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# macroeconomía del desarrollo

## **T**he impact of structural reforms on growth in Latin America and the Caribbean: an empirical estimation

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## Summary

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Since the mid-1980s, most Latin American and Caribbean countries have adopted a package of structural reforms and there has been a good deal of curiosity about the effect of these reforms on growth. Thanks to influential theoretical models incorporating market openness and to a number of empirical studies, there is a fairly widespread consensus in the literature that in general this effect has been positive. Yet, there appear to be serious methodological problems in the econometric analysis that has been used.

This paper presents an evaluation of the impact of trade and capital account liberalization, tax and financial sector reform and privatization, starting from a statistical model estimated using data collected for 17 countries of the region for the period 1970-1996. In line with the literature, the results show that growth was responsive to investment in physical as well as in human capital. Furthermore there is evidence of a positive feedback between the level of education and capital formation. The results also strongly support the positive contribution to growth of a stable macroeconomic environment.

In the aggregate, the reforms did not have a significant direct impact on the growth rate, because the different individual components of the reform package have offsetting effects. Tax reform has a positive and lasting impact on growth; capital account reform also raises the growth rate, but only up to a certain point. The other reforms, in particular trade reform, do not seem to have a robust or significant impact on the growth rate, beyond the effect they may have through the other variables in the model. On the contrary, the speed of reform matters a lot, and the more rapid the process of reform, the slower the growth rate.

The impact of macroeconomic or investment variables seems to be much more homogeneous across countries than the output response to structural reforms. A direction for future work would be to acknowledge this heterogeneity and attempt to identify why countries differed in their response to reforms, using more appropriate econometric procedures.

## Résumé

A partir de la moitié de la décennie des années quatre-vingt, les pays d'Amérique latine et des Caraïbes ont soumis leur économie à toute une série de réformes structurelles dont l'effet sur la croissance a suscité beaucoup d'intérêt et de polémique. Un premier consensus optimiste s'est formé sur la base de prémisses théoriques favorables à l'ouverture des marchés, une hypothèse qui s'est vue appuyée par de nombreuses études empiriques. Cependant, ces travaux économétriques sont entachés de nombreuses faiblesses qui en réduisent la portée.

Le présent document propose une évaluation propre de l'impact de ces réformes: libéralisation des transactions commerciales et financières, réformes fiscales et bancaires, privatisation. Les données régionales ont été recueillies pour 17 pays, couvrant la période 1970-1996. En accord avec les autres travaux publiés sur le sujet, les résultats obtenus montrent que la croissance a répondu de manière positive à l'investissement en capital physique et humain, montrant même une rétroaction positive entre ces deux éléments. Les résultats confirment aussi l'importance de la stabilité macro-économique pour impulser la croissance.

Considérées dans leur ensemble, les réformes n'ont pas eu un impact significatif sur le taux de croissance, du fait de la divergence des effets propres à chacune des composantes de ces réformes. Le volet fiscal a eu un effet positif et cumulatif sur la croissance, alors que l'influence favorable de la libéralisation des flux de capital a été plus limitée. Les autres composantes, en particulier la réforme commerciale, ne semblent pas avoir eu un impact significatif et autonome (une fois décomptée leur contribution à d'autres variables du modèle). Par contre, la rapidité avec laquelle les réformes sont mises en place est un aspect crucial, les changements rapides étant pénalisés par une moindre croissance.

La contribution des variables macro-économiques ou de l'investissement semble beaucoup plus homogène entre pays que les réactions observées en réponse aux réformes structurelles. Une direction de recherche future serait donc de reconnaître cette hétérogénéité et d'utiliser des méthodes quantitatives mieux appropriées afin d'étudier les raisons pour lesquelles ces pays ont réagi de manière différente aux réformes.

## Resumen

La mayoría de los países de América latina y del Caribe adoptó programas de reformas estructurales a partir de la mitad de los años ochenta; la evaluación de los efectos que tuvieron estos programas sobre el crecimiento ha despertado mucho interés. Bajo la influencia de una fuerte corriente teórica en favor de la apertura, y gracias a los resultados de varios estudios empíricos, se ha definido un consenso bastante amplio entorno al efecto positivo de las reformas. Sin embargo, la metodología usada en estos estudios empíricos padece de varios problemas.

Este trabajo presenta una evaluación propia de los impactos de la liberalización de las cuentas comerciales y de capital, de las reformas tributarias y financieras y de la privatización, en base a un modelo estadístico usando datos de 17 países de la región para el período 1970-1996. Conforme a los resultados obtenidos en otros estudios, los resultados muestran que el ritmo de crecimiento respondió muy favorablemente a la inversión, tanto en capital físico como en su componente humano. Además, se observó que educación e inversión se potencian mutuamente. Los resultados demuestran claramente la contribución positiva de la estabilidad macroeconómica para el crecimiento.

En término general, las reformas no tuvieron un efecto significativo sobre el crecimiento, ya que sus diferentes componentes demostraron tener impactos contrarios. La reforma tributaria tiene una influencia positiva y creciente, mientras que el efecto positivo de la liberalización de la cuenta de capital es más limitado. Las otras reformas, en particular la liberalización comercial, no han tenido efectos observables y significativos sobre el crecimiento, más allá de los que tuvieron en otras variables claves ya incorporadas en el modelo. En contraste, la velocidad con cual se ejecutan las reformas es muy importante; lo más rápido el proceso, lo menor la tasa de crecimiento.

El efecto de las variables macroeconómicas y de la inversión parece ser mucho más homogéneo entre los países que lo fue la respuesta del crecimiento a las reformas estructurales. Una dirección para futuras investigaciones sería de reconocer esta heterogeneidad y usar metodologías estadísticas más adecuadas para identificar porqué los países han diferido en su respuesta a los programas de reforma.

## Introduction

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One of the striking developments in Latin America since the mid-1980s was the wholesale adoption of a package of structural reforms that was adopted in response to the debt crisis and the recession that came to be called the “decada perdida”. These programmes included trade and capital account liberalization, privatization and tax and financial sector reform. Not surprisingly there is a good deal of curiosity about what the effect of these reforms has been. At first glance there appears to be a positive relationship between the two since the implementation of reforms coincided with the resumption of growth which was much higher in Latin America in the 1990s than the 1980s, despite several severe cycles due to financial crises and other disturbances. Adopting a longer term perspective, table 1 shows that growth during the post-reform period has been on average lower than during the pre-reform period –excluding from the latter the debt crisis of 1982 and its consequences. In fact, one cannot make any useful inferences from a comparison of growth before and after the reforms were adopted because none of the other factors that might affect growth can be held constant.

A number of attempts have been made to address this question econometrically (see in particular Easterly, Loayza and Montiel, 1997 Fernandez-Arias and Montiel, 1997 Lora and Barrera, 1998 and Edwards, 1998). Quantifying the intensity of reforms is a problem in itself. Some of these authors used proxies or outcomes such as the investment ratio or M2/Y because they did not have measures of the reforms themselves. But those outcomes undoubtedly reflect influences other than the reforms themselves.

Table 1

**LATIN AMERICA AND THE CARIBBEAN: SELECTED INDICATORS, 1971-1996**

	1971-1975	1976-1980	1981-1985	1986-1990	1991-1996
GDP growth	5.3	4.6	0.2	2.8	4.0
Inflation	38.8	35.6	185.7	312.3	83.9
Net Transfers	13.9	17.1	-0.6	-8.0	9.2
Reforms (average index)	47.3	53.1	54.6	61.8	78.8

**Source and definition:** see Annex 1.

**Note:** Annual arithmetic averages over 17 countries.

Lora (1997) addressed this problem by developing a set of measures of the reform policies themselves. Good as Lora's indexes are, they have two problems. First, they run for only ten years, 1985-1995. That is a problem because this period corresponds to a general recovery in Latin America that may have had little to do with the adoption of reforms. Also, of course, the reforms did not really start in 1985 in all countries. Rather there was a subset of countries particularly in the Southern Cone which implemented a good deal of the reform program in the 1970's. Second, Lora's indexes do not include a measure of capital account liberalization, one of the most important of the reforms. We have extended Lora's indexes back to 1970, added an index of capital account liberalization and made several additional modifications. (See Morley et al, 1999 for details).

The first advantage of our longer reform series is that we are able to separate the effect of the reforms from the effect of recovery in the region after 1985. Also using an extended reform index series allows sufficient degrees of freedom to investigate the separate effect of structural and macroeconomic reform in Latin America using only Latin American countries in the regressions. Most previous authors were forced to use a world-wide panel of countries and put in dummies for Latin America.

The paper is organized as follows: section one reviews some of the voluminous literature on the determinants of growth; section two presents our model and the estimation procedure we used to estimate it; section three contains our econometric results and section four draws conclusions from the exercise.



