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Real Effects of High Inflation

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Abstract

This paper revisits the question of the real effects of inflation, on the basis of the experience with 23 high inflation episodes in 17 countries. It finds strong indications that inflation had contractionary effects on a number of important macroeconomic variables, such as GDP, investment and employment. Moreover, high inflation led to a significant decline in real wages, a real depreciation and an improvement in external trade. These patterns are consistent with explanations that stress the transaction role of money, such as models with a cash-in-advance constraint. However, some observations are hard to reconcile with existing theory, especially the large magnitude of the fall in real wages.[1]

JEL Classification Numbers: E31, E44

Keywords: Inflation, real effects, superneutrality, cash-in-advance constraint, real wages.

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1. INTRODUCTION

A consensus on the relation between monetary and real variables remains elusive. Can the state, by printing money, grease the wheels of the market? Or is it rather throwing in sand? Were in the end the classics right who thought that "money does not matter"?

This paper examines the question empirically in a panel of 23 episodes of high inflation in 17 different countries. The choice is motivated by a paper of Sargent (1982), who argued that high inflation provides "laboratory conditions" to study monetary theory. The dominance of monetary shocks allows to abstract from other disturbances that might interfere with the analysis. In recent decades, high inflation episodes have occurred with a sufficient frequency so as to allow an examination of their common patterns.

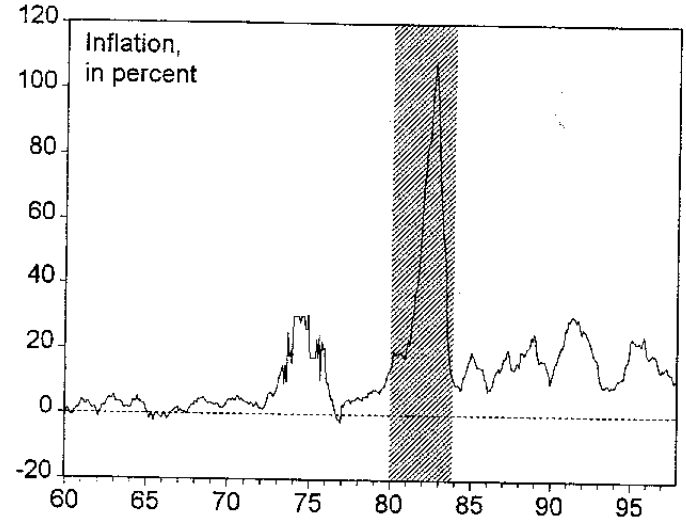
Tobin argued in 1965 that inflation could *promote* growth, since it prompts people to reduce real balances and shift their savings into capital accumulation. He derived this result – subsequently known as the Tobin effect – from a simple extension of Solow's neoclassical growth model. The policy implications were, of course, far-reaching and highly controversial: growth could be maximized if people reduce real balances to zero and the inflation rate goes to infinity.

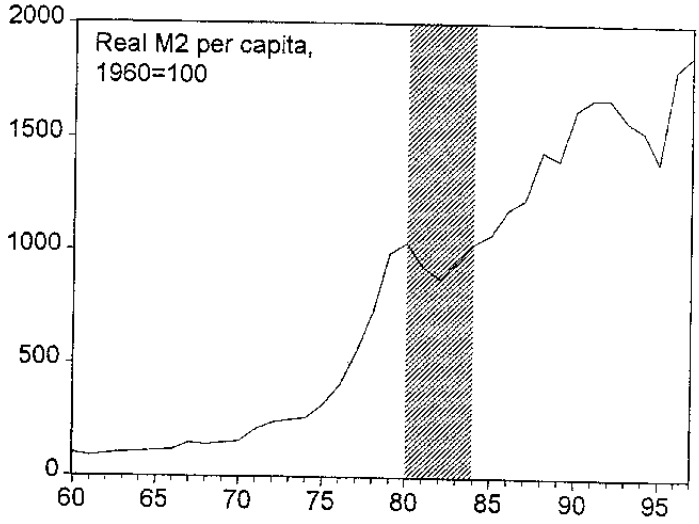
Tobin was challenged by Sidrausky (1967), who derived savings from explicit maximization. If money enters the utility function, the Tobin effect is neutralized. Inflation makes the holding of real balances more expensive relative to consumption. Therefore, individuals consume more and save less. This effect tends to reduce capital accumulation, and offsets Tobin's portfolio shift. As a result, inflation has no influence on real variables, and is *superneutral*.

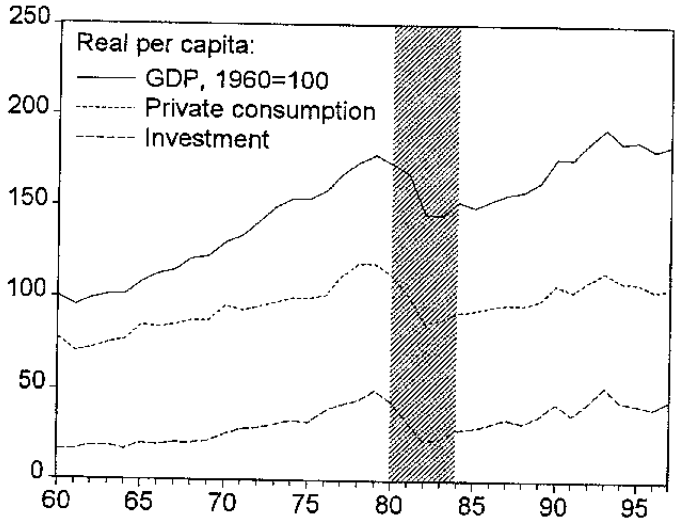
However, superneutrality is sensitive to modifications of Sidrausky's basic assumptions. Brock (1974) showed that inflation can have a *negative* effect on output if labor supply is endogenous. Just like inflation makes consumption less expensive in Sidrausky's model, it makes leisure less expensive in Brock's. People will therefore reduce their labor supply, and output contracts. A negative effect of inflation on output also arises if money is introduced via a *cash-in-advance* constraint, which stresses the transaction function of money. Stockman (1981) showed that by reducing real balances, inflation makes transactions more expensive, particularly investment transactions. This reduces capital accumulation and leads to a decline in output.

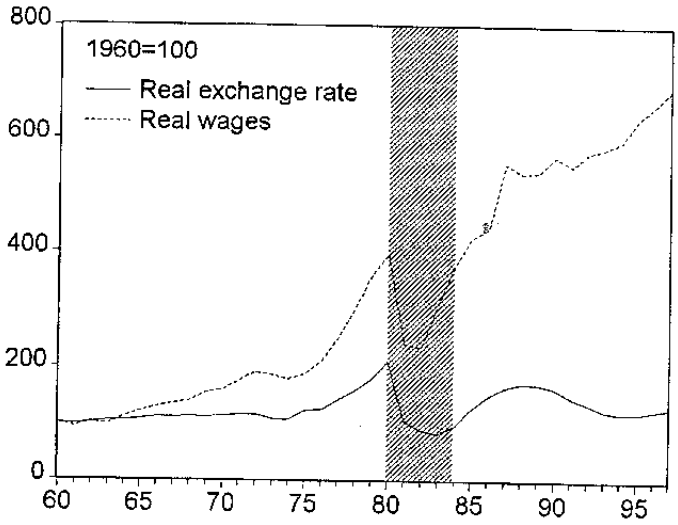
This study on the real effects of inflation begins by presenting three illustrative case studies in section 2. They suggest that inflation has *negative* effects on a large number of real variables. My approach of examining a wider set of variables (8 in total) stands in some contrast to existing empirical work, which focuses on one or two variables only. However, I find in section 3 that such a focus is in general too narrow to distinguish among competing theoretical explanations. Since the theory consists of general equilibrium models, a broader empirical approach seems to be indicated. Section 4 examines the behavior of eight different macroeconomic variables in a sample of 23 high inflation episodes. It proceeds in a sequence of increasingly formal statistical tests, and is able to shed some light on the predominant transmission channel for monetary shocks. Section 5 concludes.

