INFLATION, GROWTH, AND EXTERNAL DEBT: A VIEW OF THE LANDSCAPE

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ABSTRACT

Inflation, Growth, and External Debt: A View of the Landscape*

This paper reconsiders the relationship between inflation, economic growth and external debt, and discusses various channels through which (a) increased inflation tends to reduce growth and raise foreign indebtedness over time and (b) declining growth tends to amplify both inflation and debt. Based on a simple model of the simultaneous determination of inflation and growth, a non-parametric statistical comparison of the growth record and external indebtedness of high- and low-inflation economies reveals significantly slower growth and greater debts in the high-inflation economies since 1973. The observed growth differential indicates that the real costs of inflation over time may be quite high for individual countries as well as for the world economy as a whole.

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NON-TECHNICAL SUMMARY

Economists have long pondered the question of whether inflation is generally conducive or detrimental to economic growth. Various arguments have been put forward on both sides, not least in the ongoing debate among development economists on the long-term development of Latin America. In this debate, monetarists have generally considered price stability a prerequisite for economic growth. Structuralists, on the other hand, have contended that attempts to achieve price stability through monetary or fiscal restraint will result in unemployment and slow growth. Thus far, however, no clear empirical conclusions have emerged from historical or comparative studies of the relationship between inflation and growth in Latin America or elsewhere. Most national economies have grown relatively rapidly and slowly in periods of both inflation and deflation. This is not surprising because virtually any economic theory or empirical observation of a direct relationship between two real macroeconomic variables can in general be challenged by an alternative theory or observation of an inverse link between the two variables, and vice versa.

So it is no wonder that economists have thus far failed to identify a clear relationship, positive or negative, between inflation and economic growth in the short or the long run. If output growth in the short run is inversely related to unemployment, the short-run relationship between inflation and growth can be viewed as a mirror image of the short-run Phillips curve. Therefore, during periods of pronounced demand variations such as the 1950s and 60s, inflation and growth could be expected to be positively correlated, and negatively when supply shocks are predominant as they were in the wake of the oil price increases of 1973-4 and 1979-81. The link between inflation and growth over long periods is more difficult to deal with, because the short-run theory of inflation and national income determination must then be augmented by a long-run theory of capital accumulation, monetary expansion, technical progress and growth. A rigorous and successful integration of short-run and long-run theories is difficult to achieve, however, because of the inherent incompatibility of the full-employment assumption of neo-classical growth models with the legitimate focus of many short-run theories on unemployment and unused capacity.

This paper reconsiders the relationship between inflation, economic growth and external debt, and discusses various channels through which (1) increased inflation tends to reduce growth and raise foreign indebtedness over time and (2) declining growth tends to amplify both inflation and debt. For example, increased inflation following domestic monetary expansion may lead to: (a) more rapid growth of output in the short run through the stimulating effect of lower real wages on employment and of lower real interest rates on investment as well as private consumption, or through the direct link between credit expansion and

public as well as private expenditure; (b) a slowdown of growth in the medium term as the balance-of-payments constraint or increasing inflation forces the government to adopt more restrictive policies and as the decline of real interest rates reduces saving propensities as well as the efficiency of investments; and (c) no response of long-run growth, which is determined solely by technical progress and population growth in the steady state. In this scenario, therefore, an initially positive correlation between inflation and growth gradually becomes negative and then disappears, other things being equal.

There can also be circumstances where the predominance of a particular exogenous shock could lead to a particular pattern of inflation and growth performance over a long period, within as well as across countries. For example, an increase in oil prices as occurred in 1973-4 and 1979-81 tends *per se* to cause stagflation in oil-importing countries in the short run, a phenomenon that may be compounded over time both by the reduction of saving as a result of lower real interest rates and by monetary expansion triggered by a shortfall in tax receipts. According to this scenario one might expect to observe a negative correlation between inflation and growth over an extended period of time, with the causation running both ways: from high inflation to slow growth via declining real interest rates, saving and public expenditure, as well as increased relative price distortions; and from slow growth to high inflation via tax revenue shortfall and monetary expansion, as well as deteriorating productive capacity.

Accordingly, oil-importing economies with high inflation in the 1980s might be expected to have both experienced slower economic growth and accumulated greater foreign debts than other countries with lower rates of inflation. The second part of the hypothesis rests on the notion that high inflation reduces domestic saving propensities and hence encourages increased foreign borrowing to finance domestic investment.

The main purpose of the present paper is to develop a simple formal framework for the analysis of the interaction of inflation and growth in the medium term; to make an attempt to map the statistical pattern of inflation, growth and external debt across countries within the framework presented by comparing the growth record and external indebtedness of high- and low-inflation countries, and to investigate by non-parametric methods whether the pattern observed is significant in a statistical sense. Specifically, three related hypotheses are tested: that the rate of growth of real GDP per capita has in general been lower in high- than in low-inflation economies following the aggregate supply shocks of the 1970s; that the growth rate of real GDP per capita was generally higher in high- than in low-inflation economies in the period preceding the supply shocks; and that the ratio of external debt to GDP has tended to be higher in high- than in low-inflation economies during the entire period under consideration, 1965-85.

The non-parametric statistical comparison of the growth record and external indebtedness of high- and low-inflation economies reported in the paper reveals significantly slower growth and greater debts in the high-inflation economies since 1973. This finding can be interpreted as being consistent with the view either that the aggregate supply shocks of the 1970s played an important role in the simultaneous determination of inflation and growth in the countries under study until the mid-1980s at least; or that rapid inflation slowed down the rate of growth by discouraging saving; or that slow growth led to increased inflation via tax erosion during this period. The test results do *not* exclude, however, the possibility that statistically significant differences among average growth rates in the two groups of countries are due to factors other than inflation in particular. In general, output growth in developing countries tends to be especially sensitive to political stability and rainfall, neither of which have been taken into account here. Moreover, economic growth and inflation may be jointly influenced by institutional and structural phenomena. Nevertheless, if inflation is in some measure to blame for the average medium-term growth differential reported in the paper, then the real costs of inflation over time may be quite high for individual countries as well as for the world economy as a whole.