## I. Previous studies

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Most recent empirical work on the relationship between different policy variables of interest to policy makers and the growth rate were stimulated by the Barro (1991) specification of an empirical model inspired by the standard neoclassical growth theory. In that model all differences in growth rates between countries come from differences between actual income per capita ( $Y$ ) and the long run level of income per capita ( $Y^*$ ). All the variables of interest are inserted into the estimating equation in place of  $Y^*$ , to see whether or not they affect the level of income in the long run and therefore the rate of growth of income in the short run. A large number of possible candidates have been suggested in the literature as possible determinants of  $Y^*$ . Among these, most studies include an investment or saving rate, some measure of human capital and population growth. Beyond these three variables, one can think of three different classes of other variables which could be expected to affect the level of  $Y^*$  in different countries: structural differences between countries; exogenous factors like changes in world export markets which change across time but not across countries, and policy variables. In most studies of interest to us, it is this last set of variables which are used as the basis for estimating the impact on growth of policies or changes in policies, in particular macroeconomic and structural reforms.

Easterly, Loayza and Montiel (ELM, 1997) is a good representative example of recent work which attempts to measure econometrically the impact of reforms and other variables. They used a world-wide panel of 70 countries for each of which they created a panel of five year average observations for 1961-1993. They have two long run structural variables-population growth and a proxy for the human capital of the adult population. But since they are chiefly

interested in the effect of recent reform efforts in Latin America, they include in their regressions the black market exchange rate, the money to GDP ratio to capture financial liberalization, inflation and government consumption and the investment/GDP ratio to capture the effect of reforms not measured directly. Most of their reform variables are significant and have the expected sign. They then compare the growth rate predicted by their estimated model for each Latin American country in their sample and find that Latin America actually did better than predicted. Note that when ELM talk about reform they are mainly talking about macroeconomic policy reforms, as opposed to what we will call structural reforms such as commercial and capital account liberalization or privatization. In a later paper Fernández-Arias and Montiel (1997) add an index of structural reforms to the basic ELM model. They find that the macro reforms enacted in recent years have added 1.3% to average growth rates and the structural reforms have added an additional half a percent. They conclude that the reason that Latin America has not witnessed a bigger jump in growth overall is that the reforms were implemented in a relatively unfavourable international environment. In a final conclusion, they state that "(...) reaching much higher long-term growth rates in the region will require both an intensification of reform along the dimension already implemented and a broadening of reform (...)".

Lora and Barrera, (1998) used a set of reform indexes developed by Lora (1997) to estimate the effect of structural reform on growth in the region. They estimated a standard long run growth model using a combined panel-cross section of 19 countries with observations averaged over three year periods starting in 1987. They found that reforms had a quite powerful effect on growth, measured either directly or indirectly through investment and productivity. The problem with this procedure is that it is impossible to separate the effect of the reforms from the effect of recovery and the return of foreign capital to the region, all of which were occurring at the same time. It was largely to avoid this simultaneity problem that we extended Lora's reform indexes back to 1970.

Probably the central element of the structural reform package is trade liberalization. Thanks to influential theoretical models based on the role of openness in lessening market restriction or accelerating the diffusion of technology, and a number of empirical studies, there is a fairly widespread consensus that trade reform has been good for growth (See in particular Dollar, 1992; Sachs and Warner, 1995; Edwards, 1998). But there are now a number of papers that raise questions about the optimistic outcome of these theoretical models and leave open the possibility of divergent growth paths when countries are opening (Ros, 2000). Rodriguez and Rodrik (1999) cast serious doubt on the empirical results obtained. They show that the supposedly robust positive relationship of trade reform to growth is in fact highly sensitive to the way trade reform is measured and a number of other data problems. They conclude that the empirical case in favour of trade reform on the ground of growth enhancement is still unproven.

Aside from these measurement problems, there appears to be a serious econometric problem in the sort of cross section econometrics that has been used in impact analysis. The problem results from the fact that we do not know what the correct structural model is. The general procedure of adding possible variables and examining their significance and sign won't solve the problem because as Leamer (1983, 1985) has shown, regression results are affected by which other variables happen to be entered at the same time. Leamer (1983) and Levine and Renelt (1992) suggest an extreme values test in which one labels a variable as significant if and only if it enters the equation with the same sign and significance regardless of what other variables are included. In growth regressions, they show that virtually no variable is able to satisfy this criterion.

Sala-i-Martin (1997a, 1997b) proposes a less stringent alternative. He runs a test on 63 of the possible structural variables that have been used in the literature. After putting three variables that appear in most work (initial income, and two measures of human capital), he takes each other variable and runs it with all possible combinations of the other variables grouped three at a time. He then calculates the cumulative density function (CDF) for each variable using all the results of

all the regressions in which it appears separately. A variable is significant if its CDF is greater than 0.95. The most significant variables according to this criterion are equipment investment, number of years that the economy has been open, distance from the equator, black market premium, primary exports in 1970 and a number of political and sociological variables. Note that no measure of government spending or inflation pass the test, nor do alternative measures of financial sophistication or tariff restrictions. One operational difficulty with this procedure is that it took between two million and four million separate regressions to test the 63 variables.

More recently, Ley and Steel (1999) investigated the issue of model uncertainty in cross-country regressions using a Bayesian approach. They allowed for any subset of up to 41 regressors to be included in the specification. Sampling from a potential universe of over two trillion different econometric models built from the Sala-i-Martin data set, they identified nine best models containing between 18 and 22 regressors; 11 of these regressors could be labelled as key explanatory variables. Unfortunately, these important variables differ substantially from Sala-i-Martin's results.

Not surprisingly we had neither the computational resources nor the patience to run two trillion or even four million regressions. Nor with our data set do we have the degrees of freedom to test equations including up to 22 variables. What we want to do instead is to show the results of what, after a good deal of sifting, is the best or the most stable set of results we could obtain. Unfavourably disposed readers may accuse us of data mining. There is a good deal of truth in that. But all we can offer in reply is a careful explanation of what we did, what the apparent result of different permutations and combinations of variables was, and which of the variables appear to be robust to alternative econometric specifications.



## II. The modeling strategy

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Starting from a theoretical model, based on the standard growth theory literature, a statistical model was elaborated and estimated using data collected for 17 countries of the region for the period 1970-1996.

### A. The theoretical model

Most existing empirical literature on the effects of economic policies or structural characteristics on economic growth builds upon a common family of growth models, based on the steady-state properties of economic systems where the long-term equilibrium growth rate is determined essentially by changes in productivity, while the observed short run growth rate is related to the difference between the initial and the long run steady state level of income per capita. Unless some particular variable affects the growth rate of productivity, it does not influence the steady-state growth rate at all. Rather it affects the long run level of income ( $Y^*$ ). But that means that such variables can affect the short run growth rate by changing the gap between the current or the initial level of income and  $Y^*$ . One can think of three different types of variables which may influence  $Y^*$ : environmental, structural and behavioural. Environmental variables include the policy instruments under the control of the government, and external factors such as the terms of trade. Structural variables could include factors such as the size of the economy, type and availability of natural resources and geographic position. These variables are not under the control of policymakers and do not change over time. Finally there are behavioural variables such as the saving or investment ratio and the rate of population growth that affect the potential level of output of the economy.

The basic theoretical model can be written as:

$$d\hat{Y} = f(Y^0, Y^*) \quad [1]$$

$$Y^* = g(Z) \quad [2]$$

Where  $d\hat{Y}$  is the average growth rate of per-capita output;

$Y^0$  is the initial level of GDP per head

$Y^*$  is the potential GDP obtainable given the structural characteristics of the economy.

$Z$  are the environment structural and behavioural variables.

Intuitively, in this class of models, the larger the distance between  $Y^0$  and  $Y^*$ , the higher the growth rate. This leads to convergence of income level between countries, conditional on the maximum obtainable by each country.

- **The statistical model** will be based on the following regression equation:

$$d\hat{Y}_{i,t} = \alpha Y^0_{i,t} + \beta SR_{i,t} + \delta OE_{i,t} + \gamma ZV_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t} \quad [3]$$

where

$d\hat{Y}_{i,t}$  : average growth rate of per capita GDP for country “i” and period “t”;

$Y^0_{i,t}$  : per capita GDP at the beginning of the period

$SR_{i,t}$  : structural reform indexes

$OE_{i,t}$  : macroeconomic policy variables

$ZV_{i,t}$  : other environment and behavioral variables

$\mu_i$  ;  $\nu_t$  : respectively country-specific and time-specific variables

$\varepsilon_{i,t}$  : residuals

$Y^*$  is not observable directly. To obtain an estimable model,  $Y^*$  is approximated by a set of structural and institutional variables ( $SR_{i,t}$ ,  $OE_{i,t}$  and  $ZV_{i,t}$ ) which makes up the economic environment and may either encourage or be detrimental to production and capacity output. Some potential candidates for inclusion in this category are the reform indexes, the rate of investment, the fertility rate (high rate of population growth diverts part of the investment away from increasing the stock of working capital per worker), macroeconomic policy variables, etc.

The estimation procedure used panel-data, pooling time series from 17 Latin American and Caribbean countries. With a few notable exceptions (e.g. Cuba, Haiti or Trinidad & Tobago), the countries that were not included in the sample are among the smaller economies in the region. Thus the sample covers almost all of regional GDP and population.

The 17 countries covered are the following:

Argentina	Guatemala
Bolivia	Honduras
Brazil	Jamaica
Chile	Mexico
Colombia	Paraguay
Costa Rica	Peru
Dominican Republic	Uruguay
Ecuador	Venezuela
El Salvador	

Data were collected for the period 1970-1996, and the time-frame was sub-divided into 5 year periods (see Annex 1 for a list of variables). With time periods that long, the statistical model is expected to capture the medium to long term growth effects while filtering out as much as possible the short term fluctuations and other statistical and inference problems associated with time-series dynamics. Those level variables that change over time are defined as averages over successive 5-year periods. Changes in variables refer to the average annual variations registered during each 5-year period.

