ECONOMIC GROWTH AND INEQUALITY IN LATINAMERICAN COUNTRIES: SOME EMPIRICAL FINDINGS♠.

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Abstract: This paper explores the connection between inequality and economic growth. First, it designs an endogenous theoretical model of economic growth that predicts a quadratic relationship between the degree of inequality and the growth rate of the economy.

In addition, we test the theoretical model empirically employing a panel data encompassed by a representative sample of Latin-American economies from 1975 to 1995. Our results support the existence of a quadratic relationship between the income inequality (proxied by the Gini index) and the rate of growth of the economies. Moreover, the empirical evidence underlies the necessity of an important investment in infrastructure in less developed countries, absolutely essential to obtain the "social capacity" (Abramovitz, 1986) necessary to foster the growth rate of income.

1. INTRODUCTION.

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The study of economic growth has experienced a resurgence of interest in the last decade. This interest is based on the recent approaches developed by Romer (1986) and Lucas (1988). In contrast with the results claimed by the neoclassical models of economic growth, the new models predict a positive growth rate of real GDP per capita endogenously. This "New Theory of Economic Growth" is mainly concerned about the determinants of per capita income growth, and the ways whereby the policy maker may alter it.

The new theories support the idea of a wide concept of capital -human capital, infrastructure, public expenditure, technological capital and so for- acting as the driving engine of growth-. In the empirical field, many papers have attempted to determine the main sources of growth using cross-section or panel data for large sample of countries Regarding some of these determinants, several debates have taken place on the impact of income inequality on economic growth.

Indeed, the role of inequality in the growth process has for long been a topic of intense debate. Although this debate has provided rich insights into the relationship between inequality, public expenditure and growth, there is very little empirical analysis of the issue, partly because of the lack of a conceptual design and a succinct testable hypothesis. However, recent developments in growth theory provide a conceptual framework for analysing the impact of inequality on economic growth.

This study concentrates on the Latin American experience during the period 1975-1995. Section 2 surveys the main contributions on the influence of inequality on the growth rate of real per capita GDP. Section 3 describes a theoretical model linking public capital, inequality and growth. Section 4 explains the data employed in the empirical analysis; section 5 describes the regression results, and section 6 concludes.

2. INEQUALITY AND GROWTH.

There is no consensus about the existence of a positive or negative relationship between income inequality and economic growth. In other words, does inequality increase o reduce the rate of economic growth? The direction of the causality is unclear, as well: does more inequality enhance/weaken the growth of output; or is it the growth of output that makes income per capita more equally/unequally distributed?

The reasons why more inequality may foster growth may be summarized as follows:

The *Kaldor's hypothesis* poses that the marginal propensity to save of the rich is higher than that of the poor. Hence, if the growth rate of GDP is related to the saving rate of the economy, more unequal economies are likely to grow faster. A second reason why inequality may enhance growth is related to *investment indivisibilities*: investment projects -in particular in their setting up- often involve large sunk costs. If stock markets are not efficient, wealth needs to be sufficiently concentrated in order for an individual to be able to cover such large sunk costs and therefore initiate a new industrial activity. Another argument has to do with the traditional point of view in economic theory based on the *incentive considerations*. It basically claims that too equal societies do not provide enough incentives for people to undertake risky activities, since their level of welfare is already sufficient.

Recently, the view that inequality is growth enhancing has been challenged by some empirical studies. These papers find a negative correlation between the average rate of growth and a number of measures of inequality using cross-country regressions of GDP growth and income inequality measures.

For instance, Alesina and Rodrick (1994) regress the average of growth rate over 1960-86 on the Gini coefficient of income and land around 1960. They find out that greater inequality in the distributions of income and land appears to slow down economic growth. Perotti (1996), Person and Tabellini (1994) find a positive impact of a measure for equality on growth.

In addition to the evidence that a more equal income distribution is beneficial to growth, the empirical literature also provides insights as to the channels through which inequality affects economic growth.

Perotti (1993) emphasises the role of credit constraints. He finds that greater credit availability has a positive and significant effect on the growth rate. Moreover, the impact of credit availability on growth is bigger in countries with more unequal income distributions.