1. Inflation and growth

Economists have long pondered the question whether inflation is generally conducive or detrimental to economic growth. Multifarious arguments have been put forward on both sides, not least in the ongoing debate among development economists on the long-term development of Latin America. In this debate, which was particularly vivid in the 1960s, monetarists have generally considered price stability a prerequisite for economic growth and argued that governments should therefore enforce monetary discipline to eliminate inflation, thus creating conditions for rapid growth. Structuralists, on the other hand, have contended that in economies with major supply bottlenecks and weak export markets, attempts to achieve price stability through monetary or fiscal restraint will result in unemployment, underutilization of capacity, and slow growth (Ruggles 1964). Thus far, however, no clear empirical conclusions have emerged from historical or comparative studies of the relationship between inflation and growth in Latin America or elsewhere (Johnson 1969). For example, the economy of the United States has grown relatively rapidly and slowly in periods of both inflation and deflation (Friedman and Schwartz 1963). So have most other economies. This is not surprising. Monotonic bivariate relationships among real magnitudes are hard to find in macroeconomics. Any bivariate relationship, static or dynamic, must depend on the concurrent position or movement of other relevant variables. Therefore, virtually any economic theory or empirical observation of a direct relationship between two real macroeconomic variables can in general be challenged by an alternative theory or observation of an inverse link between the two variables, and vice versa.

Before scrutinizing the relationship between inflation and growth from this point of view and testing some hypotheses about it, which is the main purpose of this paper, it may be worthwhile to review briefly a few examples of macroeconomic relationships between endogenous variables that

move sometimes in the same direction and sometimes in opposite directions,
depending on the driving forces behind them. Such examples abound.
First, consider inflation and unemployment. An increase in aggregate
demand tends to increase inflation and reduce unemployment in the short
run, whereas an increase in production costs (e.g., wages or oil prices)
raises both inflation and unemployment, ceteris paribus. Therefore,
inflation and unemployment can obviously move in opposite directions along
a short-run Phillips curve or in the same direction as the curve shifts,
depending on whether the economy has been exposed to a demand shock or a
supply shock. This, however, was not evident to all economists a decade
ago or so. In particular, the emergence of stagflation following the
quadrupling of oil prices during 1973-74 did not per se spell the demise
of the Keynesian theory of national income determination, claims to the
contrary notwithstanding (Lucas 1981).[1] To take another example,
increased government spending increases the budget deficit and tends also
to raise nominal and real interest rates, other things being equal,
whereas an exogenous upswing in private consumption, investment, or
exports raises tax revenues and thus reduces the deficit and increases
interest rates at the same time. Therefore, the view that federal
deficits in the United States have contributed significantly to high
interest rates there and elsewhere in recent years is not contradicted by
evidence that substantial deficits have been associated with low interest
rates in earlier episodes (Barro 1981, Evans 1985). To take one more
example, a domestic economic upswing can be accompanied by either a
deterioration or an improvement of the balance of payments, depending on
whether the upswing is caused by, say, monetary or fiscal expansion (which
tends to weaken the external position) or by devaluation or an export boom
(which tend to strengthen it). This stands to reason. Yet, one of the
main tenets of the monetary approach to the balance of payments in the
1970s was that output and the balance of payments were positively related,
in contradistinction to the allegedly negative link posited by Keynesian
approaches (Frenkel and Johnson 1976).[2]

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[1] See also Bruno and Sachs (1984).

[2] See also Frenkel, Gylfason, and Helliwell (1980).

Many other examples can be cited. Real wages and employment (or GNP) can move all over the map, depending on the relative variability of labor demand and labor supply if the labor market is in equilibrium as well as on decisions made by labor market organizations in collective bargaining. It is, therefore, not very informative to regress real wages solely against output in an attempt to determine whether real wages have moved procyclically or countercyclically through time without accounting for other influences on real wages and output (Otani 1978). Similarly, while unemployment and output growth can be inversely related by Okun's law for a given labor force, capital stock, and technology in the short run, rapid growth can nonetheless coincide with high unemployment owing to changes in labor force participation, mechanization, or capital accumulation (compare Spain today, for example). Finally, real interest rates and inflation can be positively or negatively related depending on their interaction with price expectations and tax rates (Feldstein 1983). This list of examples could be extended, but not, of course, to include nominal variables such as money and prices or their time derivatives that tend to move in tandem during periods of substantial inflation.

So it is no wonder that economists have thus far failed to identify a clear relationship, positive or negative, between inflation and economic growth in the short run or the long run. If output growth in the short run is inversely related to unemployment by Okun's law, the short-run relationship between inflation and growth can be viewed as a mirror image of the short-run Phillips curve. Therefore, during periods of pronounced demand variations such as the 1950s and 1960s, inflation and growth could be expected to be positively correlated, and negatively when supply shocks are predominant as they were in the wake of the oil price increases of 1973-74 and 1979-81. The link between inflation and growth over long periods is more difficult to deal with analytically as well as empirically, because the short-run theory of inflation and national income determination must then be augmented by a long-run theory of capital accumulation, monetary expansion, technical progress, and growth. A rigorous and successful integration of short-run and long-run theories is difficult to achieve, however, because of the inherent incompatibility of the full-employment assumption of neoclassical growth models with the

legitimate focus of many short-run theories on unemployment and unused
capacity. Even so, several interesting possibilities arise in this
context.

For example, increased inflation following domestic monetary expansion
may lead to:

(a) more rapid growth of output in the short run through the stimulating
    effect of lower real wages on employment and of lower real interest
    rates on investment as well as private consumption or through the
    direct link between credit expansion and public as well as private
    expenditure,

(b) a slowdown of growth in the medium term as the balance-of-payments
    constraint or increasing inflation forces the government to adopt more
    restrictive policies and as the decline of real interest rates reduces
    saving propensies as well as the efficiency of investments, and

(c) no response of long-run growth, which is determined solely by
    technical progress and population growth in the steady state, according
    to the neoclassical Harrod-Domar-Solow-Denison model of economic growth
    with constant returns to scale.

In this scenario, therefore, an initially positive correlation between
inflation and growth gradually turns into a negative one, and then
disappears, other things being equal.

