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The Effects of Inflation on Economic Growth: Lessons from Latin America 1/

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Abstract

This paper investigates the relationship between inflation and long-run growth. It presents an endogenous growth model that illustrates the channels through which inflation affects growth. The model highlights the effects of inflation on the productivity of capital and the rate of capital accumulation. The reduction in growth is caused by a diversion of resources away from activities that lead to faster rates of growth toward activities associated with reducing the costs of inflation. The negative association between inflation and growth is assessed empirically for a sample group of Latin American countries.

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E60, 042, 054

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Contents

I. Introduction

When looking for lessons from Latin American economies that might be relevant to Eastern European countries, it seems easy to find examples of what policy problems should be avoided. One of the main economic problems of Latin America is chronic high inflation. Thus, the purpose of this paper is to examine the relationship between inflation and long-run growth. A simple model to highlight some channels through which inflation affects growth is presented in Section II. Empirical evidence showing that inflation has been an important factor inhibiting growth in Latin America is provided in Section III, and Section IV offers some concluding remarks.

The figure below plots inflation and GDP per capita growth during the period 1951–85 for 12 Latin American countries. 1/ Each observation corresponds to the average for a six-year period. As is clear from the figure, the inflationary phenomenon is not new, but has worsened since the mid-1970s. For the entire period, Argentina, Bolivia, Brazil and Chile have had average inflation rates above 50 percent. The debt crisis and many years of macroeconomic imbalances have aggravated the inflation problem in several of these countries, and most of them are still struggling with it. The figure also shows a negative correlation between inflation and per capita growth, which has also become stronger in recent years.

There are many channels through which inflation affects growth. The model in this paper focuses on the role of inflation in the allocation of resources, in particular on the role of money and its effect on the productivity of capital and the rate of capital accumulation. High inflation will induce individuals and firms to maintain low real balances to avoid the costs of inflation. This in turn will reduce the labor available for production with a consequent decline in the rate of growth. This argument has been forcefully presented by Leijonhufvud (1977, pp. 280–281) in his discussion of the consequences of inflation:

> "Being efficient and competitive at the production and distribution of 'real' goods and services becomes less important to the real outcome of socioeconomic activity. Forecasting inflation and coping with its consequences becomes more important. People will reallocate their effort and ingenuity accordingly. ...
>
> In short, being good at 'real' productive activities—being competitive in the ordinary sense—no longer has the same priority. Playing the inflation right is vital."

In a related context, Baumol (1990) and Murphy, Shleifer and Vishny (1991) address the role of the economic environment in providing incentives to allocate talents and skills in activities that have different impact on

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1/ The countries are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Peru, Uruguay and Venezuela. For details on the data and empirical evidence on growth determinants, see De Gregorio (1991a).

growth. Inflation is an example of the kind of macroeconomic distortion that can hamper growth.

II. The Model

Money facilitates transactions and the operation of the economy. Inflation, specially high rates of inflation, such as those often observed in Latin America, induces households and firms to divert resources away from productive activities toward other activities that allow them to reduce the burden of the inflation tax. The greater variability of relative prices, which always accompanies high inflation rates, creates a high risk of large losses by holding money. Windfall gains are also more likely. In such circumstances, financial markets become very sophisticated, offering a wide variety of instruments to protect financial assets against inflationary erosion. All of these developments provide the incentive to spend excessive amounts of time in cash and portfolio management instead of in productive activities. In some sense, inflation creates incentives for rent seeking behavior.

This section presents a simple endogenous growth model to illustrate how inflation affects the allocation of resources and growth. 1/ The model represents an extension of monetary models used in the 1970s and early 1980s to analyze the effects of inflation on steady state income and on welfare. 2/ By considering a technology that allows for sustainable growth, these models can be extended to consider the effects of inflation on the rate of growth of income. 3/ The economy consists of households, firms and government. The technology, at the firm level, exhibits constant returns to scale, but at an aggregate level there is an externality that generates constant returns to capital. Thus, in the aggregate, the technology exhibits increasing returns to scale (Romer, 1986). Therefore, it is possible to have a steady state with positive growth in the absence of population growth and of exogenous technical progress. It is assumed that there is no international capital mobility, so investment will equal domestic savings. The certainty case provides enough insights to discuss the main effects of inflation on growth, thus, the effects of uncertainty are not considered further here.