There are also some studies that present the role of macroeconomic volatility as the transmission mechanism between inequality and growth. Income inequality is found to be positively correlated with volatility. Alesina and Perotti (1996) maintain that casualty runs form high inequality to political instability which in turn results in macroeconomic volatility and less growth.

In a recent paper, Aghion, Caroli and García-Peñalosa (1999) point out macroeconomic volatility entailed by inequality might affect economic growth negatively. On the other hand, Barro (1999) finds some evidence for the fact that, although there is a weak relationship between income inequality and the rate of growth and investment, higher inequality tends to retard growth in poor countries and encourage growth in richer places.

On the reverse causal relationship from growth to inequality, the early literature on the evolution of income inequality over the process of development used to be described by the so-called *Kuznets hypothesis*. Using both cross-country and time series data, Kuznets found an inverted U-shaped relation between income inequality and GNP per head. That is,

the lowest and the highest levels of GNP per capita were associated with low inequality while middle levels were associated with high inequality. This result was interpreted as describing the evolution of the distribution of income over the transition from a rural to an industrial economy: income inequality should increase during the early stages of development (due to urbanization and industrialization) and decrease later on (as industries would already attract a large fraction of the rural labor force). The 1970's Kuznet's prediction seemed to be true for most of the OECD countries for the first and middle decades of the XX century (Barro, 1999). However, the downward trend in inequality experienced by these economies in the 20th century has reversed sharply. The rise in inequality shows that, as industrialization goes on, it is not necessarily the case that the income and wage distribution should become less unequal. Therefore, as the recent experience of many OECD countries shows, we could say that growth and economic development do not necessarily bring about a reduction in inequality.

Barro (1999) shows that Kuznets' curve emerges as a empirical regularity in the data although it can not explain the bulk of variations in inequality across countries over time. However, Dollar and Kraay (2000) find empirical evidence suggesting that there is no apparent tendency for growth to be biased against poor-income households at early stages of development.

Finally, Aghion, Caroli and García-Peñalosa (1999) claim that growth during the past 20 years has been closely associated with three phenomena: trade liberalization, technical change and the emergence of new organizational forms. These three factors are key components of the growth process, and they pose that these have had the effect of widening the earnings distribution.

As far as the impact of inequality on growth is concerned, the evidence arises mainly from cross-country regressions. It is well known that these are subject to a number of limitations. Moreover, on the effect of growth on inequality, the recent empirical literature has focused on the experience of developed economics (although the mechanisms explored

may also be at work in less developed countries (LDC)). Therefore we want to complement the available evidence with some research regarding the analysis in LDCs. In particular we test the relationship between inequality (proxied by the Gini index), infrastructure and economic growth in a representative set of Latin-American economies using panel data during the period 1975-1995.

This econometric approach captures possible idiosyncratic differences in growth rates by means of individual effects. Furthermore, panel data allows to work with many more degrees of freedom than time series or cross section data, to control for omitted variables bias and to reduce the problem of multicollinearity, hence improving the accuracy of parameter estimates.

3. A STYLIZED THEORETICAL MODEL OF INFRASTRUCTURE AND GROWTH.

This section will design a simplified model that intends to provide a consistent benchmark for the empirical analysis that will be presented further off in the paper. The main message of the model is the justification of a positive connection between infrastructure, equality and economic growth. However, an important point that should be kept in mind is that this relationship is not necessarily positive for all feasible amounts of expenditure but rather, within a certain range of a particular government size. As it has been discussed above, and although the topic is not by any means devoid of controversy, it seems reasonable to argue that a larger stock of public capital and a higher level of equality among the population brings about more economic development. However, this link is true only up to a certain point: since the government has to raise distortionary taxes in order to finance both public capital and social security programs, an undesirable large tax burden will exert a crowding out effect on the economy. Thus, it may well be the case that the relationship between the size of the government and the rate of growth is quadratic, as was insightfully pointed out by Barro (1990).