To take another example, a permanent export shortfall may lead to a
decline in both output growth and inflation in the short run, and then to
monetary expansion and a rebound of inflation as the government turns to
the printing presses to compensate for the decline of tax revenues. This
link may be strengthened by the erosion of tax receipts due to inflation
(Tanzi 1978). Here again a positive correlation between inflation and
growth turns negative after a time, ceteris paribus. Similarly, an export
boom may stimulate output growth in the short run and even in the long run
as well if the buildup of the foreign-trade sector and the attendant
specialization of production according to comparative advantage improves
the economy's stock of human capital (Lucas 1988), with or without
increased inflation. Finally, although intensified protectionism is
likely to increase both inflation and growth in the short run, growth
performance will probably decline as time passes with factors of

production gradually being shifted into less productive enterprises with corresponding potential deterioration of human as well as nonhuman capital.

These examples should suffice to demonstrate that it is impossible to identify a general monotonic relationship between inflation and economic growth once and for all. Nevertheless, there can be circumstances where the predominance of a particular exogenous shock could be expected to lead to a particular pattern of inflation and growth performance over a long period, within as well as across countries. For example, an increase in oil prices as occurred in 1973-74 and 1979-81 tends per se to cause stagflation in oil-importing countries in the short run, a phenomenon which may be compounded over time both by the reduction of saving as a result of lower real interest rates and by monetary expansion triggered by a shortfall in tax receipts. This process may have been reinforced in some countries by the perceived need to reverse the expansionary fiscal policies of earlier years due to increased inflation and balance-of-payments difficulties. Also, increased inflation may have distorted relative prices and production and thus impeded growth. Slower growth, in its turn, may have reduced productive capacity and thus increased inflation still further. According to this scenario one might, therefore, expect to observe a negative correlation between inflation and growth over an extended period of time, with the causation running both ways:

(a) from high inflation to slow growth via declining real interest rates, saving, and public expenditure as well as increased relative price distortions and

(b) from slow growth to high inflation via tax revenue shortfall and monetary expansion as well as deteriorating productive capacity.

Accordingly, oil-importing economies with high inflation in the 1980s might be expected to have (a) experienced slower economic growth and (b) accumulated higher foreign debts than other countries with lower rates of inflation, all things considered. The second part of the hypothesis follows directly from the first, and rests on the notion that high inflation reduces domestic saving propensities and hence encourages increased foreign borrowing for the financing of domestic investment needs. This link is reinforced by the feedback effect of debt

accumulation on domestic money supply and inflation. Subsequently,
however, it may become necessary to reduce the debt burden by economic
austerity measures which hamper growth. Casual observation seems to
support this hypothesis. Table 1 shows that highly indebted (and, mostly,
oil-importing) economies have experienced much higher rates of inflation
and lower rates of growth in the 1980s than the world at large.

The main purpose of the remainder of this paper is (a) to develop a
simple formal framework for the analysis of the interaction of inflation
and growth in the medium term along the lines suggested above, (b) to make
an attempt to map the statistical pattern of inflation, growth, and
external debt accross countries within the framework presented by
comparing the growth record and external indebtedness of high-inflation
countries with those of low-inflation countries, and (c) to investigate by
nonparametric methods whether the pattern observed is sufficiently
pervasive to be significant in a statistical sense and to be of practical
interest to policymakers trying to fight inflation and find ways to
stimulate growth. Specifically, following the presentation of the
analytical framework in section 2, three related hypotheses will be tested
in section 3:

(1) that the rate of growth of real GDP per capita has in general been
    lower in high-inflation economies than in low-inflation economies
    following the aggregate supply shocks of the 1970s;

(2) that the growth rate of real GDP per capita was generally higher in
    high-inflation economies than in low-inflation economies in the period
    preceding the oil price increases when, presumably, aggregate demand
    variations were more pronounced in the world economy than fluctuations
    in aggregate supply; and

(3) that the ratio of external debt to GNP has tended to be higher in
    high-inflation economies than in low-inflation economies during the
    entire period under consideration, 1965-85.

2. Analytical framework

Before proceeding to the empirical material and tests in the next
section, it may be useful to attempt to formalize some of the arguments
reviewed above. It should be stressed from the start that the simple

model presented below is not intended to describe the complicated dynamic
relationship between inflation and growth in full (Fischer 1983). On the
contrary, the model serves merely to highlight in a simple way the medium-
term interaction between inflation and growth described in the preceding
section and thus to provide a formal framework for the statistical
analysis to follow.

In the model, general macroeconomic equilibrium requires equality
between money supply and money demand: $M/P = Y/v$, where M is money supply,
P is the general price level, Y is real GNP, and v is the income velocity
of money. If velocity is held constant, this macroeconomic equilibrium
condition can be expressed in terms of rates of change:

(1) $p = m - g$,

where p is the rate of inflation, m is the rate of monetary expansion, and
g is the rate of growth of GNP. If the government finances its budget
deficit by printing money, the rate of monetary expansion equals the
multiple of velocity and the ratio of the deficit to GNP, d:

(2) $m = vd$.

If the deficit/GNP ratio varies directly with inflation through tax
erosion (the Tanzi effect), so that $d = c + ep - p/v$ with $e > 0$ and with
p/v representing inflation tax revenue in proportion to GNP, we then have
the following inverse relationship between inflation and growth:[3]

(3) $p = (vc - g)/(2 - ve)$,

provided that $ve < 2$ as is required for an exogenous increase in deficit
financing (i.e., in c) to increase inflation for given growth in the
model. This equation is represented by the TT schedule in Figure 1. The
TT schedule slopes down because a slowdown of growth increases inflation
and also the deficit which feeds back on inflation in the model. An
exogenous increase either in the deficit or in velocity shifts the TT

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[3]   Observe that a similar relationship between inflation and growth
could be derived either by assuming an inverse relationship between the
deficit ratio and growth or by assuming a positive link between velocity
and inflation, with or without the Tanzi effect. In either case, the
model would have the same qualitative properties as the one outlined in
the text.