Note that in equation [3] we are making the key assumption that  $Y^0$  is not itself a function of  $Z$ . That is a perfectly reasonable assumption in a pure cross-section model. However we are doing a combined panel-cross-section. In that case there is an important distinction between the observed level of income at the beginning of the entire period (1970) ( $Y^0$ ) and  $Y^0_{it}$ , income at the beginning of each 5-year subperiod. While the first can reasonably be thought of as exogenous, that is less obvious for the second.

## B. Specification issues and estimation procedure

This model is quite simple but presents several deficiencies. The first one -and the most important from both a theoretical and an empirical point of view- is that the exact list of variables on the right-hand side of the equation is unknown. As mentioned, this problem of model uncertainty has led researchers to try a large number of possible alternative determinants of  $Y^*$ . While including redundant variables has a cost in terms of efficiency and model stability, the omitted variable problem has more serious negative consequences on the statistical properties of the empirical econometric model and the inferences that can be drawn from it.

Also, some of the identified variables are not directly observable (stock of human capital) or are subject to error of measurement (stock of fixed capital). The use of proxies to capture the impact of unobserved variables leads to greater variance and some loss of information when the theoretical variables do not coincide perfectly with the observed ones.

A further problem is that sometimes it is difficult to interpret the results because of the ambiguities created by these proxy variables. For example, one of the traditional proxy indicators for financial deepening or financial reform ( $M2/GDP$ ) is also an indicator of macroeconomic policy. After periods of high inflation, the real demand for national currency tends to increase once inflation is under control. Whether the proxy then represents the effect of financial reform or of successful stabilization is unclear.

The presence of non linearities in the way control variables affect output also complicates the specification of the econometric model. That is particularly the case when the expected short term and long term impacts of a specific policy measure go in the opposite direction. The potential problem posed by non linearities in the way reforms interact with the economy deserves special attention in the present context.

For example, the expected long term impact of trade reforms from the perspective of the standard theoretical model is to increase the level of  $Y^*$  and boost the transitional rate of growth by increasing the distance between  $Y$  and  $Y^*$ . Yet in the short term, the resulting change of domestic relative prices may cause a significant fraction of the existing capital to become obsolete (net divestment). Output may shrink in sectors that compete with imports, which is likely to reduce the observed rate of growth in the economy in the short run, even if the long run equilibrium output level is higher. Furthermore a quick opening of the market to external competition also increases the uncertainty factor and may negatively affect investment. This suggests a dynamic transition where the estimated coefficient for the contemporaneous effects of reform may first be negative, then positive. For example, in their survey of 9 cases studies on the impact of reforms in Latin America

and the Caribbean, Stallings and Perez (2000) find that most LAC countries are still in the transitional phase of reforms, characterized by an initial period dominated by negative factors and a second one dominated by positive factors.

Other empirical considerations, linked to the way reforms are actually implemented, can also create non linearities in the effects of reforms on growth. The existence of policy inconsistencies, and other market frictions on the contrary may induce efficiency gains at the early stage of reforms, followed by negative outcomes as long as inconsistencies are not corrected. The impact of reform would be in this case positive, then negative. As stated by Corbo et al. (1986) in an evaluation of three Southern Cone countries (Argentina, Chile and Uruguay), those reforming economies experienced initial success at the early stages of their stabilization and liberalization programs, but each eventually encountered a boom-bust cycle.

The presence of non-linearity has practical implications for the estimation strategy. In particular, results may cancel out, or differ greatly according to the particular segmentation of the time series (i.e., annual series versus 5 or 10 years periods). Using a five year period as we do, both short and long run effects may offset each other. The speed of implementing reforms during the period may also interfere with the final result.

To take into account these problems and disentangle the contribution of reform that may have a non-linear output profile, the reform indexes were divided into two components: the level at the beginning of the five year period and its change during the period. To test for the possibility of a quadratic output profile, we added the squared value of the initial index to the regression equation.

- **The variable selection procedure**

The strategy adopted was inspired by the "general to specific" approach, in order to select the statistically relevant variables entering into our equation. The general to specific approach was backed-up by a systematic sensibility analysis of the robustness of resulting models. The objective of this step was, inter alia, to avoid imposing inappropriate restrictions by discarding explanatory variables on the basis of potentially biased statistics and to detect spurious correlations.

The first selection process among all the potential variables was implicit and made at the time of building the data base, and as such was quite arbitrary. The variables forming the initial data set are mainly economic in nature. Qualitative variables related to political, cultural and geographical factors were excluded. While some relevant information may be lost, it was hoped that the economic effect of these factors could be captured by other economic variables or by country specific dummy variables (fixed factors).

For obvious reasons linked to redundancy, strong collinearity and limited degrees of freedom, all chosen variables could not simultaneously be included in the regressions. This was particularly the case when unobserved characteristics had to be approximated by "proxy" variables, for which several alternative and highly correlated candidates were available. This obliged us to proceed to a preliminary screening process. Unfortunately, the usual reliance on "t" statistics to detect insignificant variables is quite a fragile tool in the present context. The selection process among competing explanatory variables is somewhat arbitrary and path-dependant, and calls for special care in checking the robustness of the final specification.

- **Simultaneity**

Some of the selected variables in the right hand side could present simultaneity problems with growth or strong collinearity with other control variables. This was in particular the case for four variables, namely the share of government consumption in GDP, the change in the export coefficient, the change in fiscal balance and the variation in the share of domestic credit going to the private sector. It was possible that they could be determined by the GDP growth rate, or jointly determined with it (public credit, fiscal deficit and rate of growth). After investigating alternative



specifications to investigate for predetermination and (weak) exogeneity, government consumption was discarded and the other variables were retained as potential explanatory variables.<sup>1</sup>

- **Measuring structural reform**

Obviously, if one is going to make an econometric analysis of the impact of reform, it is essential to quantify reform in some way. We used reform indexes described more fully in Morley, Machado and Pettinato (1999), which are themselves an extension of work initiated by Eduardo Lora (Lora, 1997). There are reform indexes in five areas plus an aggregate index which is a simple average of the five. The five areas are: trade, finance, tax, privatization and capital account. In each area we tried to choose indicators such as tariff or tax rates which reflect government policy rather than proxies for those policies such as openness to trade or the government deficit. Each index is normalized to be between zero and 100, with the latter being assigned to the country and year in which the sector was the most reformed or free from distortion or government intervention, and zero, to the country and year with the greatest degree of intervention. We do not mean to imply by this procedure that a high value for an index is necessarily better than a low one. As we shall see it may well be, that the optimal value for an index is not the extreme value.

The trade reform index is the average of two subcomponents, the average level and the dispersion of tariffs. Domestic financial reform is the average of three subindexes: the control or borrowing and lending rates and banks and the reserves to deposit ratio. Tax reform has four subcomponents: the maximum marginal tax rate on corporate and person incomes, the value added tax rate and the efficiency of the VAT. Our index for privatization is 100 minus the ratio of value-added in state-owned enterprise to non-agricultural GDP. Capital account reform is the average of four subcomponents reflecting the extent of government control of foreign investment, limits on profit and interest repatriation, controls on external borrowing and capital outflows. Unlike the other indexes, this one is based on a subjective interpretation of the descriptions in the IMF's annual Balance of Payments Arrangements publication.

For each of the five reform indexes and for their average, three variables were built: initial level at the beginning of the 5-years period, its squared value and the annual rate of change during the period.

- **Estimation procedures**

The iterative approach that was used to minimize the various shortcomings mentioned above is more akin to exploratory data analysis than standard econometric modelling. The methodology used to select among the various potential candidates for our preferred model was the following:

- (1) The procedure started with the specification of a first simple regression using the standard growth model and country specific dummies. The model included the following variables:
  - Initial income (the logarithm of per capita GDP at the beginning of each period measured in Purchasing Power Parity dollars);
  - Demography (the rate of growth of the population);
  - General index for human capital (captured indirectly by the share of the population without formal education);

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<sup>1</sup> The idea was to (i) regress GDP growth rate against its lagged values and contemporaneous and lagged value of change in fiscal balance or in export coefficient, then (ii) to regress the change in fiscal balance or the change in export coefficient against its lagged value and the contemporaneous and lagged value of GDP growth rate. Except for government consumption relative to GDP, the sole significant coefficients obtained for the focus variables were those of the first set of regressions (i). Simple regressions were run including the changes in fiscal balance and those in the share of domestic credit going to private sector. The relationship was found significant, but the correlation was low, indicating that the later variable was not strongly determined by the first one. Both were retained in the final specification.

- An indicator of the intensity of capital accumulation (the rate of investment);
- Natural resources endowment (approximated by the log of per capita GDP generated by natural resources-intensive sectors);
- International trade environment (the growth rate of the quantum of LDC exports to the industrialized countries).