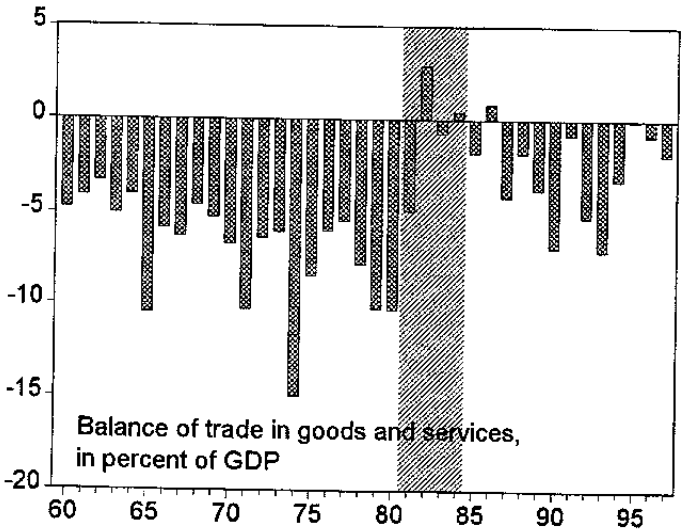
Figure 1. Costa Rica

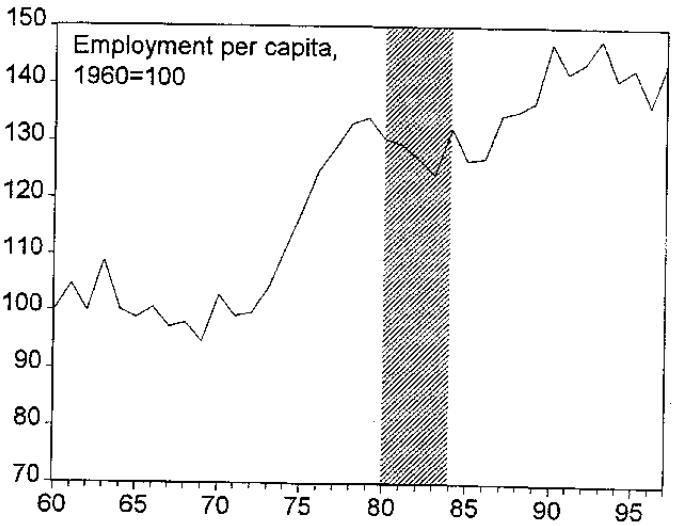












2. THREE CASE STUDIES

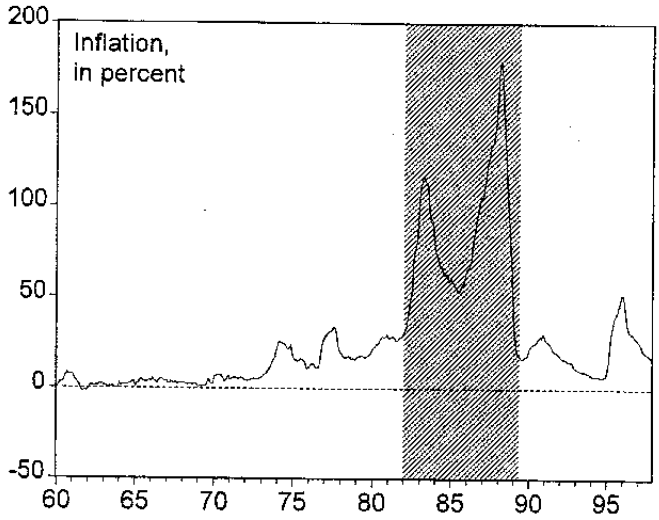
Figures 1, 2 and 3 show the effects of high inflation on eight different real variables in Costa Rica, Mexico and Ghana. In defining high inflation, I follow Bruno and Easterly (1995), who set the threshold at a minimum of 40 percent inflation for two consecutive years. They argue that 40 percent is an important breakpoint, because the chances of getting even higher inflation increase significantly beyond it. The three countries have been chosen for being close to an "average" high inflation experience, as shall become apparent below. Often, another breakpoint is set at the transition to hyperinflation (roughly, at more than 1000 percent inflation per year). It is argued that these situations are so chaotic that general economic theorems cease to hold. This hypothesis shall also be examined below. In general, the crisis periods analyzed in this paper did not start as pure inflation crises. Other factors, such as a sudden deterioration in the terms of trade or a political upheaval were the sparks that ignited destabilization. However, as the events ran out of control, monetary expansion and price increases became so rampant that they replaced the initial forces as the dominant economic shock.

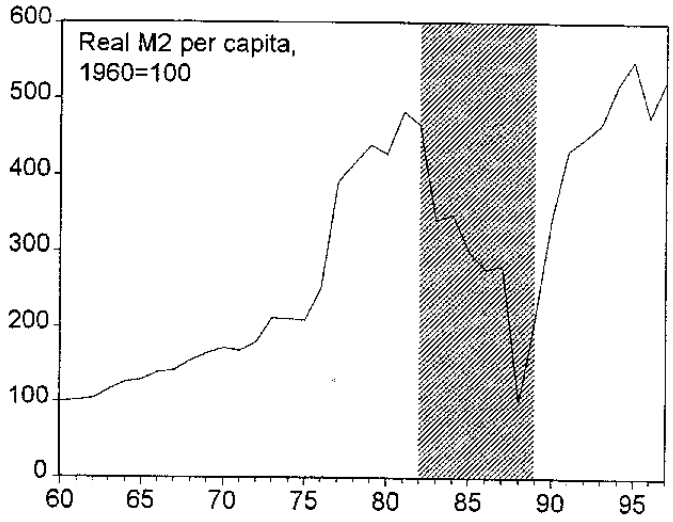
Costa Rica's inflation was quite short, lasting barely three years from 1981 to 1984. The outbreak of inflation followed on a sharp deterioration in the terms of trade during the second oil crisis. At this time, fiscal policy was expansive, and soon became unsustainable despite ample foreign financing. As the budget deficit reached 20 percent of GDP in 1981, the government defaulted on its foreign debt and recurred to monetary financing. The currency was floated, and inflation shot up to 109 percent in September 1982. The election of a new government and a solid political consensus facilitated the adoption of an adjustment program. This ensured that the inflation crisis remained a singular event in Costa Rica's monetary history.