Figure 1. Inflation and growth
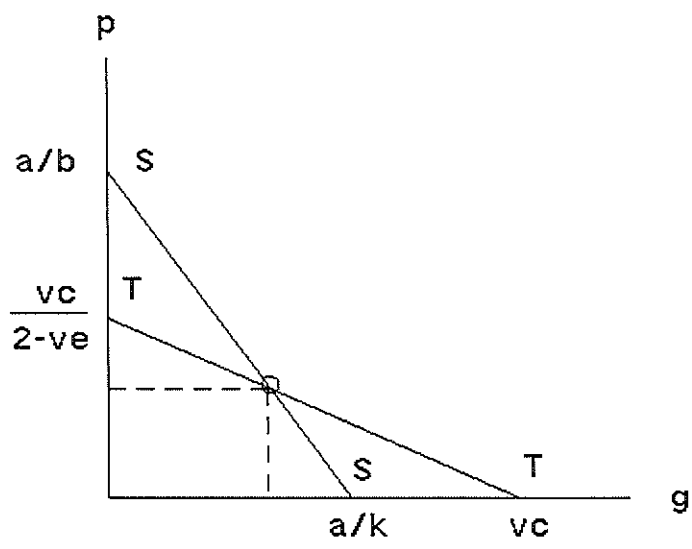
schedule to the right, thus raising the rate of inflation that is compatible with any given rate of growth.

In the neoclassical growth tradition, the medium-term rate of growth of GNP equals the ratio of the saving rate s and the capital/output ratio k:

(4) $g = s/k$.

The saving rate is assumed to vary directly with the real interest rate and hence inversely with the rate of inflation, provided that increased inflation reduces the real interest rate (Mundell 1963). Accordingly, we have $s = a - bp$ with $b > 0$, and hence:

(5) $g = a/k - (b/k)p$

for given k. This equation is represented by the SS schedule in Figure 1. The SS schedule slopes down because increased inflation reduces the real interest rate and hence also the saving rate and the rate of growth in the medium term. In anticipation of the numerical examples given below, the SS schedule is drawn steeper than the TT schedule, as is necessary for monetary expansion to be inflationary in the model. An increase in the capital/output ratio shifts the SS schedule to the left and increases its slope, thus reducing the rate of growth that is consistent with any given inflation rate.

The simultaneous determination of the rates of inflation and growth in the medium term is described by the intersection of the two schedules in Figure 1. The corresponding reduced-form solutions for p and g are:

(6) $p = (vck - a)/q$.

(7) $g = (2a - ave - vcb)/q$.

where $q = 2k - kve - b$. An important feature of the solution is that a shock to any one of the exogenous parameters of the model moves inflation and growth in opposite directions, thus giving rise to a negative contemporaneous correlation between the two. Specifically, an increase in b, k, c, e, or v unambiguously raises p and reduces g, whereas an increase in a has the opposite effect. In this model, inflation and growth can be positively correlated only if both schedules shift in the same direction and in a particular pattern--as a result, for instance, of simultaneous exogenous increases in the government budget deficit and the saving rate.

Any observed pattern of inflation and growth must be the consequence of changes in their underlying determinants, including the parameters of the present model.

To conclude this discussion, a numerical calibration of the model may be useful to illuminate its properties further. With a = 0.1, b = 0.5, k = 3, c = 0.02, e = 0.1, and v = 5, the equilibrium solution to the model is 5 percent inflation and 2.5 percent growth per year. A decrease in the exogenous component of the saving rate to a = 0.06 *ceteris paribus* raises inflation to 6 percent and reduces growth to 1 percent. Meanwhile, the saving rate falls from 7.5 percent to 3 percent of GNP. On the other hand, an increase in the exogenous component of the deficit/GNP ratio to c = 0.06 (with a = 0.1 again) raises inflation to 20 percent and reduces growth to zero, and the deficit rises from 1.5 percent to 4 percent of GNP in the process. These numerical solutions are not very sensitive to alterations in our assumptions about the responsiveness of either the saving rate or the deficit/GNP ratio to inflation. For example, reducing the assumed effect of inflation on the saving rate from b = 0.5, which is roughly consistent with the elasticity of the saving rate with respect to inflation in the United States reported, for example, by Gylfason (1981), to b = 0.1 changes the original solution to the model only marginally: inflation drops from 5 percent to 4.5 percent, while the rate of growth rises from 2.5 percent to 3.2 percent, *ceteris paribus*. Similarly, reducing the assumed effect of inflation on the deficit/GNP ratio from e = 0.1, which is of the same order of magnitude as the effects simulated by Tanzi (1978), to e = 0.02 changes the original solution insubstantially: inflation drops from 5 percent to 3.8 percent, while the rate of growth rises from 2.5 percent to 2.7 percent, other things being equal. In the special case where inflation influences neither saving nor the budget deficit (i.e., b = e = 0), inflation and growth are both 3.3 percent and, with a vertical SS schedule, the growth rate becomes insensitive to changes in either velocity or the deficit.

3. Empirical analysis

    In consideration of the complex dynamic nature of the relationship among inflation, growth, and external debt, to which the simple model

presented in the preceding section is obviously not intended to do full
justice, no attempt will be made here to estimate the parameters of the
model. Such a task would be rendered impossible in any case by the dearth
of reliable data for many of the developing countries under study.
Against the background provided in the preceding section the statistical
strategy adopted here is instead (a) to study relevant cross-section data
to see whether the hypothesized pattern of inflation, growth, and debt
since the mid-1960s is borne out by the numbers, (b) to use simple
nonparametric tests to try to ascertain the statistical significance of
the empirical pattern displayed by the data, and (c) to attempt to infer
from these tests about the relationship between inflation and economic
growth and their underlying determinants in different periods, without
necessarily attempting to establish causality. In view of the deficient
quality of some of the published data, however, the empirical results
reported below must be interpreted with caution.

a. Data

The 24 countries where inflation was in excess of 20 percent per year
on average during 1980-85 are shown in Table 2, in descending order
(column 1). Bolivia heads the list, with annual inflation of 569 percent
on average, compared with 12 percent average annual inflation in the world
as a whole during this period. All but one of these countries are low-
income or middle-income countries; the sole exception is Iceland (column
2). Other indicators of living standards, such as longevity, literacy,
and energy use, reveal a similar pattern. Apart from Iceland, Israel, and
Greece, the high--inflation countries had per capita incomes of $2100 or
less in 1985.

The growth performance of the high-inflation economies was also
strikingly poor. On average, their GDP per capita declined by 2 percent
per year during 1980-85 (column 3). Eighteen of these countries
experienced negative growth of GDP per capita during this period. GDP per
capita grew by 1 percent or more on average in only two countries in the
group (Somalia and Turkey). Also, it is noteworthy that none of the
nations on the list have a long democratic tradition except Costa Rica,
Iceland, and Israel. All the others have lived under authoritarian

governments, continuously or intermittently, in recent decades. Many have
also suffered considerable political instability.