The resulting equation explained 89% of the total variance. Note that, without giving too much an importance to this statistics, this is quite a high R<sup>2</sup> compared with the typical 0.5 mentioned by Temple (1999) for many of the world-wide cross-section regressions. The most significant variables were the initial income, with a negative coefficient and a t-statistic of -4.9, the average share of investment in GDP (positive, with a t-statistic of 4.4) and external demand (positive, with a t-statistic of 2.8). The other three variables were not significant.

(2) A more general model was selected to explain the remaining variance using the most significant variables within each group of institutional or policy variables consistent with both the theory and the empirical literature –in particular the reform indexes– and other key international environment variable, such as foreign direct investment or net transfer of resources. The screening process consisted of running a regression using the variables entering into each group, to identify the ones which could best explain the residual variance.

(3) A new model was built, including all the variables selected in (1) and (2). A selection process was initiated to obtain a parsimonious representation. The reform indexes –our main variable of interest– were spared from this testing down procedure.

(4) A sensitivity analysis was conducted on the resulting model to investigate the fragility of the parameterization and to retrieve omitted variables erroneously discarded during the previous steps. The test consisted in systematically including one by one all the previously excluded variables and checking to see if (i) the previously excluded variable had a significant coefficient when using the final model, and (ii) if coefficients of core variables were stable to the addition of other variables.

(5) Step (3) and (4) were reiterated until a stable specification was obtained.

Obviously, such procedures can be objected to as a refinement of what is called “data mining” in econometrics, and does not guarantee against spurious correlation. Yet this ad-hoc approach was a second best in our situation where (i) the real model was unknown, (ii) some of the potential variables were unobservable, and (iii) time and data constraints impeded exploring all the possible combinations of regressors as in the Sala-i-Martin (1997) or Ley and Steel (1999) procedures. Within these restrictions, this course of action reduces the risks, inherent in the path dependency of the selection procedure, of imposing unnecessary restrictions on the model within the limits imposed by the data set.<sup>2</sup> It respects also the transparency criteria set by McAleer et al.(1985).

Fixed effects were used to estimate the country dummies that ideally capture structural conditions determined by relevant variables not specified in the statistical model. Fixed rather than random effects were used for a number of reasons. First, it is probable that the error will be conditional to each country and not random. Fixed effects should capture the structural

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<sup>2</sup> Some potentially important variables were excluded on a priori basis, when the data base was built (e.g., political factors), others are implicitly included in the country specific dummies (e.g., cultural and geographical characteristics), but the procedure guarantees that all variables included in the data base are considered and that the specification retained is reasonably robust to various alternative specification within the data set.

characteristics of each country, and the probable problem of cross-country heteroskedasticity was taken care of by using GLS with cross section weights and computing heteroskedasticity-consistent standard errors. Second, the number of countries (17) makes our sample quite an exhaustive representation of the “universe” (in our case, the Latin American economies), therefore we do not need to adjust for random sampling effects (Judge et al. 1985, pp 942-963). Moreover, if on paper the random coefficient model is more flexible, it requires also better specified theoretical models than the alternative fixed effects model (Sayrs, 1989). Obviously this is not the case here and the results obtained under random effects would be more fragile.<sup>3</sup>

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<sup>3</sup> Intuitively, the random effects model gives more flexibility than fixed effects or common factor models to fit a well specified model to slightly divergent observations, considering that these deviations are due to random fluctuations. Yet, if the initial statistical model is ill-specified, the flexibility built into the estimation procedure may cause the regression to fail in discriminating between truly significant and insignificant variables.



### III. Econometric results

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The coefficients and statistics estimated for the final model are presented in the Table 2. Two sets of Reform Indexes were used. The first one is a single global indicator, equal to a simple average of the specific reform indexes; the second set includes each of the five structural reform indexes (commercial, financial, fiscal, privatization and capital account liberalization).

At this stage, a word of caution is required regarding the interpretation of the results. Pooling several countries into one sample has a very practical implication on the interpretation of the empirical research. The purpose is not only to explore whether one variable or another had an impact on growth, but also to test whether this impact was sufficiently significant for all countries and homogeneous among the respective countries to be captured by a single model, standard for all the countries. Obviously, this is a strong hypothesis, which is being questioned by a growing amount of empirical research, as in Durlauf and Johnson (1995). Therefore, if a variable did not pass the selection test, it would be wrong to conclude that it did not have any measurable impact at individual country level.

In the absence of any indication of the “true” model, the coefficients obtained for a specific “explanatory” variable may vary widely when using alternative specifications or estimation procedures. As a matter of fact, most quantifications of the contribution of specific variables found in the literature must be considered at best only as broad estimates, because practically no variable has been found robust to alternative specification (Sala-i-Martin, 1997). The individual significance of a particular variable in a regression may depend on the inclusion or exclusion of other variables. As stated by Levine and Renelt (1992), despite the fact that many indicators are significantly correlated with

growth, the cross-country statistical relationship between long-run average growth rates and almost every particular macroeconomic indicator is fragile.

**Table 2**  
**MODELING PER CAPITA GDP GROWTH RATE, 1971-1996<sup>a</sup>**

Variables \ Models		Average reform index	Sectoral reform indexes
LOG(YINIT t)	Per Capita income, beginning of period t	-10.040 (10.12)	-12.422 (11.33)
I_Y t*SEC t	Investment coefficient and secondary education, average for period t	...	0.009 (7.69)
I_Y t	Investment coefficient and secondary education	0.164 (4.51)	...
PR_Y t	Share of Primary sectors in GDP	0.180 (4.94)	0.199 (4.44)
AG_Y t	Share of Agricultural sectors in GDP	-0.216 (3.97)	-0.137 (2.28)
X_Y t	Export coefficient	-0.055 (3.42)	...
DX_Y t	Change in export coefficient	0.109 (5.92)	0.063 (2.25)
DXLDC	Change in LDC exports to DC	0.135 (7.91)	0.108 (4.58)
FDI t	Foreign Direct Investment	0.001 (2.89)	...
DFISC t	Change in fiscal balance	...	0.054 (2.02)
CREP_Y t	Credit to private sector as % of GDP	...	...
DCREP t	Change in share of private sector in domestic credit	...	0.020 (3.42)
M2_Y t	Liquidity ratio	...	...
RIN_M2 t	Share of external assets in M2	0.032 (7.57)	0.026 (11.45)
VTCR t	Real exchange rate variations	...	-0.031 (2.09)
IREME t	Average reforms: Initial index for period t	0.105 (0.68)	...
(IREME t) <sup>2</sup>	Squared initial index	-0.001 (0.70)	...
DREME t	Change over the period	-0.076 (3.77)	...
IRECO t	Trade reforms: Initial index for period t	...	-0.015 (0.96)
(IRECO t) <sup>2</sup>	Squared initial index	...	-0.000 (0.59)
DRECO t	Change over the period	...	-0.166 (10.71)
IREFI t	Financial reforms: Initial index for period t	...	0.046 (1.71)
(IREFI t) <sup>2</sup>	Squared initial index	...	-0.000 (1.59)
DREFI t	Change over the period	...	-0.003 (2.04)
IREPR t	Privatization: Initial index for period t	...	-0.054 (1.56)
(IREPR t) <sup>2</sup>	Squared initial index	...	0.000 (1.53)
DREPR t	Change over the period	...	-0.022 (6.88)
IRETR t	Fiscal reforms: Initial index for period t	...	-0.101 (4.96)
(IRETR t) <sup>2</sup>	Squared initial index	...	0.002 (6.57)
DRETR t	Change over the period	...	0.071 (4.89)
IRECA t	Capital reforms: Initial index for period t	...	0.201 (5.59)
(IRECA t) <sup>2</sup>	Squared initial index	...	-0.001 (5.50)
DRECA t	Change over the period	...	-0.006 (0.35)
	Adjusted R-squared	0.94	0.98
	Total Panel observations	75	84
	Standard Error of regression	1.13	0.99

**Sources:** see Annex 1.

<sup>a</sup> 17 countries, 5-year average from 1971 to 1990, 6-year from 1991 to 1996. Absolute value of "t" statistics in parenthesis.

**Method:** GLS with fixed effects (Cross Section Weights) with White Heteroskedasticity-Consistent Standard Errors.

Within the numerous restrictions stated above, we interpret our results as follows.

## A. Average reform index

The first specification used a global index of reforms. Two objectives were pursued here: first, to gain degrees of freedom in order to focus on non-reform variables; second to have an estimation of the net overall effect of structural reforms, on the principle that the total outcome might be more than the sum of the parts.

**Initial level of per capita income (YINIT)** has a significant and robust negative effect on the growth rate of per capita GDP. Note however that this variable is the level of income at the beginning of each five year period not the level in 1971. Thus this negative coefficient does not correspond to conditional convergence *stricto sensu*. (The conditional convergence hypothesis states that countries further from their long run steady state grow faster). The initial income at the beginning of the whole 1971-1996 period was introduced into the regressions but it proved to be insignificant in most regression runs or appeared with opposite sign (see Annex 2); thus we must look into other reasons. Considering that the income at the beginning of each period is the initial level of income in 1970 incremented by the accumulated past growth, the role of the "opening" income here more probably indicates some kind of partial adjustment behaviour (regression to mean trend), i.e. a sort of  $\sigma$ -convergence.<sup>4</sup>

**Physical capital accumulation (I/Y)** makes a significant contribution to the growth rate. According to the standard model, it allows for higher steady-state per capita income ( $Y^*$ ) and fosters growth during transition periods.