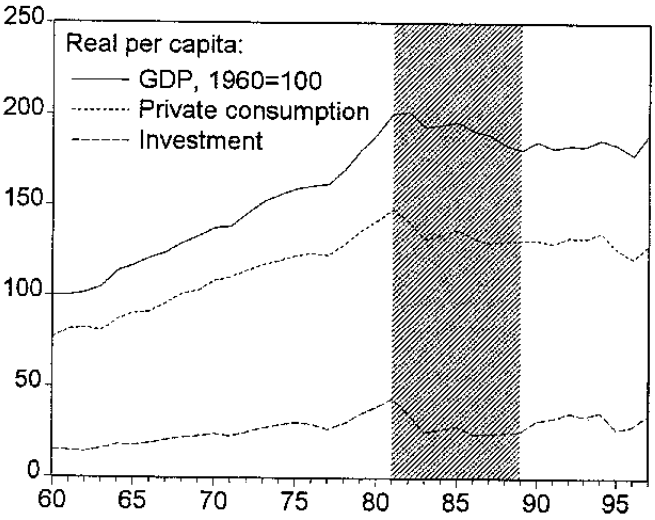
Mexico's inflation was more persistent and occupied the major part of the 1980s. Similarly to Costa Rica, a terms of trade shock combined with an unsustainable fiscal expansion to trigger the inflation crisis. A sharp drop in oil prices at the beginning of the 1980s and an increase in interest rates caused large revenue losses for the government. The state declared a unilateral debt moratorium in 1982 and was subsequently cut off from foreign funds. To cover the budget deficit, the Mexican government had no choice but to print money. The ensuing outburst of inflation peaked at 117 percent in April 1983. First stabilization efforts were thwarted by earthquakes and a collapse of the oil price, letting inflation linger on and reach a second peak with 180 percent in February 1988. Only two years later did inflation drop below 40 percent.

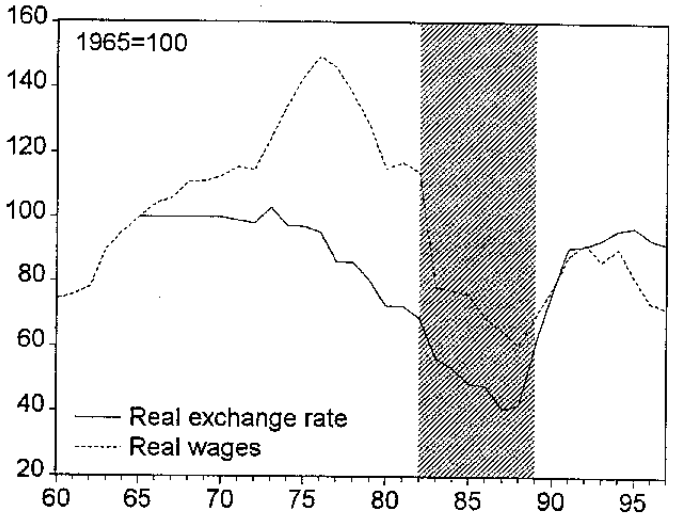
Ghana's economic decline was still more protracted than Mexico's. After gaining independence in 1957, the country - formerly known as the Gold Coast - was considered one the wealthiest and most highly educated in Africa. However, two decades of forced industrialization and import substitution undermined Ghana's comparative advantage in cocoa and gold production. The decline of these sectors virtually destroyed the government's tax base. Tax revenues fell to a mere 5 percent of GDP in 1983. As a consequence, budget deficits continuously widened and money creation accelerated, particularly during the late 1970s and early 1980s. Inflation increased and became very volatile, peaking four times at

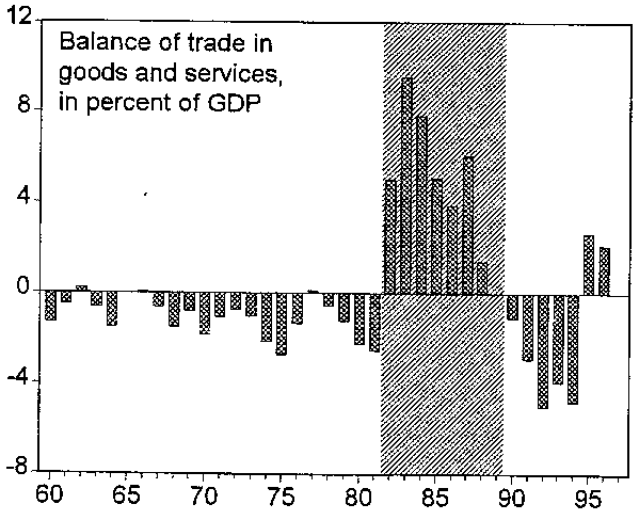
Figure 2. Mexico

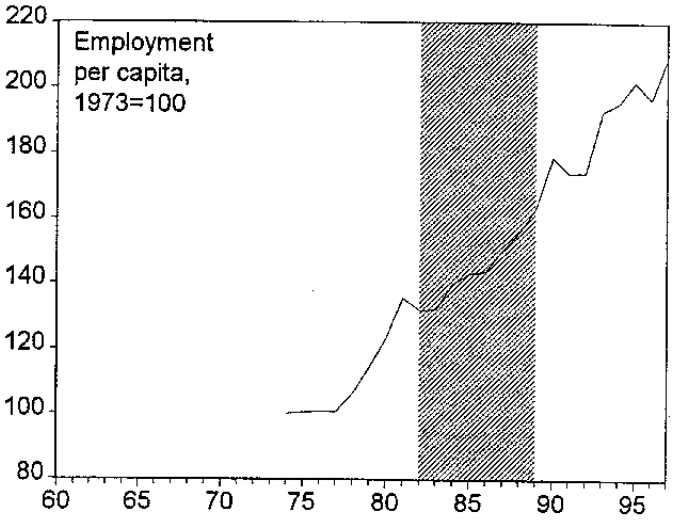












more than 100 percent between July 1977 and March 1983.[2] The economy was finally stabilized after a sharp reversal of macro policies and the introduction of market-oriented reforms in 1984.

As can be seen in figures 1 through 3, inflation was not superneutral in these three episodes, but had negative effects on the real economy, which can be summarized in the following eight stylized facts:

1. A sharp decline in real money holdings. At the end of the inflation crisis, real balances were 80 percent lower than at the start in Mexico and Ghana. Demonetization was less pronounced in Costa Rica, since inflation there was much shorter.

2. A decline in output. High inflation had a negative impact on output. The longer inflation lasted, the more profound was the contraction. While the inflation crisis looked much like a textbook recession in Costa Rica, it can be considered a depression in Mexico and Ghana.

3. A decline in private consumption. The pattern of private consumption is very similar to that of output. Interestingly, consumption contracts more sharply than GDP in Costa Rica. Since this was a short crisis, intertemporal substitution effects might have shifted some consumption into the future.[3]

4. A sharp decline in investment. Compared with its pre-crisis level, real investment fell by 45 percent in Mexico, 50 percent in Costa Rica and over 60 percent in Ghana. Although reliable data are not available, this likely led to a decline in the capital stock.

5. Little effect on employment. The employment ratio showed a steady upward trend in Mexico and Costa Rica with only minor fluctuations during the high inflation years (data were unavailable for Ghana). The upward trend in the employment ratio reflects increased labor force participation of women.

6. A sharp decline in real wages. As labor supply was rather inelastic, the brunt of adjustment was borne by real wages. During the inflation period, real wages fell by 40 percent in Costa Rica, 60 percent in Mexico and 80 percent in Ghana.

7. A decline in the relative price of non-tradables (a real depreciation). The internal real exchange rate was calculated as non-tradable prices (housing in Costa Rica and Mexico, transport in Ghana) divided by tradable prices (clothing). It depreciated by 45 percent in Mexico, 50 percent in Ghana and 60 percent in Costa Rica.