The high-inflation economies include many of the most heavily indebted
ones (column 4). For example, of the 15 countries with the heaviest
foreign debt burden listed in Table 3, eight are among the high-inflation
countries in Table 2. Four of the remaining seven had annual inflation
rates of 10 percent or more on average during 1980-85. The average ratio
of total public and private debt to GNP in the high-inflation countries
was 68 percent at the end of 1985 (Table 2, column 4). These numbers seem
to confirm the pattern shown in Table 1, but they do not, by themselves,
necessarily indicate a statistically significant relationship, let alone a
causative link among inflation, growth, and external debt.

For comparison, the experience of low-inflation economies is
summarized in Table 4, which includes all countries with less than 5
percent annual inflation on average during 1980-85.[4] Their income per
head was much higher on average than in the high-inflation economies, or
$4090 compared with $1740. Japan, Germany, and the Netherlands are the
only industrial countries in the group. The average annual rate of growth
of GDP per capita was also much higher in the low-inflation economies
during this period, or 1.6 percent compared with -2.0 percent. Finally,
the debt ratio of the low-inflation economies was much lower on average
than in the high-inflation economies at the end of 1985, or 44 percent
compared with 68 percent. These numbers indicate that low inflation seems
to have been associated with more rapid growth and less foreign
indebtedness than high inflation during 1980-85.

Tables 5 to 8 present data on high-inflation and low-inflation
economies during the period preceding and following the first oil price
increase, 1965-73 and 1973-84. Table 5 covers all countries with double-
digit annual inflation rates on average 1965-73, while Table 6 includes
countries with average inflation rates of 20 percent or more per year
1973-84. The high-inflation economies grew very rapidly during 1965-73,
or by 4 percent a year per capita on average, but were stagnant during

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[4]   Countries with population of less than 1 million are excluded, as
are those oil-exporting countries which experienced deflation during 1980-
85.

1973-84. Meanwhile, the average debt ratio rose from 21 percent to 64 percent of GNP from 1970 to 1984. Again, Iceland and Israel are the only industrial countries in the high-inflation group. Table 7 shows all countries with inflation below 3 percent a year on average 1965-73, while countries with average annual inflation below 7 percent 1973-84 are listed in Table 8. The average rate of growth of GDP per capita in the low-inflation economies fell from 3.2 percent to 2.2 percent between the two periods, while the debt ratio rose from 15 percent to 56 percent.

To provide a bird's-eye view of the data presented thus far, the cross-country averages for each period are summarized in Table 9. The table shows that (a) high-inflation economies grew more rapidly on average than low-inflation economies during 1965-73, but much less rapidly thereafter, and (b) the debt ratio was considerably higher in high-inflation economies than in low-inflation economies throughout 1965-85. The data thus reveal a fairly clear and consistent pattern which needs to be examined more closely.

Before proceeding further, it should be noted that a similar pattern emerges when the inflation record of low-growth economies is compared with that of high-growth economies. As shown in Table 10, the average rate of inflation in the 17 countries where GDP per capita fell by 3 percent or more per year on average during 1980-85 was 75 percent per year, and 19 percent per year if Bolivia, Argentina, and Peru (with 569, 343, and 99 percent annual inflation, respectively) are not included (column 2). By comparison, the average annual inflation rate in the 14 countries where GDP per capita grew by 3 percent or more each year on average during 1980-85 was 6 percent (Table 11, column 2). All the low-growth countries are low-income or middle-income countries, with per capita GDP of $1160 on average in 1985, but there are two industrial countries (Japan and Norway) in the high-growth group whose average GDP per head is $3440 (column 3). Finally, the ratio of external debt to GNP at the end of 1985 was considerably higher in the low-growth economies than in the high-growth economies, or 66 percent compared with 35 percent (Tables 10 and 11, column 4). In sum, the low-growth group thus had considerably more inflation, lower income per head, and higher debt than the high-growth group during this period.

b. Method

It now remains to determine the statistical significance of the
emirical results presented thus far. For this purpose, the growth record
and external indebtedness of the high-inflation economies will be compared
with the experience of the low-inflation economies using the nonparametric
U test developed by Mann and Whitney (1947). Similarly, inflation and
indebtedness in the low-growth and high-growth economies will be compared.
The U test, which is equivalent to the Wilcoxon rank-sum test, is
particularly suitable here because, unlike the slightly more powerful and
much more common t test, it does not require the samples under study
either to be normally distributed or to have equal variances, nor is it as
sensitive to measurement errors or extreme observations as the t test.
Also, the nonnormal distribution of the samples rules out regression
analysis. For the Mann-Whitney test to be valid, the two samples used in
each comparison must be independent of each other. This requirement is
approximately satisfied by the cross-section data used here except insofar
as inflation and growth performance in each country may have been jointly
influenced by world economic developments during the period under review.

The Mann-Whitney test is performed by pooling the two groups of
countries and arranging the observations from the two samples in ascending
order, then replacing the smallest observation by 1, the next by 2, etc.,
and the last by an integer equal to the sum of the number of observations.
The sum of the integers or ranks corresponding to the observations from,
say, the high-inflation group is the test statistic. If this sum is high
or low enough to indicate that the observations from the high-inflation
group are systematically higher or lower than those from the low-inflation
group, the null hypothesis that there is no difference between the two
groups can be rejected. To make significance tests of this hypothesis
possible, Mann and Whitney calculated the distribution of the test
statistic for small samples and showed that it is approximately normal
when the number of observations in each sample exceeds 7.