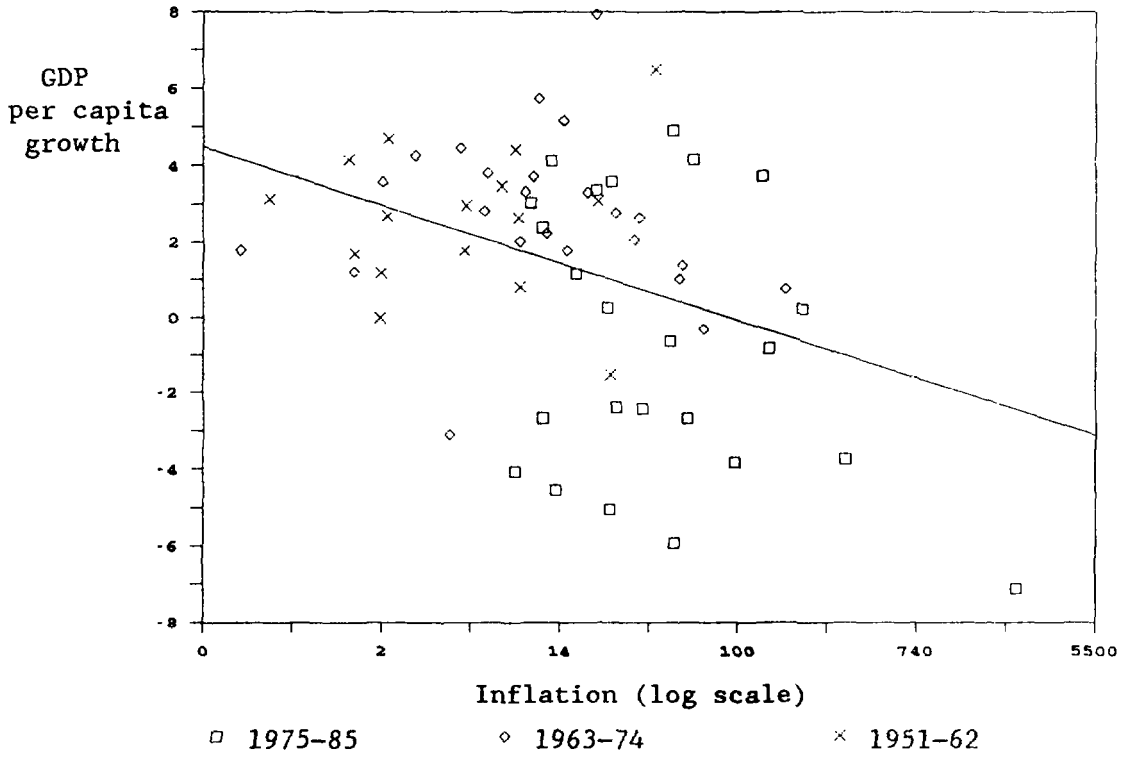
The productivity of capital depends on employment. Inflation affects growth by changing labor supply and demand, thus reducing aggregate employment in the sector that is subject to increasing returns. The lower level of employment will reduce the marginal productivity of capital. Thus, the private rate of return and consequently the savings rate will decline.

1/ The model is a simplified version of De Gregorio (1991b). In addition, that paper considers inflation as part of a public finance problem where the tax system is subject to collection inefficiencies.

2/ See, for example, Dornbusch and Frenkel (1973), Fischer (1981), Abel (1985) and the survey by Orphanides and Solow (1990).

3/ This is the basis of recent theoretical models of inflation and growth by Jones and Manuelli (1990) and Alogoskoufis and van der Ploeg (1991).

Figure. Inflation and Growth in Latin America
(In percent)



Employment can also be interpreted as effort expended while performing productive activities.