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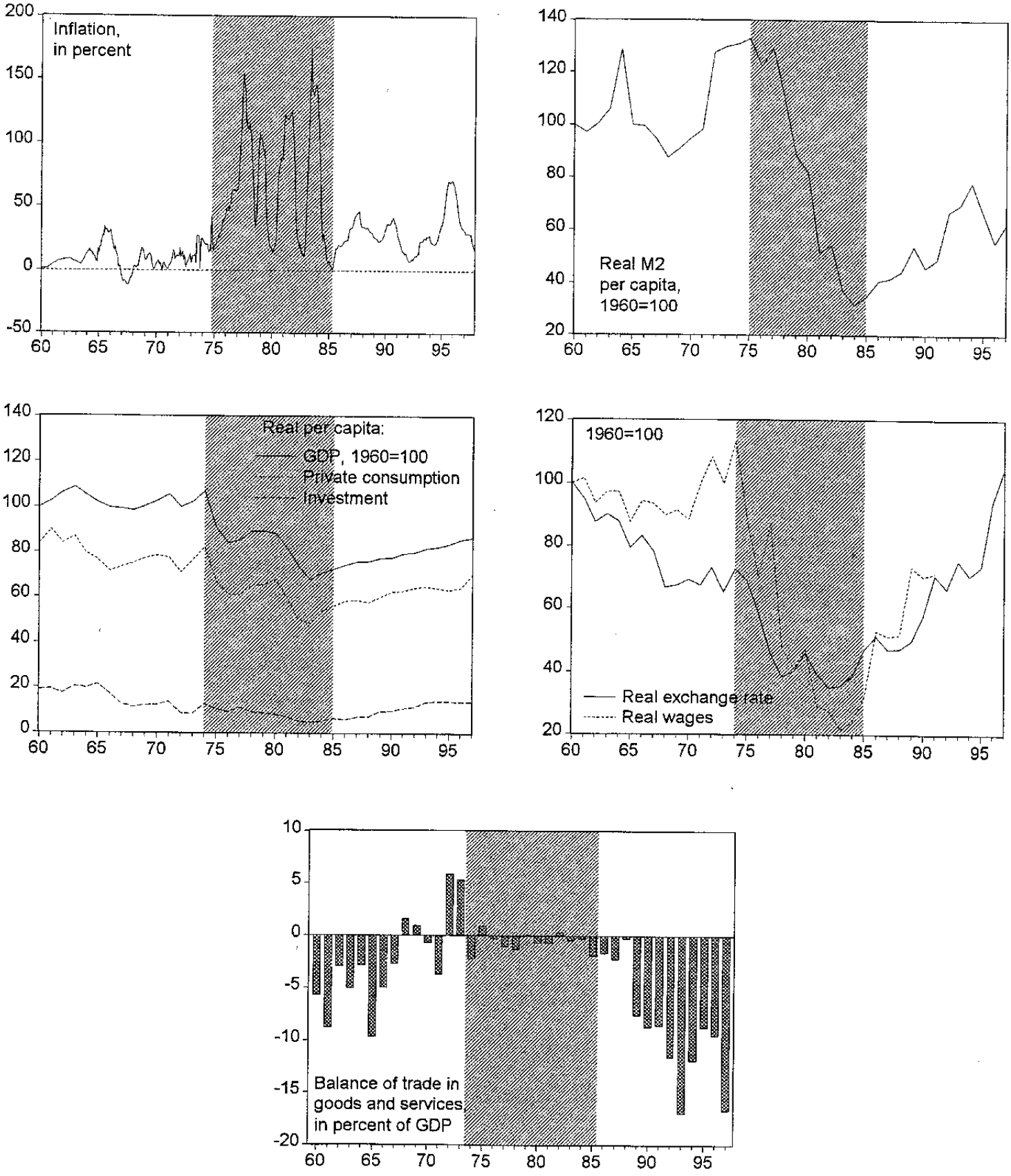
[2] July 1977 - 154 percent, December 1978 - 108 percent, October 1981 - 126 percent, March 1983 - 174 percent.

[3] This is the "temporariness effect" of Calvo and Végh (1993). For a similar pattern in Suriname see Braumann and Shah (2000).

Figure 3. Ghana



8. An improvement of the balance of trade and services. Under non-inflationary conditions, all three countries had structural trade deficits, but during the inflation period trade surpluses emerged. Most notable was the case of Mexico, which showed a surplus of almost 10 percent of GDP in 1983.

The fact that the eight real variables follow closely similar patterns in all three countries is remarkable and suggests a strong underlying economic mechanism. The recent literature on exchange-rate based stabilizations – surveyed by Rebelo and Végh (1996) – has described similar observations, confining itself, however, to the right half of Figures 1 to 3.

3. Existing Empirical Evidence

The existing empirical literature on the real effects of inflation is generally much narrower in scope than the case studies just presented. Most papers test simple relations between inflation and GDP growth. This narrowness might be an explanation for why empirical research has so far failed to agree on the most plausible theoretical mechanism. A sample of previous studies is summarized in table 2. The lack of consensus becomes immediately apparent.

Positive correlations between inflation and growth were found in some industrialized countries with very low inflation. Instead of a Tobin effect, this could also be the result of short-run nominal rigidities. The positive correlations disappear in data sets that contain countries with higher inflation. Among such studies, an important group claims to find *superneutrality*. However, Bruno and Easterly (1995) point out that superneutrality most commonly arises when both growth and inflation are averaged over more than 15 years. This technique entails a significant loss of information and might produce misleading results. Inflation crises tend to be discrete events that often last a few years only. Averaging over a long period of time therefore does not allow to examine inflation crises with a sufficient degree of resolution. Examples include McCandless and Weber (1995) or Kormendi and Maguire (1984). Papers that use higher frequency data (e.g. annual data), capture inflation crises with a higher resolution. Those studies tend to find a *negative correlation* between inflation and growth.

Although a negative correlation seems to gather increasing empirical support, it could be the result of several different theoretical mechanisms. It is necessary to go beyond the simple correlation between inflation and growth in order to distinguish e.g. among Brock's endogenous labor supply and Stockman's cash-in-advance model. However, only a handful of papers examine correlations between inflation and other macroeconomic variables. Fischer (1993) and Barro (1995) find a negative effect of inflation on capital formation, Cardoso (1992) finds a negative effect on real wages and Fischer, Sahay and Végh (1999) report negative relations with consumption, investment, the real exchange rate and the current account. This latter study is the most comprehensive to date and can be directly compared to the present paper.

In sum, the arguments in favor of negative real effects of inflation have gained much weight in recent years. However, existing empirical studies do not yet allow to identify the theoretical mechanism that is responsible for these effects. This could be accomplished by examining a broader set of variables, in particular labor market variables such as real wages and employment.

Table 1. Empirical Studies on the Real Effects of Inflation

Author	nominal variable	real variable	Number of countries	Time period	Data frequency	Correlation
Phillips (1958)	ω	U	1 (UK)	1880-1950	annual	positive
McCandless, Weber (1995)	μ	Yg	110	1960-90	30-year averages	positive for OECD, zero otherwise
	π	Yg	110	1960-90		zero
Bullard, Keating (1995)	π	Yg	58	1960-90	annual	positive at very low π zero otherwise
Geweke (1986)	μ	Yg	1 (US)	1870-1978	annual	zero
Boschen, Mills (1995)	μ	Yg	1 (US)	1951-90	quarterly	zero
Kormendi, Meguire (1985)	μ	Yg	47	1950-77	28-year	zero
	π	Yg	47		average	negative
De Gregorio (1992)	π	Yg	12	1950-85	6-year average	negative
Cardoso (1992)	π	w	7	1977-89	12-year average	negative
Fischer (1993)	π	Yg	68	1961-88	annual	negative
	π	Kg				negative
	π	Ng				zero
Barro (1995)	π	Yg	117	1960-90	10-year	negative
	π	Ig			average	negative
Bruno, Easterly (1995)	π	Yg	127	1961-92	annual	negative
Ghosh, Phillips (1998)	π	Yg	145	1960-96	annual	negative
Fischer, Sahay, Végh (1999)	π	Yg	130	1960-97	annual	negative
	π	Cg				negative
	π	Ig				negative
	π	e				negative
	π	CA				negative

ω = nom. wage growth, μ = money growth, π = inflation, Y = real GDP, K = capital stock, I = real investment, w = real wage, N = employment, C = consumption, e = real exch. rate, CA = current account, g = growth rate

4. A Panel of 23 Inflation Crises

This section extends and refines the case studies above by pooling data from 23 inflation crises in 17 different countries. The data will be subject to a sequence of tests that examine the real effects of inflation from different angles and with an increasing degree of formality. Again, an inflation crisis shall be defined as a minimum of two consecutive years with more than 40 percent inflation. Table 3 lists the cases studied in this paper.