**Exports and the external market.** A dynamic international market for the exports of all developing countries (**DXLDC**) has a strong and robust positive effect on the growth rate. Furthermore even controlling for the dynamics of international markets, countries that had an increase in their export coefficient or export-led growth, (**DX\_Y**) tended to have higher growth. Nevertheless, this positive effect was only transitory or contingent. The export coefficient (**X\_Y**) by itself (i.e., considering levels and not variations) has a negative and significant impact on growth as opposed to the positive impact for the change in export coefficient. In other words, there was a growth penalty for structurally export oriented countries. The results obtained in Annex 2, when country specific initial conditions are substituted for fixed effects, may help to explain this result (traditional export oriented Latin American countries have small domestic market size and are more vulnerable to shocks).

**Primary Sector.** Economies led by a strong primary sector measured by (**PR\_Y**) tended to grow faster than the industry or service oriented ones. But apparently this positive effect came from mining and other extractive activities. Agriculture (including forestry and fishing) as a share of GDP (**AG\_Y**) has a negative and significant impact on growth. A priori, this outcome is more in line with traditional growth models that stressed resources endowments or with disequilibrium approaches centring on external constraints and goes against the approaches emphasising dynamic comparative advantages, because primary sectors activities are believed to be less favourable in terms of technological transfers.

**Foreign direct investment (FDI)** as could be expected, is positively related with growth, albeit the interpretation of this relation is neither robust to alternative specification (see Annex 2) nor, as we shall see, straightforward.

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<sup>4</sup> Partial adjustment accelerates the convergence of the cross-section towards its stochastic steady-state, a situation where the observed sample variance  $\sigma(t)$  has converged to its minimum (albeit non null) value (Quah 1995).

Associated with the result for FDI, a higher **share of external assets** as percent of broad money (**RIN\_M2**) has a positive impact on growth. This result is quite robust to alternative specifications and may be related to two types of interpretation. The first interpretation refers to the external dependence of the economies in the region, growth being determined by the inflow of foreign capital. A high ratio of foreign asset in the monetary base reflects the favourable impact of foreign capital inflows in lowering the hard currency restriction. The other interpretation is related to the style of macroeconomic policy, in particular a conservative supply of domestic credit to keep monetary aggregate in line with international reserve objectives.<sup>5</sup> It is difficult to differentiate between the two competing explanations, as neither domestic credit variables nor net transfer of resources were found to be robust and significant in alternative regression runs.

**Reforms.** According to the results the average level of reform (**IREME**) did not significantly affect growth. Neither the initial average index nor its quadratic value (**IREME<sup>2</sup>**) have significant coefficients. As we shall see, this seems to be so because the individual reforms have different and offsetting effects on growth. In interpreting this result we should bear in mind that we are looking at the direct growth effect of reforms, over and above whatever effect they may have through the other variables, such as investment, that also affect the growth rate.

While the reform indexes themselves did not seem to have much effect on the growth rate, the speed of reform (**DREME**) matters a lot. A strong and consistent result both for the aggregated reform index as well as for the component parts is that the more *rapid* the process of reform, the *slower* the growth rate, controlling for other variables.<sup>6</sup> This is consistent with a sort of “J-Curve” reaction in the growth process when some sectors are forced to contract, others to expand. When the reform process is very rapid, the destruction of firms accelerates and the overall growth rate of the economy declines.

## B. Disaggregated reform indexes

The second specification used disaggregated reform indexes to investigate the specific impact of each of the five reforms. We will confine our discussion to significant differences between this model and the model with the aggregate reform indexes since the general form and the variables that appear are quite similar. In particular the initial level of income, the investment ratio, the external environment, the growth of exports and the importance of the primary sector all appear in this regression with the same sign and significance that they had in the aggregate reform model. But there are some important differences or additions.

The first is the appearance of **human capital** as measured by level of education of the labour force. However measured, it was not robust in the previous model. Here we measured it as (**SEC**) the proportion of adults with secondary education or better. An interesting feature is that investments in physical and in human capital seem to interact. When entered separately both SEC and I\_Y have roughly the same coefficient (0.18 for secondary education, 0.16 for investment; the difference was tested not significant using the Wald test), thus both were combined to make a new variable (**SEC\*I\_Y**).<sup>7</sup> What is important here is that the variables seem to reinforce each other effects: the “t” statistics obtained for the combined physical and human capital indicators is much higher than those resulting from keeping them separated (7.7 versus 3.2 and 3.7, respectively).

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<sup>5</sup> This may explain why the volume of domestic credit going to the private sector showed a negative –albeit not robust– sign during the model selection process: a higher share of domestic credit, either public or private, reduces the relative weight of external assets in the money supply.

<sup>6</sup> In particular the macroeconomic indicators, because fast reform programmes may inspire much needed credibility to the stabilization packages implemented in particularly unstable countries (Paunovic, 2000).

<sup>7</sup> Similar combination between GDP and Schooling variables is used in Barro (1997).



Countries with a higher stock of human capital seem to take better advantage of their investment in physical capital.

Improving **fiscal balances (DFISC)** is positively associated with periods of higher growth. As mentioned above, when testing for exogeneity between growth and fiscal deficit, this effect seems to be genuine and not caused by higher growth itself. Nevertheless, the fiscal effect seems to be transitory in this model, because the level of fiscal balance (**FISC**) is not a significant variable here, after controlling for other variables. The last part of the sentence is important, because it would be wrong to imply that any level of fiscal deficit is compatible with sustainable growth, in particular when it creates an external disequilibrium.

Closely associated with the situation of the public finance, the change in the share of **domestic credit going to private sector** (relative to domestic credit)<sup>8</sup> (**DCREP**) has a positive impact on growth. Once again, this is only a transitory effect because this variable is not significant when considered in level. This unexpected result will be commented later when discussing the problem of the reforms of the financial sector.

Stable **real exchange rates** have a positive impact on growth. But the impact seems limited to the variance of the real rate, (**VTCR**) and not to its appreciation or depreciation (changes in the real exchange rates were not significant). Given that the real exchange rate is the product of nominal exchange rate variation and the inflation differential, the interpretation of this result is that the coherence of macro-prices (domestic prices and exchange rate) provides a positive context for growth.

Interestingly enough, no significant impact was found for other external sector indicators that were significant in the previous model, in particular export orientation and foreign investment. The impact of these variable is probably captured by the commercial and capital account opening indexes. Indicators of financial development (liquidity coefficient or financial savings as a share of GDP) did not appear to be serious candidates for explaining growth in the region.

Other variables that were introduced but did not survive the winnowing procedure described above are indicators of internal equilibrium such as the level of inflation. Its variance has a negative impact, but in the final model this effect is captured by the standard deviation of real exchange rate. In none of the tested model did the net transfer of resources appear to be a serious candidate to explain growth, something highly surprising when considering that periods of sustained growth coincide with a strong positive flow of external resources into the region (see table 1 again). This aspect is probably captured by the variable RIN\_M2.

In contrast to the predictions of the standard approach, the growth rate of the population did not significantly reduce the rate of growth of per capita GDP. This result is also consistent with other empirical researches on the impact of high fertility rates on per capita growth (Temple, 1999).

The insignificance of openness or structural financial factors is puzzling when considering long term growth model and goes against both theoretical models or many other empirical results. However they do agree with the Rodrik and Rodriguez (1999) conclusions on trade reform, and are also compatible with the cautious conclusion reached by Levine (1997). As we shall see infra when looking into the results obtained for the reform indexes, it seems that commercial and financial reforms in Latin America were not as successful as expected.

#### • **The Impact of Individual Reforms**

The main objective of this research was to examine the effect of specific reforms. As a matter of fact, this quest proved to be frustrating. The quantification of the direct contribution of reforms to

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<sup>8</sup> The volume of domestic credit going to private sector, as percentage of GDP, has a negative –albeit non significant– impact on GDP growth rate.

growth in Latin America is quite an elusive target. Perhaps that is because their contribution is marginal or nil. Another option is that reform effectiveness is highly conditional on a set of preliminary conditions. In this later case, indiscriminately pooling all countries in the same sample would lead to insignificant results. Thus our interpretation of the results presented below is as much conjecture as conviction.

In each case we have entered in the regression equation the value of the reform index and its square at the beginning of the period and the change in the index over each five year period.

- **Commercial (IRECO, IRECO<sup>2</sup>, DRECO).**

According to the results in table 2, trade liberalization and openness tend to negatively affect the rate of growth, holding all other factors constant. But the negative relationship with the level of trade reforms is not significantly different from zero, and is not robust to alternative specifications, while one observes a very significant negative impact of changes in the index (DRECO). At microeconomic level, we can think of two possible explanations for this result: either (i) opening domestic markets to foreign competition had a destructive impact on import substitution industries, not compensated by expansions in other sectors, or (ii) big bang approaches (high variation of the reform index) increased uncertainty level and led to non-optimal economic decisions.