As a matter of fact, the role of the state in the economy is one of the most controversial issues among economists and politicians. There is now a certain consensus, however, in that the blind belief in the state as a wise, benevolent agent – very much accepted while the keynesian paradigm permeated mainstream economics - has been replaced by a more skeptical approach towards the government. It is not at all clear that bureaucrats seek common good or even that they know how to implement the best policies to achieve it. In other words, the invisible hand of markets seems to be superior to the visible, perhaps too clumsy, hand of the government. This point is specially important for LDCs, particularly of the Latin America area. This is, perhaps, one of the regions in which the active role of the state has been more fervently advocated, not only on keynesian grounds but also as a result of the – now decadent - development theories of the 50s and 60s (Rosenstein-Rodan, Hirshman and Myrdal)[1].

It seems, thus, that a more balanced view of the role of the state in the economy will be to claim that the public sector is necessary for a country to succeed since there are activities that can not be supplied by the market but, at the same time, it is not generally true that a large state is optimal. In fact, probably what matters is the quality of the government rather that is size, although of course the former is difficult to measure. In any event, it is clear that too large a government harms the economy via distortions, crowding out of private activity, and encourages the proper environment for undesirable activities as corruption and rent seeking to flourish.

Now lets move on to some aspects in which the public activity may be beneficial for the economy. Perhaps two of the more obvious ones are the following, (precisely those that encompass the goal of this paper): the provision of public capital and the correction of inequality. As far of the first of these two aspects are concerned, public capital has been traditionally considered a public good. Of course, different categories of it can be subject to various degrees of non-rivalry or non-excludability, but in general it is accepted that they should be supplied by the state. On the other hand, one of the main goals of fiscal policies is

[1] For an excellent review and criticism of these theories, see Krugman (1994).

a redistributional task among the different economic categories in society via the interplay of taxes and transfers.

Indeed, from a certain point of view both aspects are intimately related and can be thought of as different aspects of infrastructure, if we understand it in a broad sense, i.e. comprising productive infrastructure and social infrastructure (Mas et al., 1995). Of course, it can be claimed that all infrastructure is productive, and that will be precisely the main point of the model, so this terminology may be not too accurate. Perhaps it is more reasonable to think of productive infrastructure in the traditional sense, as public services (electric energy, telecommunications, water facilities), public works (roads and channels) and other transportation such as railways, harbors, and airports (Gramlich, 1994). In turn, social infrastructure is that intended to have a direct impact on the welfare and quality of human capital, such as hospital, schools and universities. The argument is straightforward for activities related to education: since nowadays the main source of income for a particular individual is his human capital, a good education may provide somebody coming from a low economic background with a well paid job. If this is true for many other individuals, the income distribution will tend to be more equal over time if education is provided adequately.

1. Assumptions

a) Preferences

Preferences are assumed to be of the standard Ramsey type. The economy is composed by infinitely lived agents, that maximize the present value of their intertemporal utility function [1].

$$U(0) = \int_0^{\infty} e^{-\rho t} U(C(t)) L(t) dt \qquad [1]$$

Where ρ is the discount rate, L(t) is the size of the family and C(t) consumption in time t.

Instantaneous utility function is assumed to be of the variety of Constant Relative Risk Aversion (CRRA) (equation 2).

$$U(C(t)) = \frac{C(t)^{1-\sigma} - 1}{1-\sigma} \qquad [2]$$

Where σ represents the relative risk aversion coefficient, and also the inverse of the intertemporal elasticity of substitution. We shall assume for simplicity that population growth is zero and normalize initial population to 1.

From now on we shall drop the subscript t in order to alleviate notation.

b) Technology

Output Y is composed of one sort of final good that is sold in competitive markets. Three main inputs enter in the production function of the economy: private capital K,

public expenditure G, and social expenditures S. Some caveats are in order here. First, there is no labor in the production function for simplicity. This assumption is harmless, though, as long as we think of private capital as an aggregate of physical and human capital (along the lines of Rebelo, 1991). Second, G is considered here a flow rather than a stock. This point is also innocuous; if we assume that public investment is proportional to the public stock, the analysis will be similar in both cases. Infrastructure in this model is a non rival good, not subject to congestion.

It has been already argued in the literature that infrastructure enhances the marginal productivity of capital. There is some evidence at the firms'level (Gillen, 1996) suggesting that a better endowment of infrastructure may reduce inventory and transportation costs, improve logistics and facilitate smooth relationships with customers and suppliers.