The data set covers the period of 1961-97. There were in fact more countries experiencing inflation crises during this time, but problems in data quality and coverage prevented their incorporation in the data set. A country was included only if continuous time series for 7 of the 8 real variables were available, and if all series covered at least 25 consecutive years. In total, there were 605 annual observations on inflation, real GDP, private consumption, investment, real M2 and the trade balance, 596 observations on real wages, 593 on the internal real exchange rate and 489 on employment. GDP, private consumption, investment, employment and real M2 are expressed in per-capita terms. Real wages, the real exchange rate and real M2 are expressed in terms of tradable goods prices (clothing).

Table 2. Inflation Crises

Country	Peak Inflation (annual average)	Year	Country	Peak Inflation (annual average)	Year
Argentina I	444	1976	Jamaica	77	1992
Argentina II	3080	1989	Mexico	132	1987
Bolivia	11750	1985	Nicaragua I	70	1979
Brazil I	87	1964	Nicaragua II	33554	1987
Brazil II	2800	1990	Peru	7481	1990
Chile	505	1974	Suriname	369	1994
Costa Rica	90	1982	Turkey I	110	1980
Dominican Republic	51	1990	Turkey II	106	1994
Ecuador	76	1989	Uruguay I	125	1969
Ghana	123	1983	Uruguay II	97	1973
Iceland	84	1983	Uruguay III	113	1990
Israel	374	1984			

A dynamic profile of inflation crises

Figure 4 takes a closer look at the dynamics of the 23 inflation crises in our sample. It tracks the median of the variables, beginning six years before the peak of inflation and ending six years after. This is a straightforward generalization of the case studies presented in section 2. Basically, 23 different inflation crises are condensed into one.

High inflation (in excess of 40 percent) lasted on average for 7 years. The pattern of a typical crisis tended to be asymmetric: inflation rose more slowly than it fell. Apparently, the

deterioration of macroeconomic policies is progressive and drawn-out, but disinflation can be achieved rather quickly. The median inflation peak is 123 percent, very close to the peaks in the case studies presented before.

Real money balances fall substantially during an inflation crisis. At the height of the crisis, they are 27 percent lower than at the beginning. This is likely to have an important effect on the cost of transactions. However, the decline is reversed rapidly after inflation is brought under control. Re-monetization is so fast that real balances overshoot their initial values. This finding would support the use of the exchange rate as a nominal anchor for stabilization, letting money supply adjust endogenously. In contrast, if monetary growth targets are chosen as the anchor, they might be easily too tight, restraining a rapidly expanding money demand and choking off the recovery.

In our sample of countries, there is no evidence for superneutrality. Output, private consumption and investment *declined* during inflation crises. Investment was the most volatile, contracting by a median of –11 percent during the peak inflation year. Private consumption and output declined by –3 percent. During the subsequent recovery, investment expanded twice as fast as the other aggregates. However, a closer look at the data reveals an interesting secondary crisis at around t+5, when output and investment stagnate, and consumption declines. Also, growth in real balances slowes down considerably. Kiguel and Liviatan (1992) and Végh (1992) have argued that stabilizations often lead to an initial expansion followed by a contraction, especially if they use the exchange rate as a nominal anchor.[4] While these authors mainly referred to recessions after the *tablita* experiments in the early 1980s, more recent experiences in Mexico, Argentina (the "tequila crisis" of 1995) and in Brazil (1998) lend support to this view.

Real wages fell dramatically during inflation crises, hitting a minimum in period t+1, 21 percent below their initial value. Similarly, the real exchange rate (defined as the relative price of non-tradable goods) depreciated by 35 percent between t-6 and the peak inflation year t. Both variables recovered swiftly after stabilization, describing a U-shaped time profile. In line with the real depreciation, the external accounts improved during high inflation., A surplus emerged in the balance of goods and services around the inflation peak (t), whereas deficits prevailed in other years.

Consider for a moment the right half of the U-shaped pattern in real wages. The combination of rising real wages, an appreciating real exchange rate and a deteriorating external balanced has caused alarm in many countries undergoing stabilization. Frequently, a causal relationship was assumed to run from wage increases to the real exchange rate and the trade deficit. The impression arose that a loss in competitiveness threatened to undermine the success in controlling inflation and questioned its sustainability. However, in a wider perspective all three developments simply look like different aspects of the economic rebound after inflation. Real wages, the real exchange rate and the trade balance are restoring the levels they had before the onset of inflation.

Finally, employment dips slightly during the crisis, and again at t+5, but its variations are minor compared with other variables.

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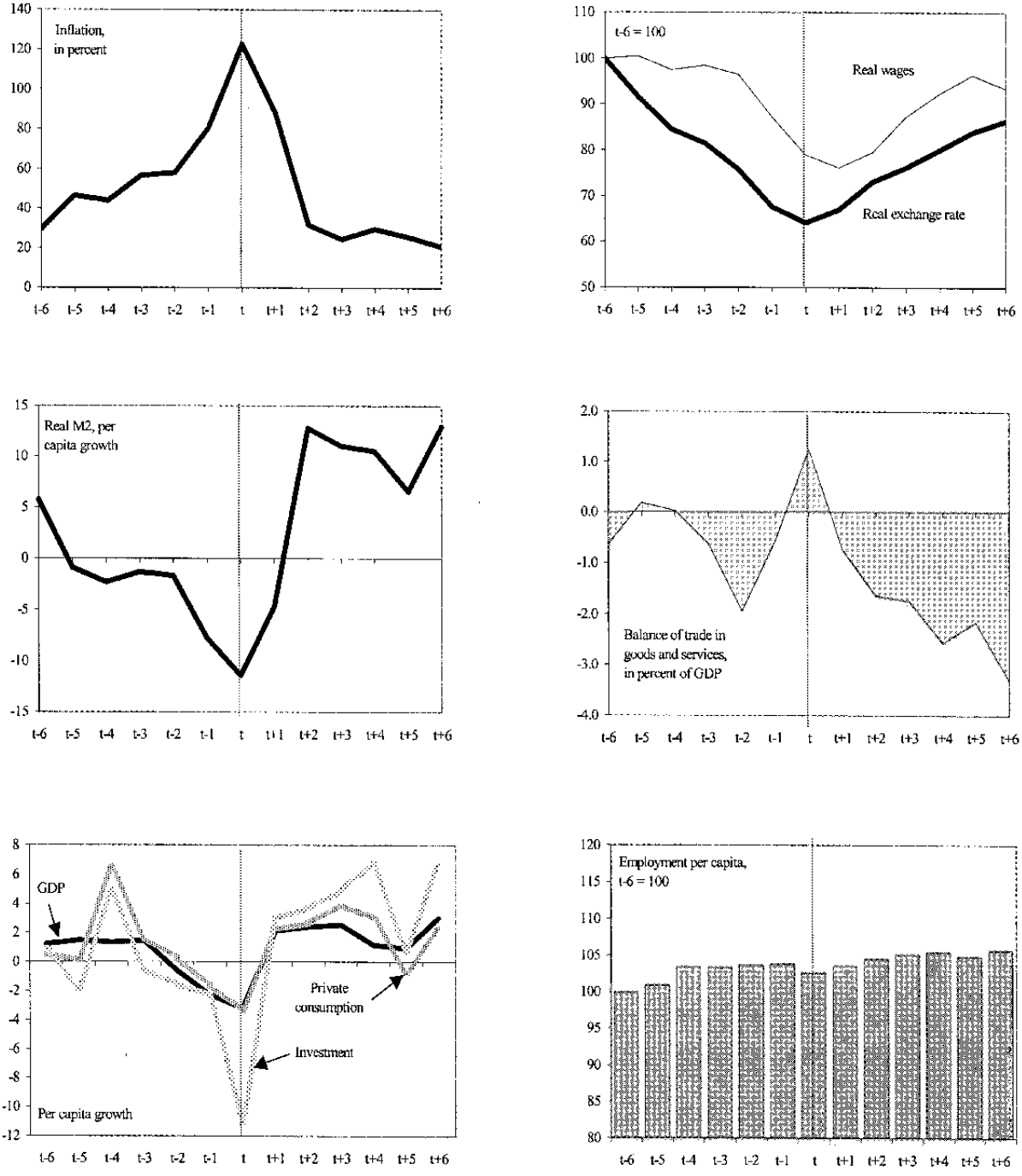
[4] See also Uribe (1998), Agénor and Montiel (1996).