Even if these negative impacts are short term in nature, the model could not capture any long term positive impact as far as trade reforms are concerned, contrary to the theoretical expectations that greater opening favours the diffusion of exogenous technical progress and more efficient resource allocation (albeit an alternative specification gives more positive results but on weaker statistical ground see Annex 2). In the same line, neither the export coefficient nor the export diversification index were serious candidates as consistently significant and positive explanatory variable during the model selection process. Export orientation and openness do not seem to have played any long term significant role in the region during the period under review, once one controls for other external trade sector variables such as external demand or hard currency availability.

- **Internal Financial Reform (IREFI, IREFI<sup>2</sup>, DREFI).**

Internal financial reform does not seem to have had any kind of significant result on the growth rate of the region. The initial level of reform has a weak positive influence on the rate of growth. But the effect does not appear to be significant. As with the commercial reform, changes in the reform index during the period (DREFI) are negative though barely significant. The short term negative effect is consistent with the Latin American experience with finance sector liberalization, many of which led to serious crises.<sup>9</sup>

- **Privatization (IREPR, IREPR<sup>2</sup>, DREPR).**

Privatization reforms appear to have no significant effect on the growth rate, but as with the first two indexes, the implementation of the reforms (DREPR) has a strong negative effect in the short run. Alternative specifications (see Annex 2) tend to suggest that the positive outcome are in the long term. A possible explanation for this result may be that the short term collateral positive outcomes (privatization giving greater credibility to the reform package) were captured by the macroeconomic variables and could not balance the fact that recently privatized firms may contract output and reduce employment in order to improve profitability and productivity. It may also be the case that extensive and bold privatization programs –as captured by a high rate of change in the

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<sup>9</sup> Remember that the indicator for volume of domestic credit to private sector was found to have a diffuse negative influence on the growth rate. In the region, most experiences of banking sector liberalization in the nineties led to a boom of credit for consumption and non tradable activities. In turn, the crises that followed the financial bubbles determined the pattern of stop-and-go growth which have been an unfortunate characteristic of Latin America during the nineties which severely limited the average growth rate (ECLAC, 2000).

reform index– might divert financial resources from other productive investments. It should be mentioned that the coefficient on DREPR was not always robust to alternative specifications.

- **Tax (IRETR, IRETR<sup>2</sup>, DRETR).**

Tax reforms are a special case in our regression equation. This is the only reform that shows increasing returns in the long term (initial level coefficient is negative and the squared value is positive). Both are also robust and significant. Even the short term effects (DRETR) are positive, significant and robust to alternative specifications. It would therefore appear that improving tax administration and reforming fiscal policy is a risk-free win-win strategy for boosting growth, both in the long and short run. One should however bear in mind that due to the relative weights of the negative and positive parameters and the low value of the index, the actual contribution of fiscal reform to growth must at best have been marginal on average of the countries during the most of the 1970-1996 period. Using the coefficients in the table, the break even point where further reform has a positive net impact on growth is around the 60 mark on the scale of the fiscal reform index, a level not reached by most countries until the late 1980s. Obviously, because of the variance of the estimated parameters, this data is just illustrative.

- **Capital account (IRECAP, IRECAP<sup>2</sup>, DRECAP)DRECAP).**

The results obtained for capital account reforms go against the widely accepted opinion that capital opening was adverse to growth in LAC countries. Yet, once other macroeconomic environmental variables are controlled (for example the level of net reserves and the variance in real exchange rate), the initial level of reform on capital account has a positive and quite important influence on the rate of growth considering the average value observed for this index. Long term positive effects seem to reach a peak as indicated by the negative sign found on IRECAP<sup>2</sup>. (The inflection point is at an index value of around 67). Note that even with diminishing returns reflected in the negative sign on IRECAP<sup>2</sup>, the net impact of this reform is positive for all index values inside the 0-100 domain. Also note that as opposed to financial liberalization, there is no significant short term negative impact from the implementation of the reform despite the increased vulnerability to short term capital flows that may have resulted.

At first glance, this result may appear puzzling if one considers the kind of consensus against capital account liberalization that seems to be emerging in the region. Nevertheless, one has to keep in mind that this result holds only when controlling for other variables, and indirectly capture the favourable impact of foreign direct investment<sup>10</sup> while the other macroeconomic variables (foreign assets as a share of money supply and real exchange rate stability) filter-out the potentially destabilizing effect of short term capital flows (CEPAL, 1995).

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<sup>10</sup> This variable was significant in the previous model, when reform indexes were not disaggregated.



## IV. Conclusions

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We now summarize the results of our econometric exercise with respect to six different classes of variables: standard growth model variables, initial structural conditions (see Annex 2), macro policy variables, external orientation or conditions, sectoral orientation and structural policy reform variables.

In the absence of clear indication of the “true” theoretical model, the coefficients obtained for a specific “explanatory” variable may vary widely when using alternative specifications or estimation procedures, rendering any precise quantification of the true contribution of the control variable to the total growth (e.g., via the computation of semi-elasticity) a futile exercise. Even if we took reasonable precautions to limit the risks that were controllable within the available data set, the present exercise should be thought of as nothing more than an exploration of the potential relationship between growth and a sub-set of control variables. Inferring the relative quantitative contribution of each variable to total growth or building a simulation model based on the estimated coefficients would be highly hazardous.

1. **Standard growth model variables and initial conditions:** The standard econometric growth model starts with the investment share, measures of human capital and population growth as determinants of  $Y^*$  and adds the initial level of income as a test of convergence. In line with the literature we find that the investment share raises the short run growth rate and the share of adults with little education lowers it. Furthermore there is evidence of a positive feedback between the level of education and capital formation. That is, the growth rate is higher for a given level of capital formation the better educated is the

population. Population growth did not prove to be significant in our final model estimations. As to the initial level of income at the beginning of the 1970s, instead of being negatively related to growth, it turned out to be positively related. That says that there was divergence rather than convergence over time. But, while the level of income in the early 1970s was positively related to growth, the level of income at the beginning of each five year period was highly significant and negative. Countries with a high level of income in relation with their potential output at the beginning of a period tend to grow slowly and vice versa. This reflects the importance of reversion to the mean growth rate proper to each country or cluster of countries ( $\sigma$ -convergence).

There are some other structural conditions set at the initial level around 1970 which have a significant effect on relative growth rates (see Annex 2). The first is country size. Other things equal, bigger countries tend to grow faster than small ones and the effect is highly significant and robust.

2. **Macro-and macro policy variables:** Our results strongly support the positive contribution of macroeconomic policy variables and prudent policy management to economic growth. Other things equal, countries grow faster when they have low fiscal deficits and stable real exchange rates. Note that the relative level of the real exchange rate did not survive in the fixed model. Rather it is fluctuations in the rate that matter (negatively). Changes in relative prices, inflation and sharp fluctuations in the nominal exchange rate make planning harder, investment more uncertain and according to our results, reduce the growth rate. In all models, the ratio of foreign assets to money is consistently related to growth. Several theoretical approaches compete to explain this effect, but all converge to the same practical recommendations. That variable may either reflect the positive effect of cautious monetary expansion, the importance of strong backing for the domestic currency or the favourable impact of hard currency inflows on the foreign exchange constraint. In any one of the three cases, the variable seems to be a good measure of prudent monetary policy, and it has a robust, positive effect on the growth rate. Financial deepening, measured by M2/Y is positively (but weakly) related to growth, and this indicator has competing interpretation in terms of macroeconomic stability (see page 15). Given the financial repression literature, we thought that a companion measure –the share of total domestic credit going to the private sector– would also be an important contributor to growth. But it did not add much to the other financial variables in the model.

3. **External variables:** Changes in the international market for developing country exports had an important positive impact on average growth rates. And, controlling for the growth of the overall market for LDC exports, countries in which the export share grew more rapidly registered higher growth rates. But it is important to note that neither the export share itself nor any other measure of outward orientation was significantly related to higher growth rate, at the contrary. Faster growing countries were those in which the share of exports was growing, although perhaps from a small base.

4. **Sectoral variables:** We included a number of other possible structural variables which differ both between countries and over time. Two turned out to be robust and significant: the share of primary products and agriculture in GDP. The primary product share is positively related to growth and the agriculture share is negatively related, in contrast to the results obtained for initial (1970) conditions (see Annex 2). That tells us that it was a dynamic advantage to have a big mining or petroleum sector.

