000=100).	ECLA (2009)
aid	Percentage of total donors' ODA net disbursements over GDP in each period, constant prices, US $ (year 2000=100).	DAC (2009)
aid grants	Percentage of total donors´ ODA grants net disbursements over GDP in each period constant prices, US $ (year 2000=100).	DAC (2009)
aid loans	Percentage of total donors´ ODA loans net disbursements over GDP in each period, constant prices, US $ (year 2000=100).	DAC (2009)
control of corruption	Goes from -2.5 (minimum control of corruption) to +2.5 (maximum control).	Kaufmann et al. (2009)
inflation	Average inflation rate during each period.	World Bank (2009)
terms of trade volatility	Percentage of export prices index over import prices index (year 2000=100). Variable corrected by its difference with 100.	World Bank (2009)
human capital	Geometric average of combined gross enrolment ratio for primary, secondary and tertiary schools, for each country in the studied period.	World Bank (2009)

Table A1.(continued) Variables' description and information sources

Variable	Description	Sources
homicide rate	Ratio of mortality from homicide and injuries inflicted by another person and wounds caused by legal intervention or war operations, expressed per 100,000 populations.	Pan American Health Organization (2009)
aid volatility	Ratio of variation coefficient of the aid proportion over GDP and the variation coefficient of the proportion of revenues over GDP, for each country in the studied period.	DAC (2009) and ECLA (2009)
primary energy production	Natural logarithm of primary energy production (10^{15} btu).	US Energy Information Administration (2009)

Note: Average growth rates are calculated according to the general formula $\left(\sqrt[T-t_0]{y_T/y_{t_0}}-1\right)\times 100$, where y_{t_0} and y_T are, respectively, the values of the variable at the initial and the last period. The average of each variable for each country in the studied period is calculated by geometric average since this is a more suitable location measure when dealing with ratios and indices, and because it is less sensitive to outliers.

Table A2.Descriptive statistics

Variable	Obs.	Mean	Standard deviation	Min.	Max.
inequality adjusted GDPpc growth rate	80	1.8816	2.9540	-5.6072	10.0711
GDPpc growth rate	80	1.7578	2.7999	-6.2739	7.8487
inequality adjusted $GDPpc_{t0}$	80	7.3113	0.8111	5.3067	8.5963
$GDPpc_{t0}$	80	7.7520	0.7397	5.9480	8.5963
aid	80	3.4331	6.0736	0.0000	25.4698
aid grants	80	3.1724	5.6578	0.0328	30.3348
aid loans	80	0.1760	2.2024	-9.4777	6.2366
aid × control corruption	80	-2.5587	5.1109	-23.0333	0.6204
control of corruption	80	-0.3682	0.6243	-1.4627	1.4370
inflation	80	10.8495	9.5493	1.0001	45.7097
terms of trade volatility	78	1.1670	14.6767	-35.0500	55.0667
human capital	80	64.9263	13.3744	33.5042	90.1912
homicide rate	80	18.2406	18.2642	0.2000	81.3340
aid volatility	80	8.7023	20.7220	-128.7877	73.1881
primary energy production	80	8.8658	1.9411	6.1626	12.4486

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