1. Households

The problem facing the consumer consists of the maximization of the present discounted value of an instantaneous separable utility function of consumption (c) and leisure (e):

$$\text{Max} \int_0^{\infty} [u(c_t)+\nu(e_t)]e^{-\rho t}dt, \tag{1}$$

subject to the flow budget constraint:

$$\dot{v} = rv+w\ell-c-im+g, \tag{2}$$

and

$$\ell+T_1\left(\frac{m}{c}\right)+e = \bar{\ell}, \tag{3}$$

where ℓ is labor supply and $\bar{\ell}$ is the endowment of labor. Wealth is v, g is government transfers, r is the real return and i is the nominal interest rate. People demand money because it facilitates transactions. To purchase goods, individuals need to spend time shopping (T_1), which is a decreasing and convex function of the ratio between real balances and consumption spending (Savings, 1971). The real wage is w. The utility functions u and ν are strictly concave in consumption and leisure, respectively. In order to have a well behaved solution, it is assumed that both functions are logarithmic, so that u(c)=log(c) and ν(e)=log(e). Solving the consumer optimization problem, the steady state rate of growth of consumption is given by:

$$\frac{\dot{c}}{c} = r-\rho. \tag{4}$$

This expression corresponds also to the steady state rate of growth of output. Therefore, all the growth effects of inflation will finally come through its effects on r. The optimal condition for money holdings is:

$$-\frac{w}{c}T_1'\left(\frac{m}{c}\right) = r+\pi = i, \tag{5}$$

where π denotes inflation.

Households also have to choose continuously the optimal combination between consumption and leisure. The optimality condition for this choice is given by:

$$\frac{\nu'(e)}{u'(c)} = \frac{w}{\Gamma_1(i)} . \tag{6}$$

where

$$\Gamma_1(i) \equiv 1 + i\frac{m}{c}(i) . \tag{7}$$

Γ_1 is the effective price of consumption, and it can be verified to be positive and increasing in i. Although the market price of the consumption good is equal to one by the choice of numeraire, consumers actually pay more. In addition to the market price households spend an additional amount of time equal to $-(1/c)(m/c)T_1'$, when consumption is marginally increased. Since the opportunity cost of time is w, the additional time spent in transactions has a value of $-(w/c)(m/c)T_1'$. Using equation (5) this cost is equal to im/c, which is the second term at the left hand side of (7). Now, the effects of inflation on household behavior can be seen. An increase in the rate of inflation, and consequently in the nominal interest rate, will reduce optimal real balances making the consumption good more expensive per unit. In equation (6) the added cost causes substitution from consumption to leisure, which will reduce labor supply. 1/

2. Firms

The production function is assumed to be of the form suggested by Romer (1986), which considers capital to have external effects on productivity. The production function is:

$$y_t = \ell_t^{1-\alpha} k_t^{\alpha} \bar{k}_t^{1-\alpha}, \tag{8}$$

where ℓ is labor, k is firms' capital stock and $\bar{k}$ is aggregate capital. Since firms are relatively small, $\bar{k}$ is not under their control. At the firm level the production function exhibits constant returns to scale and a competitive equilibrium can be supported. At an aggregate level, however, there are increasing returns to scale. 2/

As in the case of consumers, firms also have to spend resources on transactions. In this paper the Dornbusch and Frenkel (1975) formulation is adopted by assuming that there is a cost per unit of output involved in

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1/ Note that in the model inflation has no direct effect on the savings rate (see equation (3)). The particular logarithmic form for u and ν guarantees that leisure and employment are constant along the steady state growth path.

2/ This externality creates a gap between the marginal and the social productivity of capital. The rest of the discussion will only consider the decentralized equilibrium.

delivering goods, which is decreasing and convex in real balances relative to total production. Thus, the problem of the firm can be written as (time subscripts are omitted):

$$\text{Max} \int_0^{\infty} \left[\left(1-T_2\left(\frac{m}{y}\right)\right)y - w\ell - rk - m\pi - \bar{m}\right] e^{-rt}dt, \tag{9}$$

subject to equation (8).