Following this procedure, standardized Mann-Whitney U statistics were
computed to compare the growth rates and debt ratios of the high-inflation
economies with those of the low-inflation economies during the three

sample periods. The results are summarized in Table 12. Since all the
samples included are large enough for the U statistics shown to be
approximately normally distributed, those statistics can be interpreted as
t statistics. For example, the entry "Yes[*]" (followed by 3.1 in
parentheses) in the bottom left corner of the table indicates that the
annual average rate of growth of the high-inflation economies during 1980-
85 was significantly lower than that of the low-inflation economies (at
the 0.01 level of significance in a one-tailed test).

c. Results

The test results reported in Table 12 suggest that output growth was
significantly lower on average in the high-inflation economies than in the
low-inflation economies after 1973, whether the period of comparison is
1973-84 or 1980-85. Moreover, the average rate of inflation was found to
be significantly higher in the low-growth economies during 1980-85 than in
the high-growth group (U = 3.0). On the other hand, the tendency for high
inflation to be accompanied by rapid growth during 1965-73 does not pass
the significance test, indicating that the average growth rates observed
during this period may have been higher in the high-inflation economies in
the sample than in the low-inflation economies by coincidence (Table 9,
column 2).

By and large, these results support the conclusion that the low rate
of economic growth achieved on average by the high-inflation economies
after 1973 was not coincidental. Along the lines developed in sections 1
and 2, this finding can be interpreted as being consistent with the view
that (a) the aggregate supply shocks of the 1970s played an important role
in the simultaneous determination of inflation and growth in the countries
under study until the mid-1980s at least, or (b) rapid inflation slowed
down the rate of growth by discouraging saving, or (c) slow growth led to
increased inflation via tax erosion during this period. The present data
and test results do not permit us to discriminate among those
possibilities. This paper should accordingly be viewed as a prelude to,
and not as a substitute for, a detailed empirical study of the effects of
inflation on saving behavior and public finances and vice versa and of
their interaction with and implications for growth performance in
individual countries and the world economy as a whole.

Concerning the results on debt, the hypothesis that the debt ratio was higher on average in the high-inflation economies than in the low-inflation economies does not pass the significance test at the 0.05 level for any of the three periods under review. At the less stringent 0.1 level, however, this hypothesis cannot be rejected for either 1965-73 or 1980-85 (in a one-tailed test). The tendency for inflation and foreign indebtedness to amplify each other may have been obfuscated to some extent by other factors such as, for example, domestic political concerns in the countries under study, including import substitution and intensified protectionism which tend to increase inflation and reduce indebtedness as well as growth over time. On the other hand, a comparison of the low-growth and high-growth economies during 1980-85 shows a significantly higher average debt ratio in the low-growth group at the 0.01 level (U = 2.3).

It needs to be emphasized in conclusion that the tests reported here are designed to determine only whether the observed differences between the growth performance and external indebtedness of the high-inflation and low-inflation economies are statistically significant evidence of differences in their economic environment. Therefore, the test results do not exclude the possibility that statistically significant differences among average growth rates in the two groups of countries are due to factors other than inflation in particular. It is conceivable that similar differences among average growth rates in the two country groups would have been observed in any case independently of their inflation record. In general, output growth in developing countries tends to be especially sensitive to political stability and rainfall, neither of which have been taken into account here. A comprehensive account of growth performance, however, is beyond the scope of this paper. Moreover, economic growth and inflation may be jointly influenced by institutional and structural phenomena. For instance, an underdeveloped financial system may impede growth and also fuel inflation by forcing the government to finance budget deficits by printing money rather than by issuing bonds domestically, without there necessarily being a direct causal link between inflation and growth in either direction. This, incidentally, may be one reason why average income per head is much lower in the high-inflation

group than in the low-income group (Tables 2 and 4, column 2) and also
much lower in the low-growth group than in the high-growth group (Tables
10 and 11, column 3), although the income differences between the two
groups are not statistically significant (U = 1.1 and U = 1.5,
respectively).

4. Discussion

Because economic growth differentials are cumulative, they can build
up to substantial income differences in a relatively short time. If, for
example, real GNP per capita in the high-inflation and low-inflation
economies were to continue to grow by -2.0 percent and 1.6 percent a year
on average, respectively, for 20 years, other things being equal, then the
proportional difference between the per capita income levels of the two
groups of countries would more than double over the period. Specifically,
average income per head in the high-inflation economies would fall by one-
third in this case, or from $1740 in 1985 to $1170 in 2005 (measured in
1985 US dollars), while average income per head in the low-inflation
economies would rise by 37 percent, or from $4090 to $5600, between 1985
and 2005 (Tables 2 and 4, column 2). Thus, the average per capita income
of the high-inflation countries would fall from a bit more than two-fifths
of the low-inflation countries' average income per head to one-fifth in 20
years, and to one-seventh in 30 years.

So drastic a divergence of income levels, and so long-lasting, is
unlikely to occur in practice, however, because external circumstances
keep changing as time passes and also because governments or the general
public in high-inflation countries would almost surely react sooner or
later by taking measures to stem or reverse the decline of their
economies. After all, the long-run rate of growth of income per capita
depends ultimately on technological progress, including the improvement of
human, financial, and physical capital as well as creative
entrepreneurship. Nevertheless, if inflation is in some measure to blame
for the average medium-term growth differential underlying the above
arithmetic, then the real costs of inflation over time may be high indeed
by this yardstick for individual countries as well as for the world
economy as a whole.

Table 1. Inflation, growth, and external debt, 1980-85

(Weighted averages, in percent)

	Highly indebted economies	Developing economies	Industrial economies
Inflation 1/	89	44	6
Growth 2/	0.1	3.3	2.3
Debt ratio 3/	40	32	...

1/ Average annual rate of inflation of GDP deflator.

2/ Average annual rate of growth of real GDP.

3/ External public debt as percentage of GNP at the end of 1985.

Source: The World Bank, World Development Report, 1987, Tables 1, 2, and 19.

Table 2. High-inflation economies:

Inflation, growth, and external debt, 1980-85

		(1) Inflation 1/	(2) Income 2/	(3) Growth 3/	(4) Debt 4/
1.	Bolivia	569	470	-7.3	137
2.	Argentina	343	2130	-3.0	56
3.	Israel	196	4990	-0.1	106
4.	Brazil	148	1640	-1.0	44
5.	Peru	99	1010	-3.9	75
6.	Mexico	62	2080	-1.8	53
7.	Ghana	57	380	-4.0	24 5/
8.	Zaire	55	170	-2.0	112 5/
9.	Iceland	49	10710	-0.7	59
10.	Uruguay	45	1650	-4.6	58
11.	Yugoslavia	45	2070	0.1	35
12.	Somalia	45	280	2.0	54
13.	Turkey	37	1080	2.0	35
14.	Costa Rica	36	1300	-2.2	114
15.	Poland	35	2050	-0.4	...
16.	Nicaragua	34	770	-3.2	185
17.	Sudan	32	300	-3.4	70 5/
18.	Ecuador	30	1160	-1.4	62
19.	Mozambique	26	160	-12.2	...
20.	Sierra Leone	25	350	-0.1	33
21.	Portugal	23	1970	0.2	57
22.	Colombia	22	1320	0.0	33
23.	Greece	21	3550	0.4	43
24.	Tanzania	20	290	-2.7	49
Unweighted **average**		86	1740	-2.0	68

1/ Average annual rate of inflation of GDP deflator 1980-85, in percent.