The term (S/Y) intends to capture the fact that a part of the social security payments intended to enhance equality among the population also increase the productivity of the other inputs. The idea of considering transfers also as productivity enhancing may be less intuitive, but its rationale is simple for developing countries (that are the subject of our study). If the governments provide the means for the poor sectors of population to acquire higher levels of education, better sanitary conditions and a general improvement in their welfare, it is clear that the efficiency level in the economy will also be increased. This type of public expenditure is assumed to be subject to congestion (and hence is divided by Y): to capture this idea we can think of the kind of congestion that occurs in hospitals, schools and universities, specially when they are provided by the State. The absence of user's may entail that the demand for these services is excessive.

Therefore the production function can be written as

$$Y = AK^{\alpha} G^{1-\alpha} \left(\frac{S}{Y}\right)^{\varepsilon} \qquad [3]$$

$$0 < \alpha < 1$$

$$0 < \varepsilon < 1$$

The restrictions over the parameters are intended to preserve the competitive setting of the economy. Notice that the production function is of the AK type in K and G considered together, and therefore it will be able to display endogenous growth.

A is an index of efficiency in a broad sense: i.e. it can include not only technological progress *stricto sensu* but also the quality of institutions, the lack of distortions (Easterly, 1993), the degree of financial efficiency (Roubini and Sala i Martin, 1992) and other variables that are not captured already by the provision of infrastructure.

c) Dynamics of private capital

As it is usual in this type of setting, the law of motion of capital represents net investment as the difference between gross investment and break-even investment.

$$\dot{K} = (1 - \tau_1 - \tau_2)Y - C - \delta K \qquad [4]$$

In which τ_1, τ_2, represent constant tax rates, to which we shall refer below, and δ is the rate of depreciation of private capital.

d) Public sector behavior

We assume that the government levies taxes on output and uses them to finance the two kinds of public expenditure we have alluded to before: G and S. In addition, the State runs a balanced budget, which is an appropriate hypothesis for the long run (Barro, 1990).

$$G + S = (\tau_1 + \tau_2)Y \quad [5]$$
$$G = \tau_1 Y \qquad [5']$$
$$S = \tau_2 Y \qquad [5'']$$

Therefore the budget constraint may be written as:

2.1. Discussion of the model

As it is often the case in these kind of models, there is an externality: individuals, when deciding to invest an additional unit, are implicitly benefiting the entire economy by means of increasing Y and K ultimately and S, through the balanced budget assumption. However, they will not take into account this effect due to its small impact in the marginal productivity of their capital. They will tend, thus, to underinvest, and the markets outcome will not be Pareto optimal. A social planner, as we shall consider below, will indeed take into account the externality and achieve the social optimum.

a) Competitive solution

Individuals maximize their utility function (eq. 1) subject to the budget constraint (eq. 4). The control variable for their problem is C and the stock variable is K. Denoting by MPK the marginal productivity of private capital and by τ the sum of the two tax rates, τ_1 and τ_2, the present value Hamiltonian and the first order conditions (FOC)[2] are as follows

$$H = e^{-\rho t}\frac{C^{1-\sigma}-1}{1-\sigma} + \lambda\left[(1-\tau_1-\tau_2)Y - C - \delta K\right]$$

$$H_C = 0 \quad \Rightarrow \quad e^{-\rho t}C^{-\sigma} = \lambda \qquad [6]$$

$$H_K = -\lambda \quad \Rightarrow \quad \lambda(1-\tau)MPK - \delta K = -\lambda \qquad [7]$$

$$TVC \quad lim_{t\to\infty}\lambda_t K_t = 0$$

As it is usual in these kinds of models, we can take logs and derivatives in equation 6, plug in equation 7 and rearrange terms in order to get the rate of growth of the economy, eq.

[2] The utility function and the production function are concave in C, K, and therefore the FOC will indeed guarantee a maximum (Mangasarian, 1966).