The necessary conditions for optimality are:

$$-T_2'\left(\frac{m}{y}\right) = i, \tag{10}$$

$$\Gamma_2'(i)(1-\alpha)\ell^{-\alpha} k^{\alpha} \bar{k}^{1-\alpha} = w, \tag{11}$$

and

$$\Gamma_2'(i)\alpha\ell^{1-\alpha} k^{\alpha-1} \bar{k}^{1-\alpha} = r, \tag{12}$$

where

$$\Gamma_2(i) = 1-T_2(i) - i\frac{m}{y}(i). \tag{13}$$

Since there are no costs of adjusting capital, firms will always have the optimal level of capital, and hence the economy will always be on the steady state growth path. The level of capital will be such that the private return r equals the (private) marginal return of capital. In equilibrium $k=\bar{k}$ (normalizing the population to one), and hence the rate of return will be:

$$r = \Gamma_2'(i)\,\alpha\ell^{1-\alpha}, \tag{14}$$

Inflation has two effects at the firm level. First, by reducing real balances it will have a direct negative impact on the rate of return (equation (14)). 1/ Second, in equation (11), labor demand will fall. Since on the households side the supply of labor also falls, total employment, and hence the private rate of return will fall, which implies a decline in the rate of growth. The model illustrates how an increase in the rate of inflation affects the profitability of firms by making them use more inputs on transactions rather than on productive activities. On the other hand, households find less incentive to supply productive labor, and spend

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1/ Note that equation (14) defines implicitly r since $i=r+\pi$. The results discussed in the text can be easily verified by implicit differentiation.

more time avoiding the costs of inflation. The model also shows that a reduction in employment will reduce the productivity of capital even when the rate of investment remains constant.

III. Empirical Evidence

A negative relationship between inflation and long run growth in a cross section of countries was found in Kormendi and Meguire (1985). Levine and Renelt (1990) examine the robustness of this finding and conclude that the relationship is sensitive to the econometric specification. Recently, however, additional evidence supporting a negative correlation between inflation and growth in cross-section of countries has been documented in Fischer (1991) and in Roubini and Sala-i-Martin (1991). Latin America is perhaps where this relationship has been found to be most robust as discussed in Cardoso and Fishlow (1989) and De Gregorio (1991a). 1/

In De Gregorio (1991a) growth regressions for a panel of 12 Latin American countries using 6-year average data for the period 1950-85 show that high inflation has been one of the main factors hindering growth during the period. The estimations are carried out by using generalized least squares to consider country-specific random effects. The dependent variable is the average rate of growth (Y) during each subperiod. The following equation shows this relationship (t-statistics in parentheses):

$$
\begin{aligned}
Y = {} & -0.047 + 0.145\ I + 0.328\ FI + 0.00065\ LIT - 0.107\ G \\
& (-2.40) \quad (3.29) \quad (2.38) \quad (2.35) \quad (-1.89) \\
& - 0.008\ \log\pi - 0.963\times10^{-5}\ GDP0 \qquad R^2=0.46 \quad \text{No obser.}=64, \\
& (-4.10) \quad (-4.89)
\end{aligned}
$$

where I is the total investment rate, FI is the share of foreign investment, LIT is the average literacy rate during the whole period, G is the share of government consumption, $\log\pi$ is the natural logarithm of the average inflation rate and GDP0 is average GDP per capita during 1959-61. When inflation is introduced linearly the value of its coefficient is highly

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1/ Barro's (1991) empirical work on growth determinants reports that a dummy variable for Latin American countries appears to be significant with a negative coefficient. Roubini and Sala-i-Martin (1991) using the Barro (1991) data set show that adding inflation as one of the determinants of growth significantly reduces the "Latin American dummy."

dependent on the sample. The parameter is stable when inflation enters in logarithmic form, although the R^2 is lower than in the linear case. 1/

In the previous regression the semi-elasticity of inflation is 0.008. This value implies that reducing the rate of inflation to half of its actual value may allow growth to increase by 0.4 percent a year, which in a period of 35 years, as in the sample period of this paper, yields a 15 percent differential in per capita GDP. These values are quantitatively important since the growth in average per capita GDP in Latin America was 1.6 percent during the 1950-85 period. Average inflation (after excluding the Bolivian hyperinflation) in the panel data used in this section is 34 percent, which implies that a reduction in inflation of 17 percentage points is required to achieve a 0.4 increase in growth.

It is necessary, however, to verify whether or not the results are driven by the inclusion of countries experiencing high inflation. To evaluate the robustness of this result, the sample was modified by two criteria. The first modification was to eliminate countries that experienced high inflation. Regressions were then run sequentially, first excluding Brazil, then Argentina, then Bolivia and, finally, Chile. In most of the regressions the impact of inflation was both negative and significant. 2/ The second procedure was to eliminate all observations with inflation rates that were higher than a specified cutoff point--of 50, 40, 30, 20 and 10 percent per year. Again, the results were robust.