5. **Structural reform variables:** The main purpose of this econometric exercise was to attempt to isolate the effect of structural reforms on growth after accounting for all the other factors that also have an impact on that variable. There are four main findings:

- a. In the aggregate (average reform index), the reforms did not have a significant direct impact on the growth rate. That seems to be because the different individual components of the reform package have offsetting effects. In interpreting this result one should bear in mind that we are looking here at the effect of the reforms on growth after accounting for other factors such as investment, macro policy and so on that also influence the growth rate. Our result suggests that if the reforms had a strongly positive effect on growth, it must be mainly through these other variables rather than in addition to them. A review of both the successful and aborted stabilization attempts in the 1980s and early 1990s tends to support the hypothesis that structural reforms were very instrumental in determining the successful outcome of macroeconomic stabilization programmes (Paunovic, 2000). Reforms had also a positive impact on investment in some countries (ECLAC, 2000; Stallings and Peres, 2000).
- b. While the reform indexes themselves did not seem to have much effect on the growth rate, the speed of reform matters a lot. A strong and consistent result both for the aggregated reform index as well as for the component parts is that the more *rapid* the process of reform, the *slower* the growth rate. There is a sort of “J-Curve” reaction in the growth process, and gradualism in the adoption of reforms permits a smoother and less destructive reassignment of resources.
- c. Only two of our five reforms have a robust and significant direct impact on growth-tax reform and capital account liberalization. Tax reform has an increasingly positive impact on growth throughout the relevant range of reform. Capital account reform also raises the growth rate, but only up to a certain degree. The other reforms, in particular trade reform, do not seem to have a robust or significant impact on the growth rate, beyond what effect they may have through the other variables in the model.
- d. The relationship between reforms and growth is probably non-linear. In some cases there are increasing and in some cases decreasing returns to reform. Not including non-linearities when running reform-growth regressions can lead to the possibly erroneous conclusion that because a particular reform is positively related to growth, one should push on with the reform process regardless of the level of reform already reached. We found this to be particularly true in the case of capital account liberalization. In the same vein, the negative, albeit not always significant, sign observed for the quadratic variable representing the average reform index speaks against adopting a passive “wait and see” attitude or pushing for “an intensification of reforms along the dimensions already implemented” recommended in some previous studies. Rather than waiting for miracles when reforms mature, a cautious “reforming the reforms” approach seems to be a better strategy (Ffrench-Davis, 1999).
6. **Methodology.** Even if our data set accepted quite well the use of a single “Barro type” growth equation to model the output motion of LAC countries, the results are more disappointing if one considers the particular impact of reforms. This is particularly striking and has important implications in terms of policy making: understanding how and when reforms work is necessary if one wants to design a successful policy package. The documented weakness of cross-country estimation procedures, either because of model uncertainty or because of the underlying hypothesis of country homogeneity calls for further research trying alternative quantitative methodologies.
- a. Our standard theoretical model states that reforms influence growth by augmenting  $Y^*$ , the steady-state level of income. In this framework, the influence is direct. As we mentioned, it is probable that during the crisis and post-crisis period, the main influence of reform was indirect, either through its effects on macroeconomic stabilization or in promoting the recuperation of productive investment. In this context, starting from a simultaneous equation specification would be more appropriate.
- b. The impact of standard growth variables seem to be much more homogeneous across countries than the output response to structural reforms. A direction for future work would be

to acknowledge this heterogeneity and attempt to identify why countries differed in their response to reforms. Country-case studies should be the basis for identifying potentially relevant variables and distinguishing success stories from failures. In a second step, variance analysis could be used to pin-point more consistently the critical factors explaining these divergent outcomes. Once a homogeneous subsets of countries have been identified, traditional econometrics could then be used to parameterize growth equations on these clusters. Alternatively, these split-variables could be used in endogenous data sorting procedures such as regression trees to break up the countries into homogeneous sub-sets.



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## **Annex**

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## Annex 1 Variables Used In Regressions

Variable \ Codes	Variable	Change in Variable	Source
<b>National Accounts</b>			
GDP, national currency at constant prices	YT	DYT	ECLAC
Population, millions	POB	DPOB	ECLAC
Per Capita GDP national currency at constant prices	YC	DYC	ECLAC
Per Capita income, international dollars at PPP (beginning of each period).	YINIT	...	Penn World Tables
Fixed Investment, % of GDP (constant prices)	I_Y	dI_Y	ECLAC
Share of agriculture, forestry and fishing in total GDP, constant prices	AG_Y	dAG_Y	ECLAC
Rural population (% of total)	RUR	DRUR	ECLAC
Share of primary sectors (agriculture, forestry, fishing and mining in total GDP, constant prices)	PR_Y	dPR_Y	ECLAC
<b>Trade</b>			
Total Exports of Developing Countries (constant prices)	XLDC	DXLDC	IMF
Export Coefficient, % of GDP at constant prices (goods and services)	X_Y	dX_Y	ECLAC
Import Coefficient, % of GDP at constant prices (goods and services)	M_Y	dM_Y	ECLAC
Trade Coefficient, % of GDP at constant prices (goods and services)	XM_Y	dXM_Y	ECLAC
Trade Deficit, % of GDP at constant prices (goods and services)	COM		ECLAC
Export Concentration (percentage share of the ten leading products)	COX	DCOX	ECLAC
Trade Balance, % of GDP at current prices (goods and services)	BCOM	DBCOM	IMF
<b>Financial Deepening Indicators</b>			
Money and Quasi-Money (M2), % of GDP current prices	M2_Y	dM2_Y	IMF
Quasi-Money, % of GDP current prices	CUA_Y	dCUA_Y	IMF
Net Foreign Assets, % of M2	RIN_Y	dRIN_Y	IMF
Claims on Private Sector, % of Total Domestic Credit	CREP	DCREP	IMF
Claims on Private Sector, % of GDP at current prices	CREP_Y	dCREP_Y	IMF
<b>Macro Indicators</b>			
Government consumption, % of GDP (constant prices)	GC	DGC	ECLAC
Fiscal balance of general government, % of GDP (current prices)	FISC		IMF
Rate of inflation (consumer price index, December to December)	INF	DINF	IMF
<b>Reforms</b>			
Commercial Reforms	RECO	DRECO	Morley et al. (1999)
Finance Reforms	REFI	DREFI	Morley et al. (1999)
Fiscal Reforms	RETR	DRETR	Morley et al. (1999)
Privatization	REPR	DREPR	Morley et al. (1999)
Capital Account liberalization	RECA	DRECA	Morley et al. (1999)
Average Reform Index	REME	DREME	Morley et al. (1999)
<b>Shocks</b>			
Effects of the Terms of Trade, weighted by the export coefficient	ETI		ECLAC
Net Transfer of Resources, % of total exports (current prices)	TNR		ECLAC
<b>Physical and Human Capital</b>			
Non residential capital stock per worker in dollars, 1985 price.	KNRES	DKNRES	Penn World Tables
Foreign Direct Investment (millions of dollars)	FDI	DFDI	ECLAC
Share of Labour Force without Formal Education	NOSCH	DNOSCH	Lee and Barro (1997)
Share of Labour Force with Primary Education	PRIM	DPRIM	Lee and Barro (1997)
Share of Labour Force with Secondary Education	SEC	DSEC	Lee and Barro (1997)
Share of Labour Force with Higher Education	SUP	DSUP	Lee and Barro (1997)

**Note:** 1971-1996 times series divided in five years intervals 1971-75, 1976-80, 1981-85, 1986-90, and 6 years for 1991-1996.

## Annex 2 Results Obtained From Alternative Statistical Models

Alternative specifications were used to further investigate the robustness of the results presented in table 2 and identify influential variables not retained in the model. Two alternative specifications are presented here, one substituting fixed effects for initial conditions, the other dropping the partial adjustment variable (**YINIT**).

- **Model with country-specific initial conditions**

The fixed factors do not provide information on what kind of structural conditions might cause a higher or lower intrinsic propensity to growth. We substituted fixed effects for a common factor plus the average value for the first 5 year period (1971-1975) for the following variables: *country size* (measured by population), *per capita income*, *stock of non residential capital per worker*, *level of education* of the adult population, *economic size of public administration* (measured by public consumption in relation to GDP), *degree of urbanization*, *deepness of the financial sector*, *openness*, *export orientation* and *diversification*. (See table A2.1)

Starting with the variables identified in the fixed effect specification for either the average or desegregated reform indexes, a sequence of variable addition and selection based on “t” values was then applied to reduce this model to a parsimonious and stable specification.

The most unexpected result in these regressions is that the sign on (**YINIT**<sup>0</sup>) is positive and significant. Thus there is no sign of (conditional) convergence between rich and poor countries in Latin America and the Caribbean. Also size matters (See the positive, significant coefficient on **POB**). Being a large country or a rich one at the beginning of the 1970s improved the probability of achieving higher growth rates over the period of analysis. This empirical evidence on size coincides generally with the literature on the subject.<sup>11</sup> Low educational levels, represented by the share of persons without formal education, (**NOSCH**<sup>0</sup>) reduced the growth potential of the countries considered. Contrary to what was obtained (See table 2) the signs on **PR\_Y**<sup>0</sup> and **AG\_Y**<sup>0</sup> are negative and positive respectively, and both are significant.

In the disaggregated reform regressions, the primary and agricultural share variables become insignificant when replaced by the share of the rural population. This result is puzzling, not only because it contradicts some endogenous growth approaches (urbanization creates economies of agglomeration) but also because, according to our data set, in the Latin American context of the early 1970s, rurality meant also small, uneducated and poor countries. This rural variable does not appear to be a proxy for other productive characteristics: Substituting the share of the rural population for the weight of the agricultural sector or primary sectors in the total GDP does not lead to significant results. This variable may capture some non economic characteristics not included in our data base. In any case, the influence of this variable has been decreasing with time: Substituting initial values for period averages leads to a weaker and not significant coefficient.

- **Other variables.**

This regression equation confirm the role of macroeconomic-related variables. The level of fiscal balance enters as a significant (positive) variable. The coefficient on the share of credit going to the private sector is higher and the impact of volatility of the real exchange rate is larger. A higher financial government surplus (or a lower deficit) increases growth prospects, fiscal balance being (weakly) exogenous with respect to GDP growth, according to the data set. The effect of improving the fiscal balance, which was only temporarily significant in the fixed effects model of table 2, appears to be durable in the initial conditions specification. A new variable entering the

<sup>11</sup> “The higher GDP and productivity growth rate for large countries is a historical fact”, in Perkins and Syrquin, (1989). See also Damijan (1997), Salvatore (1997) or chapter 11 in ECLAC (2000).

regression in table 1 is the amount of credit going to the private sector. Since this is the only case where this variable was found to be significant and positive, this result must be accepted with caution.