8. Substituting the ratio G/K for its expression according to equation 9 provides a close form solution, eq. 10, in terms of the parameters of the model. The expression for the rate of growth clearly poses a quadratic relationship between both types of public expenditure and economic growth, precisely because of the crowding out effect entailed by the taxes.

$$\frac{\dot{C}}{C} = \frac{1}{\sigma}\left[(1-\tau)MPK - \rho - \delta\right] \qquad [8]$$

$$\frac{G}{K} = \left(A\tau_1\,\tau_2^{\varepsilon}\right)^{\frac{1}{\alpha}} \qquad [9]$$

$$\frac{\dot{C}}{C} = \frac{1}{\sigma}\left[(1-\tau)\alpha\, A^{\frac{1}{\alpha}}\,\tau_1^{\frac{1-\alpha}{\alpha}}\,\tau_2^{\frac{\varepsilon}{\alpha}} - \rho - \delta\right] \qquad [10]$$

c) Social planner solution.

As it was mentioned above, the rate of growth displayed in equation 10 is not Pareto optimal because individuals do not internalize the externality present in the model. The social planner solution will deliver a higher rate of investment and growth since the externality is taken into account explicitly. The set up of the model in this case is very similar, the main difference being the fact that the planner maximizes equation (1) subject to (4) and (5'). Following the same steps as above, the rate of growth will be given by eq. 11, clearly larger that 10 due to the concavity of the production function in both types of capital ($\alpha < 1$).

$$\frac{\dot{C}}{C} = \frac{1}{\sigma}\left[(1-\tau)A^{1/\alpha}\tau_1^{1-\alpha/\alpha}\tau_2^{\varepsilon/\alpha} - \rho - \delta\right] \qquad [11]$$

The tax rates can now be chosen optimally. In order to ascertain which are the tax rates that maximize growth, we can apply the usual efficiency conditions for the goods and services delivered by the public sector, following Barro and Sala-i-Martin (1998).

Intuitively, these conditions use the fact that the social cost of an additional unit of G or S is 1, and this cost must be equal, in equilibrium, to their marginal contribution to output, $\delta G/\delta Y$ and $\delta S/\delta Y$, respectively. Thus, the optimal tax rate for each kind of public expenditure is:

$$\tau_1 = \frac{1-\alpha}{1+\varepsilon} \quad [12]$$

$$\tau_2 = \frac{\varepsilon}{1+\varepsilon}$$

$$\tau = \frac{1+\varepsilon-\alpha}{1+\varepsilon}$$

When ε is large, the intuition is easy to grasp: the government employs a bigger part of the budget in a increase of the social expenditure. The same holds true for the size of (1-α) and the share of G in the total expenditure.

In order to contrast the theoretical model, we have employed a panel data approach to investigate the correlation between the inequality indicators, the infrastructure and the economic growth of the countries that have been chosen for the paper.

4. THE DATA.

In the empirical part of this paper we have employed a set of variables, comprising different kind of indicators in order to capture the links between public capital, inequality and growth. Other variables reflecting economic conditions or institutional factors have also been taken into account. The sample is made up of 16 Latin American countries[3]. (Lack of available data prevents us for including also some countries with very poor statistics, such as Bolivia or Nicaragua). The period is 1975-1995.

[3] The countries included in the study are: Argentina, Brasil, Chile, Colombia, Costa Rica, R. Dominicana, Ecuador, El Salvador, Guatemala, Honduras, Méjico, Panamá, Paraguay, Perú, Uruguay y Venezuela.

Most of the data are only available since 1975, conditioning the temporal starting point of the research. Since we lacked the entire series for some of the variables, and following other similar contributions (i.e. Barro, 1999), we have constructed averages over subperiods of five years, and thus we have four observations for each of the 16 Latin America Countries. Variable sources are defined more precisely in the next table.

Table 1. Data Description and Sources.

VARIABLES	SOURCES
1- Real GDP per capita in constant dollars of 1985.	Summers y Heston (versión 5.6) and missing data from (Global Development Finance & World Development Indicators).
2- Private Investment and Public investment.	Summers y Heston (versión 5.6) and missing data from (Global Development Finance & World Development Indicators).
3- Inflation Rate.	World Development Indicators 1999, CD-R. World Bank.
4- Gini Index	Data Base from Deininger-Squire (1996)
5- Foreign Direct Investment	International Financial Statistics (International Monetary Fund).
6- Inequality in Wages (Index).	Urban Real Minimum Wage, from Statistical Abstract of Latin America, Vol. 33. (1994)
7- Population and Surface.	World Development Indicators 1999, CD-R. World Bank.
8- Telephones.	World Development Indicators 1999, CD-R. World Bank.
9- Public Deficit.	World Development Indicators 1999, CD-R. World Bank.
10- Roads and Railways	Canning and Fay Data Base. www.worldbank.org/html/dec/Publications/Workpapers/WPS1900series/wps1929/canning1.xls

Source: own elaboration.