The fact that inflation has negative effects on growth (holding investment constant) suggests that the relationship between inflation and growth is to a large extent the result of the effects of inflation on factor productivity. Two caveats are, however, worth mentioning. First, investment considered in Section II refers to a broad concept of capital accumulation. It includes, among other components, knowledge and quality of capital goods, which are not appropriately measured by the variables included in the regressions. Therefore, the coefficient of inflation could be capturing the effects on the rate of accumulation of this broad concept of capital. Second, investment rates include public investment which, contrary to private investment, can be positively correlated with inflation. This is particularly relevant in countries that rely heavily on inflationary taxation. Therefore, the correlation between private investment and inflation is weakened. Thus, part of the effect of inflation on private investment could be captured by the inflation rate rather than by total investment rates.

1/ Political instability, measured by indices of civil liberties and political rights, appears to be significant in some regressions. However, those indices are highly correlated with the logarithm of the inflation rate, consequently in the equation reported above the index of political instability is omitted. See Alesina, et al. (1991) for additional evidence on the effects of political instability on long-run growth.

2/ The results are similar when the variance of inflation is used instead of the average rate of inflation.

To determine the total effects of inflation on growth, all forms of investment can be omitted from the regression. The following regression can be considered to measure the total effect of inflation on growth:

$$Y = \underset{(0.35)}{-0.006} + \underset{(0.32)}{0.029}\, G - \underset{(-4.16)}{0.010}\, \log\pi - \underset{(-1.81)}{0.645\times10^{-5}}\, GDP0$$

R^2=0.23 No obser.=68.

Again, average inflation has negative effects on growth. As expected, the coefficient of inflation is larger when investment is omitted. The coefficient, however, does not seem to show a large increase. In this case, the semi-elasticity of growth with respect to inflation is 0.010, which implies that reducing inflation to half of the sample average would increase per capita growth by 0.5 percent a year. The small increase of the coefficient of inflation when investment is omitted indicates that, with the caveats made above, the effects of inflation on growth are primarily through the impact on the e productivity of capital rather than through its rate of accumulation. 1/

Another interesting result concerns the effects of government consumption. The results depend crucially on whether the investment rate is included as a regressor or not. In the first regression government consumption negatively affects growth. However, when investment rates are excluded, the point estimate of the coefficient on government spending is positive but not statistically different from zero. The results indicate two kinds of effects on growth. When investment rates are included, the negative coefficient may reflect the adverse effect that distortions arising from taxes to finance the budget have on the rate of return on investment. Nevertheless, when investment rates are omitted, government spending may also capture a positive effect coming from the (omitted) investment rates, which suggests the existence of complementarities between government spending and investment. The net result of these two effects would not be significantly different from zero.

IV. Concluding Remarks

The main conclusion of this paper is that persistent inflation may reduce growth prospects in Eastern Europe as it has done in Latin America. One should bear in mind, however, that the model and the evidence presented do not allow lessons to be drawn about the relationship between inflation and the problems of shortages and monetary overhang, which are at the center of the discussion on macroeconomic management in Eastern Europe during the transition toward a market economy.

1/ This result is consistent with evidence for less developed countries, which shows interest rates have a low, if any, effect on savings, e.g., Giovannini (1985).

It is important to emphasize that removing inflation is a necessary but not sufficient condition for fostering growth. The recent Bolivian experience, although successful on the inflation front, shows that resuming growth requires more than macroeconomic stability. 1/

A question not addressed in the paper is the cause of inflation. Evidence shows that fiscal imbalances are at the center of high inflationary experiences. Therefore, establishing an efficient tax system may avert heavy reliance on the inflation tax and thus avoid its negative consequences for growth.

The difficulties in reducing inflation in Latin America are related to the fact that the economies have adapted to living with high inflation. Although there might be agreement on the necessity to reduce inflation, there is disagreement on how to cope with it. In particular, the conflict concerns the distribution of the costs of disinflation. Eastern European economies, in contrast, have a unique opportunity to build institutions and to create an economic environment that provides incentives for investment and growth.

1/ For further discussion see Calvo and Guidotti (1991).

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