Figure 4. Macroeconomic Patterns in High Inflation Episodes
(23 episodes, median values)



An econometric analysis

Figure 4 is broadly consistent with the effects of high inflation described in the case studies. However, in order to assess the statistical significance of these effects, a more formal econometric analysis is helpful. Table 4 presents the results of regressions similar to those of Fisher, Sahay and Végh (1999). I pooled the data from all 23 inflation crises in the sample, covering the time span of six years before to six years after the inflation peak. The eight real variables were regressed on 9 inflation time dummies (from t-4 to t+4) and three control variables: real LIBOR interest rates, industrialized country growth and the terms of trade. The inflation time dummies capture the real effects of inflation. Since inflation was the dominant internal disturbance in the 23 crises, no other domestic variables were used as regressors. The three external variables control for the effects of worldwide shocks, such as changes in world growth and fluctuations in international commerce and finance.

The effects of inflation have the expected signs on all real variables and are, in general, highly significant. The negative effect on real wages is the least robust, but the level of significance is just slightly above 5 percent. The pattern of the coefficients exhibits the same dynamic profile as the graphs in Figure 4; all variables reach their minima (or maxima, in the case of the trade balance) at time t, the climax of the crisis. International interest rates have a significant negative effect on real balances and the national account aggregates. Industrialized country growth correlates positively with output and consumption growth. Rising terms of trade lead to an appreciation of the real exchange rate and show a (positive) Laursen-Meltzer effect on external trade.

To test the sensitivity of the results, the regressions were also run without the hyperinflation episodes. Setting the threshold at an annual inflation rate of 1000 percent, Argentina II, Bolivia, Brazil II, Nicaragua II and Peru were excluded. The coefficients on real M2 declined for t-2, t-1 and t, but remained practically unchanged for all other dependent variables. T-values declined slightly due to the loss of degrees of freedom, but the significance of the inflation dummies was preserved. This exercise sheds some light on the debate of whether hyperinflations fall outside the standard economic framework. It is sometimes argued that periods of hyperinflations are so chaotic and confusing that rational decision-making becomes impossible. If anything, my results suggest that the presumption of rational man can be retained even when studying situations of extreme monetary growth. Indeed, hyperinflations can serve as an especially severe test of economic theory.

In sum, high inflation is associated with a significant contractionary impact on the economy. Real balances fall, and the national account aggregates go through a deep recession. The real exchange rate depreciates and the external accounts improve. Employment is reduced, though not as sharply as output. However, workers are the principal losers from an inflation crisis, since the dramatic fall in real wages leads to a strong redistribution of income away from labor.

Table 4.

Independent variables	Dependent Variables: Real M2 growth	Y growth	Cp growth	I growth	N growth	real wage	real ex. rate	Trade balance
Constant	11.23 (1.81) *	2.54 (1.92) *	2.11 (1.03)	10.92 (2.10) **	-3.57 (1.60)	120.52 (7.04) ***	54.29 (3.89) ***	-10.67 (5.05) ***
t-4	-7.12 (1.42)	1.07 (1.01)	4.52 (2.74) ***	0.81 (0.19)	-1.77 (1.09)	-4.68 (0.34)	-19.39 (1.73) *	1.20 (0.70)
t-3	-2.65 (0.54)	0.14 (0.13)	1.52 (0.94)	-2.29 (0.55)	-2.93 (1.87) *	-2.13 (0.16)	-13.14 (1.19)	1.20 (0.72)
t-2	-10.69 (2.16) **	-2.97 (2.83) ***	-0.21 (0.13)	-2.16 (0.52)	-1.57 (1.00)	-7.38 (0.54)	-15.95 (1.44)	0.85 (0.50)
t-1	-12.76 (2.57) ***	-3.67 (3.49) ***	-3.42 (2.11) **	-7.77 (1.87) *	-3.80 (2.43) **	-21.64 (1.58)	-28.83 (2.60) ***	2.64 (1.56)
t	-18.26 (3.69) ***	-5.98 (5.70) ***	-5.45 (3.36) ***	-15.05 (3.63) ***	-4.56 (2.91) ***	-26.45 (1.94) *	-28.66 (2.59) **	4.74 (2.82) ***
t+1	-6.21 (1.24)	0.59 (0.55)	3.92 (2.39) **	6.26 (1.49)	-0.49 (0.31)	-25.00 (1.81) *	-22.72 (2.03) **	1.01 (0.60)
t+2	12.27 (2.46) **	0.51 (0.48)	2.20 (1.34)	8.21 (1.96) **	0.22 (0.14)	-17.74 (1.29)	-11.51 (1.03)	0.30 (0.18)
t+3	4.91 (0.98)	1.09 (1.03)	2.20 (1.34)	2.24 (0.54)	-0.66 (0.41)	-8.42 (0.61)	-6.35 (0.56)	0.12 (0.07)
t+4	4.53 (0.88)	0.39 (0.36)	2.12 (1.26)	4.61 (1.07)	-1.03 (0.64)	-8.48 (0.60)	2.82 (0.24)	-1.04 (0.59)
real LIBOR	-1.08 (1.78) *	-0.31 (2.42) **	-0.50 (2.51) **	-1.23 (2.42) **	-0.06 (0.29)	-2.45 (1.47)	0.15 (0.11)	0.14 (0.69)
Industrialized country growth	0.00 (0.00)	0.41 (2.17) **	0.82 (2.85) ***	0.38 (0.51)	0.42 (1.55)	-0.57 (0.23)	-5.38 (2.72) ***	0.34 (1.14)
Terms of Trade	-0.02 (0.36)	-0.01 (1.39)	-0.02 (1.67)	-0.05 (1.29)	0.04 (2.42) **	-0.08 (0.62)	0.59 (5.91) ***	0.05 (3.35) ***
Number of observ.	288	289	289	289	255	290	285	289

Note: t-statistics are in parentheses. Significance at the 10, 5 and 1 percent level is indicated by one, two and three stars, respectively.