5. Empirical Results.

The purpose of our empirical investigation is to estimate the effects of inequality, infrastructure and public expenditure on economic growth in 16 Latin American countries for the period from 1975 to 1995.

The methodology pursued has been a panel data analysis, to exploit both the cross sectional differences and the time dimension of the performance of the various countries considered. An important point should be stressed here. We are not trying to explain all factors underlying economic growth in Latin America for the period expressed, neither do we want to come up with the best model available from an econometric viewpoint. Rather, we are searching for reasonable correlations among the relevant variables and economic growth.

There is a related controversy on the literature, especially after the influential paper of Levine and Renelt (1992) on whether the procedure of running different variants of a baseline equation is valid. However, we agree with Barro and Sala-i-Martin (1995) in that the aforementioned procedure, although not devoid of drawbacks, has already shown light on some of the determinants of growth, and may be also illuminating in the future.

Furthermore, it is also advisable to run alternative specifications of a basic equation in order to circumvent multicollinearity, since very often the regressors are correlated. The R^2 obtained in these estimations will not be very high precisely because all relevant variables can not enter in an equation at the same time. However, as we said above, we do not see this issue as a crucial one.

The basic specification underlying our analysis is an equation of the form:

$$\gamma_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \qquad [13]$$

where the γ_{it} is the rate of growth of the real GDP per capita, α_i stands for the intercept, that in this case represents the basic idiosyncratic features of each country. In terms of the equation [10] displayed in the theoretical model, it captures parameters that are constant

over time, as the discount rate ρ, or the "social capability" (Abramovitz, 1986). X_{it} is a vector of regressors that encompasses those variable affecting the steady state of the members of the sample, ε_{it} are the i.i.d. random disturbances and i represents the country i^{th}. The results of the estimation of different variants of the regression equation displayed above are presented in table 2.

Table 2. Growth, inequality and public capital.
Dependent Variable: growth rate of real per capita GDP (1975-1995).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Private Investment					0.5197 (3.7307***)	0.5489 (3.894***)	0.6024 (4.4103***)		0.5762 (4.085***)
Inequality in Wages	-0.01432 (2.3858**)	-0.014 (2.3982**)			-0.01619 (3.4034***)	-0.0159 (3.2857***)	-0.021 (4.0635***)	-0.02 (3.4113***)	-0.0207 (4.037***)
Inflation rate	-0.000471 (0.3667)				-0.001477 (1.6775*)			-0.001592 (1.604)	-0.001221 (1.3557)
Rate of change of Gini Index	0.1316 (1.6899*)	0.1449 (2.1351**)	0.145 (2.0535**)	0.1422 (1.979*)					
R. Ch. Of Gini squared	-1.6918 (1.775*)	-1.9205 (2.7083***)	-1.9706 (2.6747**)	-1.9733 (2.6364***)					
Foreign Direct Investment				1.0683 (1.5401)					
Railways/population							0.0952 (2.6392**)	0.07816 (1.6666)	0.086 (2.3235**)
Roads/population					-0.01819 (1.9666*)	-0.0193 (2.0507**)			
telephones/popu.			0.00029 (1.8090*)					0.00033 (1.8514*)	
Public Invest.								0.33041 (1.9532*)	
Public deficit									-0.006 (0.0516)
Number of observations	40	40	40	40	64	64	64	64	64
R^2 Adjusted	0.2422	0.2665	0.2064	0.1821	0.3456	0.3192	0.3554	0.3269	0.3534

T-student statistics under coefficients. * significant at 90%. ** significant at 95%. *** significant at 99%.