2/ GNP per capita 1985, in US dollars.

3/ Average annual rate of growth of GDP per capita 1980-85, in percent.

4/ Total external long-term debt as percentage of GNP at the end of 1985.

5/ Data on private debt not available.

Source: The World Bank, World Development Report, 1987, Tables 1, 2, 18, 19, and 27.

Table 3.   Highly indebted economies:

Burden of debt and inflation, 1980-85

(In percent)

		Debt burden 1/	Inflation 2/
1.	Yemen, Arab Republic	56	10
2.	Burma	51	3
3.	Mexico	48	62
4.	Somalia	45	45
5.	Chile	44	19
6.	Yemen, PDR	42	6
7.	Argentina	42 3/	343
8.	Costa Rica	40	36
9.	Jamaica	36 3/	18
10.	Uruguay	36	45
11.	Portugal	34	23
12.	Egypt	34	11
13.	Colombia	33	22
14.	Algeria	33	7
15.	Ecuador	33	30

1/   Debt service as percentage of export of goods and services, 1985.

2/   Average annual rate of inflation of GDP deflator 1980-85.

3/   Data on private debt not available.

Source: The World Bank, World Development Report, 1987, Tables 1, 18, and 19.

Table 4. Low-inflation economies:

Inflation, growth, and external debt, 1980-85

		(1) Inflation 1/	(2) Income 2/	(3) Growth 3/	(4) Debt 4/
1.	Japan	1.2	11300	3.1	. . .
2.	Liberia	1.6	470	-5.3	85
3.	China	2.4	310	8.6	3 5/
4.	Burma	2.6	190	3.5	42
5.	Ethiopia	2.6	110	-2.2	37
6.	Malaysia	3.1	2000	3.0	62
7.	Singapore	3.1	7420	5.3	10 5/
8.	Germany	3.2	10940	1.5	. . .
9.	Thailand	3.2	800	3.0	36
10.	Netherlands	3.5	9290	0.3	. . .
11.	Panama	3.7	2100	0.2	72 5/
12.	Jordan	3.9	1560	0.4	71
13.	Oman	4.9	6730	-0.8	24 5/
Unweighted average		3.0	4090	1.6	44

1/ Average annual rate of inflation of GDP deflator 1980-85, in percent.

2/ GNP per capita 1985, in US dollars.

3/ Average annual rate of growth of GDP per capita 1980-85, in percent.

4/ Total external long-term debt as percentage of GNP at the end of 1985.

5/ Data on private debt not available.

Source: The World Bank, World Development Report, 1987, Tables 1, 2, 18, 19, and 27.

Table 5. High-inflation economies:

Inflation, growth, and external debt, 1965-73

(*In percent*)

		(1)	(2)	(3)
		Inflation 1/	Growth 2/	Debt 3/
1.	Indonesia	63	6.0	30
2.	Uruguay	52	0.6	12
3.	Chile	50	1.5	32
4.	Argentina	24	2.8	23
5.	Brazil	23	7.3	12
6.	Zaire	19	1.5	...
7.	Korea	16	7.8	23
8.	Iceland	15	3.2	...
9.	Yugoslavia	11	5.2	15
10.	Colombia	11	3.8	22
11.	Turkey	10	4.0	15
12.	Nigeria	10	7.2	6
13.	Peru	10	0.7	38
Unweighted average		24	4.0	21

1/ Average annual rate of inflation of GDP deflator 1965-73.

2/ Average annual rate of growth of GDP per capita 1965-73.

3/ Total external long-term debt as percentage of GNP at the end of 1970.

Source: The World Bank, World Development Report, 1986, Tables 1, 2, 17, 18, and 25.

Table 6. High-inflation economies:

Inflation, growth, and external debt, 1973-84

(In percent)

		(1) Inflation 1/	(2) Growth 2/	(3) Debt 3/
1.	Argentina	181	-1.2	47
2.	Israel	84	0.9	100
3.	Chile	75	1.0	100
4.	Brazil	71	2.1	44
5.	Uganda	64	-4.5	20
6.	Peru	57	-0.9	68
7.	Bolivia	54	-1.8	109
8.	Ghana	52	-3.5	...
9.	Uruguay	50	1.5	54
10.	Zaire	48	-4.0	...
11.	Iceland	47	0.7	56
12.	Turkey	42	1.9	32
13.	Mexico	32	2.2	54
14.	Yugoslavia	25	3.4	42
15.	Costa Rica	24	-0.1	114
16.	Portugal	20	2.4 4/	62
Unweighted average		58	0.0	64

1/ Average annual rate of inflation of GDP deflator 1973-84.

2/ Average annual rate of growth of GDP per capita 1973-84.

3/ Total external long-term debt as percentage of GNP at the end of 1984.

4/ Refers to 1973-82.

Source: The World Bank. World Development Report, 1986, Tables 1, 2, 17, 18, and 25.

Table 7. Low-inflation economies:

Inflation, growth, and external debt, 1965-73

(*In percent*)

		(1) Inflation 1/	(2) Growth 2/	(3) Debt 3/
1.	China	-0.9	5.1	...
2.	Zimbabwe	1.1	6.0	...
3.	Malaysia	1.2	4.1	11
4.	Liberia	1.5	2.7	39
5.	El Salvador	1.6	1.0	17
6.	Ethiopia	1.8	1.5	10
7.	Guatemala	1.9	3.2	6
8.	Sierra Leone	1.9	2.0	14
9.	Morocco	2.0	3.0	...
10.	Kenya	2.3	4.1	27
11.	Panama	2.4	4.6	...
12.	Lebanon	2.5	3.6	...
13.	Thailand	2.5	4.9	11
14.	Burkina Faso	2.6	0.4	7
15.	Egypt	2.6	1.6	...
16.	Hungary	2.6	5.8	...
17.	Dominican Rep.	2.7	5.6	24
18.	Burma	2.8	0.6	5
19.	Burundi	2.9	3.4	3
20.	Honduras	2.9	1.6	16
Unweighted average		2.0	3.2	15

1/ Average annual rate of inflation of GDP deflator 1965-73.