General correlations with inflation

Next, the data set is expanded to cover all observations between 1961 and 1997, including years with low inflation. Figure 5 plots the correlations of inflation with the eight real variables. These charts abstract from the dynamics of inflation crises and give a more general picture of the effects of inflation. Except for the trade balance, all variables appear as rates of change, and the inflation rate is shown in logs. To smooth out the data, the whole set of observations was divided into 24 subsamples containing 25 observations each. Figure 5 plots the median values for the subsamples.[5] Because the majority of observations correspond to single- and lower double-digit inflation rates, the data are dense in this range, but thin out toward higher inflation rates.

The *negative correlation* between inflation and economic activity is clear and statistically significant in all cases except employment. *Higher inflation reduces growth* in output, consumption, investment, real balances and real wages. It depreciates the (internal) real exchange rate and improves the trade balance, whereas the effect on employment is hump-shaped and turns negative only at high rates of inflation.

The figures also suggest that the negative *relation may not be monotonic*. Economic activity first seems to *increase* as one moves up the lowest brackets of inflation. Output growth reaches a maximum at 6.8 percent inflation, growth in private consumption and investment at around 12 percent. How far this reflects short-run price rigidities cannot be assessed in this study. In any case, it is interesting to note that Ghosh and Phillips (1998) find a similar non-monotonic relationship between GDP growth and inflation, with a growth maximum of at 2.5 percent inflation.

Again, the strong impact of inflation on real wages is striking. The elasticity of real wage growth to (log) inflation is –2.5, compared to –0.9 for (per capita) GDP growth. This is somewhat puzzling, since simple neoclassical growth models suggest that the two variables move closely in line. An institutional explanation for this behavior seems implausible, as wage adjustments become more frequent (monthly, if not daily) during high inflations.

The results can be used for a preliminary assessment of the different theoretical explanations. A negative relation between inflation and growth seems well established. However, this negative relation can be either the result of a decline in labor supply (Brock) or of a decrease in capital accumulation (Stockman). Although both mechanisms produce similar effects on output, they differ in their implications for the labor market. A decline in labor supply (an upward shift of the labor supply curve) leads to lower employment and higher real wages. This does certainly not hold in our data, as one of the most striking findings was the strong decline in real wages. Together with the significant contraction in investment, capital decumulation becomes a more successful explanation.

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[5] The first subsample contains 31 observations. This procedure is directly comparable to Ghosh and Phillips (1998), who plot the relation between inflation and growth.

Figure 5. Real Effects of Inflation
(rates of growth, trade balance in percent of GDP)