The dependent variable is the rate of growth of real per capita (log) GDP. The main messages we can obtain from these tables are as follows:

a) Public investment. We used the data on public investment as a percentage of GDP. Results regarding this indicator were not very satisfactory, however. This is not a surprise, since the appropriateness of this variable as a proxy of public capital has been questioned, as indicated in numerous papers, for example, Sánchez-Robles (1998). The variable public capital has the correct sign, positive, and is significant at 90% only in one case: in equation 8, table 2. The point estimate is reasonable in terms of its magnitude: the value is around 0.30, which is more or less half the figure we got for private investment. The economic interpretation is straightforward. Since we are working with logs, the values of the coefficients may be interpreted as elasticities. In this particular case, a 1% increase in public investment will expand economic growth approximately in 0.30 percentage points.

b) We have tried to capture the impact of public capital by means of including also physical indicators of infrastructure, as an alternative to monetary measures, that may be easily contaminated by measurement error due to corruption (Pritchett, 1996). The variable that performs best is the ratio railways/population[4]. It is significant at 95% in 2 cases and the point estimate is also quite stable, around 0.08. Results were different for the case of the network of roads. We constructed two indicators, length of roads over population and length of roads over surface. We used different data sets, as well. After exploring different data sets, as the one provided by SALA, we ended up employing the ones compiled by Canning (Canning and Fay, 1993), which seemed to have the best quality. However, results were rather disappointing. The variable roads/population displays the opposite sign, negative, and the coefficients are significant. If we use the alternative, roads/Km^2, the sign is either positive or negative, but the coefficients are no longer significant. This counterintuitive result may be attributed to the lack of quality of the data on roads, or, more simply, to the fact that the endowments of roads are not large enough to exert a noticeable

impact on growth. The lack of quality of the data is, indeed, a serious drawback of this investigation. There is not a precise definition about roads, and therefore sometimes not only paved roads are considered but also even rural ways or engraved paths**.** Anyhow, it is clear that further research should be devoted to this issue, and in particular it would be advisable to build up a sound data basis of the type, providing information on the state of conservation and the length of roads of the various Latin American countries. This task would help economic policy decisions, since it is common knowledge that a broad and good network of roads enhances inputs' productivity and thus exerts a positive influence on private and foreign investment and, in last instance, on economic growth.

c) Finally, an indicator linked to communications, (number of telephones/population), was found to be positive, significant at 90% in eq. 3 and eq. 8.

d) Two indicators have been used to capture inequality. Their interpretation is not easy, since links between inequality and growth can be argued to be positive or negative (Barro, 1999). First we tried to capture inequality with the variable "inequality in wages", the connection is not clear and it will be a subject of future research. However, we can think of it as a proxy of distortions in labor markets, thus the negative sign suggest that more disturbed markets -as denoted by higher minimum wages- jeopardize growth

The second indicator is the Gini index and we only had data of this indicator for 10 Latin American countries. We have tried to capture a quadratic relationship by means of introducing the term Gini squared. Now the signs are as expected and both terms are significant, showing a hump shaped relationship between inequality and growth

d) We have also introduced other variables in the equations consistently with the literature on growth in Latin American countries. Private investment seems to be crucial for economic growth, as shown by the high value of the coefficient and its significance in

[4] It seems reasonable to divide over population instead of over surface since huge parts of Latin America (as the Amazonian forests) are not populated.

almost all cases. Inflation is negatively and in most cases significantly correlated with growth. Foreign Direct Investment (FDI) is positive and significant.

6. CONCLUSIONS.

Our initial question was to find out the relationship -always controversial- between two kinds of public expenditure (infrastructure and social provisions) and economic growth.

About inequality and growth we have found a quadratic relationship between inequality and growth. The interpretation is the following: the countries with a small degree of inequality and the ones in which the income is very unequal distributed, experience a low rate of growth, while in the countries where there is a large proportion of medium income class, the rate of growth will be higher.

Other variables included in the regressions have resulted significant. As our alternative to the inclusion of monetary proxies of infrastructures, we have preferred to include physical units to avoid the corruption and measurement error problems. The variable that experiences a best performance is the ratio railways/population, and telephones/population has result significant too. These findings are interesting and reinforce the idea that investment in infrastructure will foster the rate of growth of the LDCs.

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