2/ Average annual rate of growth of GDP per capita 1965-73.

3/ Total external long-term debt as percentage of GNP at the end of 1970.

Source: The World Bank, World Development Report, 1986, Tables 1, 2, 17, 18, and 25.

Table 8.   Low-inflation economies:

Inflation, growth, and external debt, 1973-84

(In percent)

		(1) Inflation 1/	(2) Growth 2/	(3) Debt 3/
1.	China	1.8	5.2	...
2.	Switzerland	3.9	0.7	...
3.	Germany	4.1	2.1	...
4.	Hungary	4.3	3.3	38
5.	Singapore	4.4	6.9	...
6.	Ethiopia	4.4	-0.5	30
7.	Guinea	4.5	1.1	60
8.	Japan	4.5	3.4	...
9.	Austria	5.3	2.5	...
10.	Netherlands	5.9	0.9	...
11.	Burma	6.0	4.0	35
12.	Malaysia	6.2	4.9	...
13.	Liberia	6.7	-3.1	77
14.	Panama	6.7	2.7	73
15.	Papua New Guinea	6.8	-1.6	78
Unweighted average		5.0	2.2	56

1/   Average annual rate of inflation of GDP deflator 1973-84.

2/   Average annual rate of growth of GDP per capita 1973-84.

3/   Total external long-term debt as percentage of GNP at the end of 1984.

Source: The World Bank, World Development Report, 1986, Tables 1, 2, 17, 18, and 25.

Table 9. Inflation, growth, and external debt:

An overview

(Unweighted averages, in percent)

	(1) Inflation 1/	(2) Growth 2/	(3) Debt 3/
High-inflation economies			
1965-73	24	4.0	21
1973-84	58	0.0	64
1980-85	86	-2.0	68
Low-inflation economies			
1965-73	2.0	3.2	15
1973-84	5.0	2.2	56
1980-85	3.0	1.6	44

1/ Average annual rate of inflation of GDP deflator.

2/ Average annual rate of growth of real GDP per capita.

3/ Total external long-term debt as percentage of GNP at the end of 1970, 1984, and 1985.

Source: Tables 2, 4, 5, 6, 7, and 8.

Table 10. Low-growth economies:

Growth, inflation, and external debt, 1980-85

		(1) Growth 1/	(2) Inflation 2/	(3) Income 3/	(4) Debt 4/	
1.	Mozambique	-12.2	26	160	...	
2.	Bolivia	-7.3	569	470	137	
3.	Nigeria	-6.7	11	800	18	
4.	Niger	-6.6	8	250	64	
5.	Trinidad & Tobago	-5.7	8	6020	15	5/
6.	Ivory Coast	-5.5	10	660	110	
7.	Liberia	-5.3	2	470	85	
8.	Togo	-5.1	7	230	121	
9.	Uruguay	-4.6	45	1650	58	
10.	Venezuela	-4.5	9	3080	46	
11.	Guatemala	-4.3	7	1250	21	
12.	Madagascar	-4.0	19	240	105	
13.	Ghana	-3.0	57	380	24	5/
14.	Peru	-3.9	99	1010	75	
15.	Sudan	-3.4	32	300	70	5/
16.	Argentina	-3.0	343	2130	56	
17.	Philippines	-3.0	19	580	52	
	Unweighted average	-5.2	75	1160	66	

1/ Average annual rate of growth of GDP per capita 1980-85, in percent.

2/ Average annual rate of inflation of GDP deflator 1980-85, in percent.

3/ GNP per capita 1985, in US dollars.

4/ Total external long-term debt as percentage of GNP at the end of 1985.

5/ Data on private debt not available.

Source: The World Bank, World Development Report, 1987, Tables 1, 2, 18, 19, and 27.

Table 11. High-growth economies:

Growth, inflation, and external debt, 1980-85

		(1) Growth 1/	(2) Inflation 2/	(3) Income 3/	(4) Debt 4/
1.	India	3.0	8	270	15
2.	Norway	3.0	8	14370	...
3.	Malaysia	3.0	3	2000	62
4.	Thailand	3.0	3	800	36
5.	Japan	3.1	1	11300	...
6.	Burma	3.5	3	190	42
7.	Sri Lanka	3.7	15	380	49
8.	Hong Kong	4.5	8	6230	1 5/
9.	Congo	4.7	13	1110	86 5/
10.	Singapore	5.3	3	7420	10 5/
11.	Cameroon	5.4	12	810	31
12.	Korea	6.4	6	2150	43
13.	Botswana	8.6	5	840	47 5/
14.	China	8.6	2	310	3 5/
Unweighted average		4.7	6	3440	35

1/ Average annual rate of growth of GDP per capita 1980-85, in percent.

2/ Average annual rate of inflation of GDP deflator 1980-85, in percent.

3/ GNP per capita 1985, in US dollars.

4/ Total external long-term debt as percentage of GNP at the end of 1985.

5/ Data on private debt not available.

Source: The World Bank, World Development Report, 1987, Tables 1, 2, 18, 19, and 27.

Table 12. Comparison of growth performance and indebtedness

in high-inflation and low-inflation economies:

Results of nonparametric tests

(Standardized Mann-Whitney statistics in parentheses)

Hypotheses

	(1)	(2)
	Growth rate was lower in high-inflation economies	Debt ratio was higher in high-inflation economies
1965-73	Uncertain (-0.7)	Uncertain (-1.6)
1973-84	Yes* (2.2)	Uncertain (-0.4)
1980-85	Yes* (3.1)	Uncertain (-1.3)

Source: Author's computations.

* Statistically significant difference at the 0.01 level (in a one-tailed test) between growth performance in high-inflation and low-inflation economies.

Note: A negative correlation between, say, inflation and growth implies a positive U value in parentheses and vice versa.

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