- **Average Reform Index**

The level of reforms, which was positive, but insignificant in the fixed effect specification, appears to be somewhat more significant, especially its quadratic term, which is negative, suggesting positive but diminishing returns to reform. Note that, as in the fixed effect model, there is a negative shock effect from reforming rapidly.

- **Dissagregated Reform Indexes**

With the important exception of the rate of change in capital account liberalization, the results obtained with the initial conditions model do not differ appreciably from those of table 2. The case of the speed of opening the capital account is the only one where the two models differ notably. That variable was negative and insignificant in the fixed effects model, but here it is positive and significant.

- **Model without initial income**

In the model presented in table 2, income at the beginning of each five year period was always very significant, thus this variable was systematically retained in all the sensitivity analysis that were applied. Out of curiosity, an alternative model without this partial adjustment mechanism was estimated. (See table A2.2) For the most part the results for the macro and structural variables are the same as they were in table 2. Investment, human capital, export orientation, international reserves and FDI all have roughly the same sign and significance that they had in our first model. But there are differences.

One that is puzzling is the share of primary products and rural population. Here the share of agriculture in GDP was insignificant, but the rural population share is positive and highly significant which it was not in the other regressions. One possible explanation for this result is that the trend evolution of the rural population share, which declines regularly over time, is spuriously capturing part of the negative coefficient observed for initial income (YINIT) at the beginning of each five-year period (Per capita income is a variable that increases over time and is comparatively lower in rural-oriented countries).

Of particular interest to us is the comparison of results for the relationship between the reform indexes and growth. Here there are several important differences. First of all the average reform index now has a far larger and more significant positive impact on growth than it did in table 2. Second, the speed of reform which was highly negative and significant before is still negative, but now it is insignificant. The reasons for these results for the average reform index can be found in the changes in the roles of several of the individual reforms. The most important is trade reform. It now has a positive and highly significant effect on growth.

Without including YINIT in the regressions, the results show a positive influence of reforms on growth. This means that (1) our data set is compatible with the positive results obtained by some of the previous author revised in part I; (2) these positive results are obtained only because the model is misspecified –i.e., a zero-coefficient restriction is imposed a priori on the initial income, yet our paper shows that this is a very strong restriction which is not supported by either growth theory or by the results obtained from the statistical model.

**Table A2.1**  
**MODELING PER CAPITA GDP GROWTH RATE, 1971-1996 RESULTS OBTAINED**  
**FOR INITIAL CONDITIONS MODEL<sup>a</sup>**

Variables \ Models		Average reform index	Sectoral reform index
C	Constant	32.985 (4.74)	-9.452 (0.98)
LOG(POB 1971-75)	Average 1971-75 Population	...	2.144 (7.17)
LOG(YINIT 1971-75)	Average 1971-75 Per Capita income	2.177 (1.91)	4.897 (3.68)
NOSCH 1971-75	Average 1971-75 Actives without formal education	-0.027 (3.51)	-0.081 (5.32)
RUR 1971-75	Average 1971-75 Rural population	...	0.063 (2.32)
PR_Y 1971-75	Average 1971-75 Share of Primary sectors in GDP	-0.292 (3.66)	...
AG_Y 1971-75	Average 1971-75 Share of Agricultural sectors in GDP	0.172 (2.37)	...
LOG(YINIT t)	Per Capita income, beginning of period t	-6.295 (5.12)	-7.387 (7.08)
I_Y t	Investment coefficient	0.042 (1.15)	0.103 (3.30)
PR_Y t	Share of Primary sectors in GDP	0.192 (2.58)	0.085 (1.78)
AG_Y t	Share of Agricultural sectors in GDP	-0.211 (2.51)	...
X_Y t	Export coefficient	-0.031 (3.29)	...
DX_Y t	Change in export coefficient	0.104 (2.17)	0.083 (2.21)
DXLDC	Change in LDC exports to DC	0.170 (7.10)	0.084 (2.48)
FDI t	Foreign Direct Investment	0.001 (2.07)	...
FISC t	Fiscal balance	0.083 (2.87)	0.150 (3.63)
CREP_Y t	Credit to private sector as % of GDP	0.047 (2.82)	...
DCREP t	Change in share of private sector in domestic credit	...	0.037 (4.27)
M2_Y t	Liquidity ratio	...	0.054 (2.37)
RIN_M2 t	Share of external assets in M2	0.028 (4.33)	0.015 (3.63)
VTOR t	Real exchange rate variations	-0.097 (4.90)	-0.105 (4.92)
IREME t	Average reforms: Initial index for period t	0.134 (1.47)	...
(IREME t) <sup>2</sup>	Squared initial index	-0.001 (1.82)	...
DREME t	Change over the period	-0.074 (2.42)	...
IRECO t	Trade reforms: Initial index for period t	...	-0.026 (0.90)
(IRECO t) <sup>2</sup>	Squared initial index	...	-0.000 (0.55)
DRECO t	Change over the period	...	-0.085 (4.38)
IREFI t	Financial reforms: Initial index for period t	...	0.030 (1.03)
(IREFI t) <sup>2</sup>	Squared initial index	...	-0.000 (1.17)
DREFI t	Change over the period	...	0.001 (0.89)
IREPR t	Privatization: Initial index for period t	...	0.026 (0.63)
(IREPR t) <sup>2</sup>	Squared initial index	...	0.000 (0.06)
DREPR t	Change over the period	...	-0.028 (5.92)
IRETR t	Fiscal reforms: Initial index for period t	...	-0.073 (1.96)
(IRETR t) <sup>2</sup>	Squared initial index	...	0.001 (3.10)
DRETR t	Change over the period	...	0.039 (2.50)
IRECA t	Capital reforms: Initial index for period t	...	0.222 (5.18)
(IRECA t) <sup>2</sup>	Squared initial index	...	-0.002 (4.72)
DRECA t	Change over the period	...	0.051 (2.70)
	Adjusted R-squared	0.89	0.89
	Total Panel observations	75	84
	Standard Error of regression	1.26	1.18

Source and method: See Table 2, page 22.



**Table A2.2**  
**MODELING PER CAPITA GDP GROWTH RATE WITHOUT INITIAL INCOME EFFECT 1971-1996<sup>a</sup>**

Variables		Average reform index	Sectoral reform index
L_Yt	Investment coefficient and secondary education	0.121 (2.32)	...
PRIMt	Primary education	0.103 (3.05)	...
PR_Yt	Share of Primary sectors in GDP	-0.152 (3.06)	...
RURt	Share of rural population	0.250 (6.39)	0.172 (4.66)
X_Yt	Export coefficient	-0.121 (5.39)	-0.105 (3.15)
DX_Yt	Change in export coefficient	0.107 (3.80)	0.143 (6.15)
DXLDC	Change in LDC exports to DC	0.292 (21.15)	0.290 (14.75)
BCOMt	Trade balance as % of GDP	0.292 (4.89)	0.131 (4.38)
FDIt	Foreign Direct Investment	0.001 (1.95)	...
CREP_Yt	Credit to private sector as % of GDP	...	-0.081 (5.31)
M2_Yt	Liquidity ratio	...	0.089 (3.78)
RIN_M2t	Share of external assets in M2	0.032 (4.15)	...
VTcRt	Real exchange rate fluctuations	-0.062 (4.87)	-0.140 (7.55)
DTcRt	Change in real exchange rate (a positive variation means a depreciation)	...	-0.034 (1.71)
IREMEt	Average reforms: initial index	0.423 (1.85)	...
(IREME <sup>2</sup> )	squared initial index	-0.003 (1.71)	...
DREMEt	change over the period	-0.050 (1.62)	...
IRECOt	Trade reforms: initial index	...	0.052 (3.91)
(IRECO <sup>2</sup> )	squared initial index	...	-0.001 (5.20)
DRECOt	change over the period	...	-0.223 (10.34)
IREFIt	Financial reforms: initial index	...	0.017 (0.61)
(IREFI <sup>2</sup> )	squared initial index	...	0.000 (0.62)
DREFIt	change over the period	...	0.001 (0.87)
IREPRt	Privatization: initial index	...	-0.104 (2.48)
(IREPR <sup>2</sup> )	squared initial index	...	0.001 (2.82)
DREPRt	change over the period	...	-0.036 (5.07)
IRETRt	Fiscal reforms: initial index	...	0.044 (1.18)
(IRETR <sup>2</sup> )	squared initial index	...	0.001 (1.96)
DRETRt	change over the period	...	0.057 (9.12)
IRECAt	Capital reforms: initial index	...	0.257 (6.39)
(IRECA <sup>2</sup> )	squared initial index	...	-0.002 (5.75)
DRECAt	change over the period	...	0.098 (6.43)
	Adjusted R-squared	0.91	0.93
	Total Panel observations	75	84
	Standard Error of regression	1.44	1.34

Sources and method: See Table 2, page 22.





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