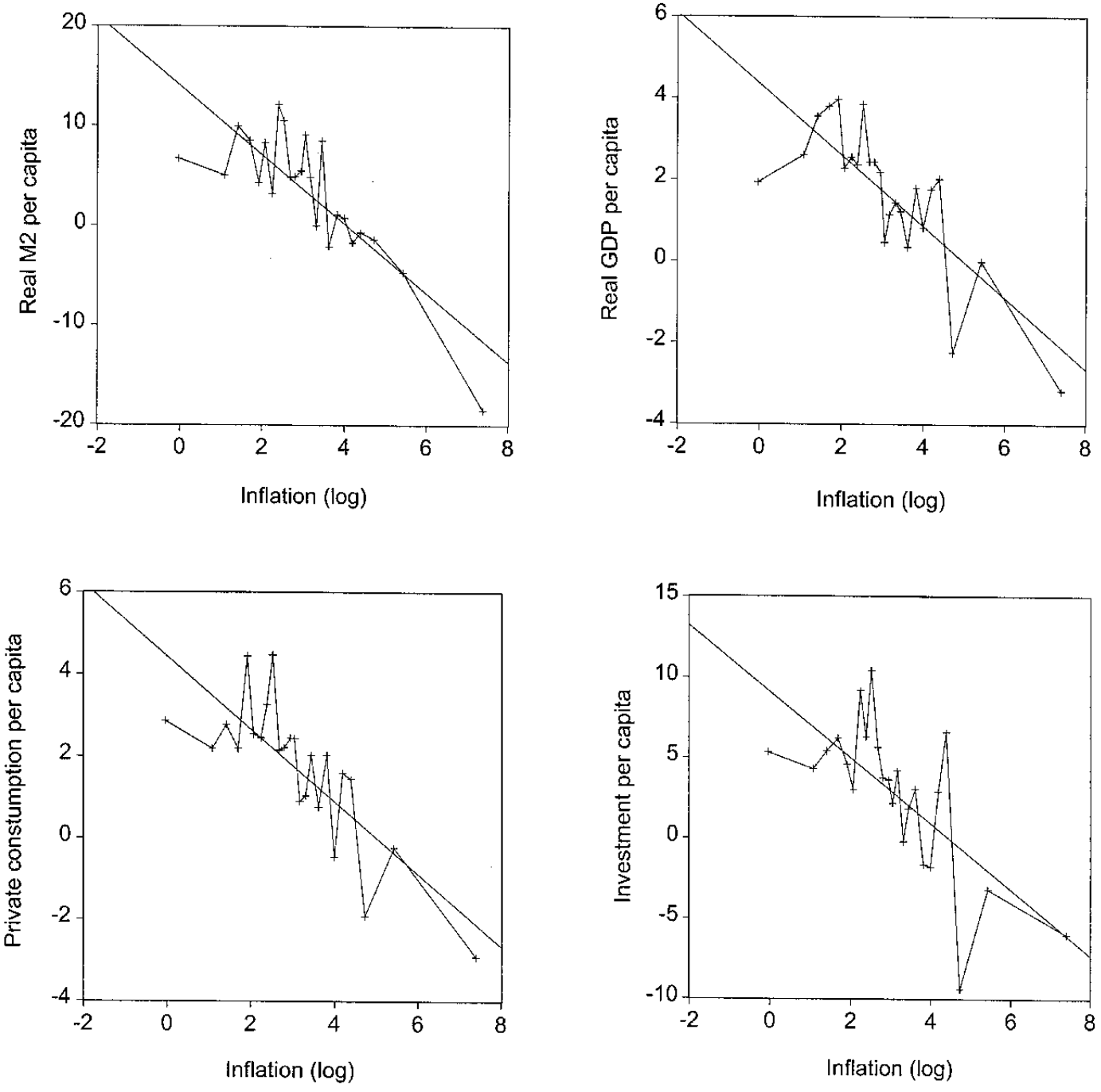
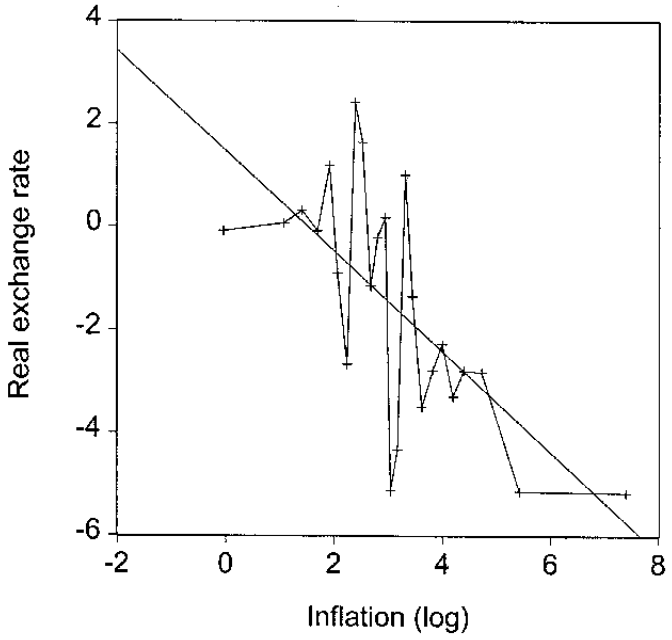
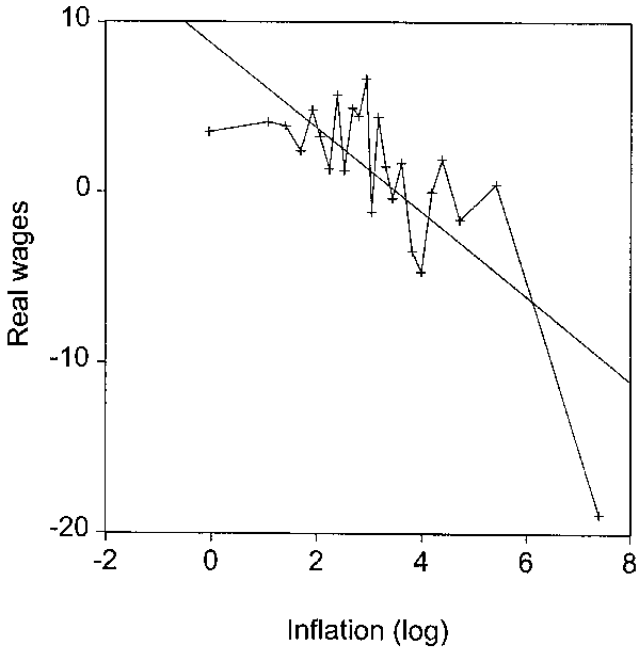
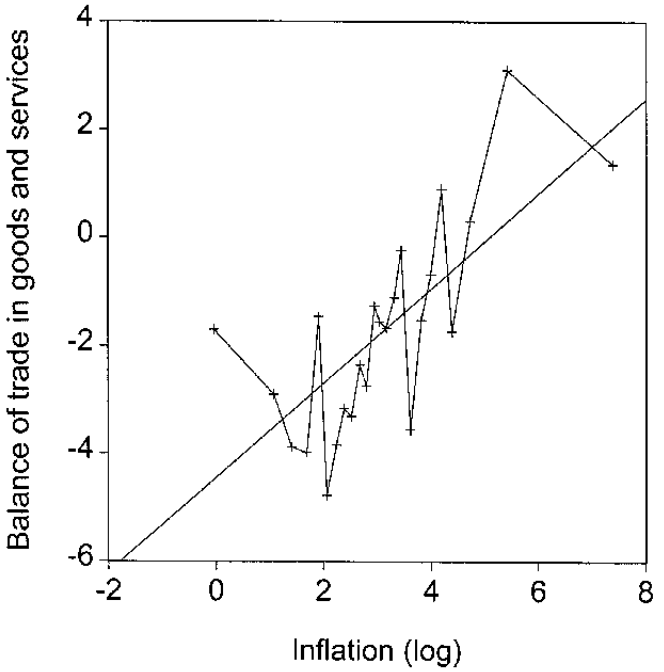
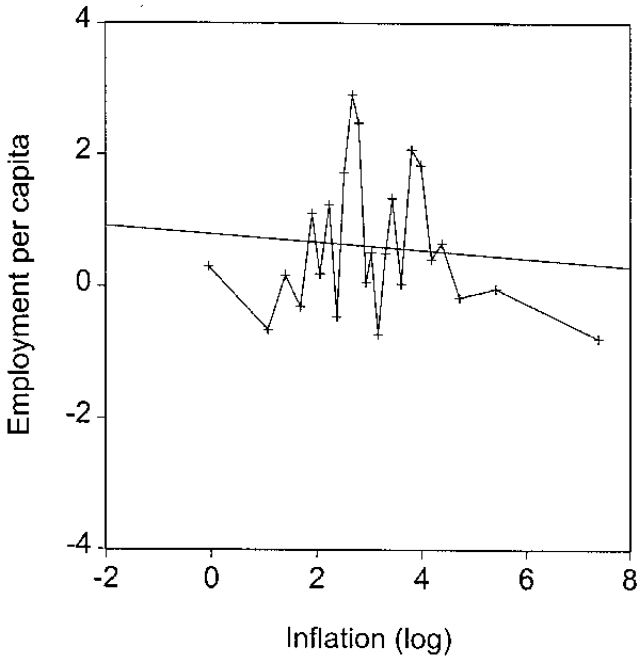


Figure 5 (continued)









An intuitive description of the transmission channel for inflation may go as follows: Higher inflation leads people to reduce their real money holdings. This increases transaction costs, especially on investment purchases. Investment thus declines, reducing the country's capital stock. This leads to a downward shift of the labor demand curve, lowering real wages. The elasticity of labor supply determines the amount of the decline in employment. If labor supply is not very elastic, employment may not change very much, and the brunt of adjustment is borne by real wages. A lower capital stock, in turn, produces lower output.

5. Conclusions

The brief survey of existing empirical literature in section 3 showed that much evidence is accumulating in favor of *negative real effects of inflation.* This paper strongly supports that view. In addition, the variables examined in the last section allow to go one step further and conduct a preliminary assessment of different theoretical mechanisms to explain these effects. The sharp fall in real wages and the contraction of investment support a cash-in-advance approach like Stockman's, where inflation leads to a decline of the capital stock. If declining labor supply were the main cause of the drop in output, we should observe *increasing* real wages. However, we don't.

The apparent success of a cash-in-advance approach suggests important conclusions about the role of money in the economy. More than any other approach, the cash-in-advance model stresses the *transaction function of money*. In analyzing inflation, it is therefore paramount to model money as a means of transaction. Still, there are some observations that cannot be explained by simple one-sector models like the ones discussed above. First, the extent of the decline in real wages is surprising. It would be very important to understand the reasons for this, since it is the source for a large redistribution of income in the society. Dornbusch and Edwards (1992) note that high inflation is often the result of populist policies. Populists try to redistribute income to urban workers and the poor by means of expansionary macroeconomic policies. Sooner or later, these attempts hit resource constraints and fail, causing high inflation. It is ironic that the very classes that were promised to benefit from populist policies are bound to pay for them.

Second, the observed depreciation of the real exchange rate and the improvement of external accounts during high inflation point to other potential extensions of the model. To account for changes in relative prices, the model needs to encompass two sectors of production. Also, monetary growth models should to allow for international trade, in order to explain the reaction of the external balances. Both extensions suggests a closer integration of macroeconomics and foreign trade theory, a combination that seems appealing and natural, since both fields essentially use a general equilibrium approach.

DATA SOURCES

Inflation rates, M2: IMF, *International Financial Statistics*
Housing, clothing and transport price indices: ILO, *Yearbook of Labor Statistics,* national authorities and IMF country reports.
GDP, private consumption, gross fixed capital formation, exports and imports of goods and nonfactor services: UN, *National Account Statistics* and IMF country reports.
Population: IMF, *International Financial Statistics*
Wages and employment: ILO, *Yearbook of Labor Statistics*, national authorities and IMF country reports.

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