IMF Working Paper

WP/98/23

INTERNATIONAL MONETARY FUND

European I Department

The Nonmonetary Determinants of Inflation: A Panel Data Study[1]

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March 1998

Abstract

This paper explains inflation performance in a sample of industrial and transition economies by looking at policymakers' incentives to inflate the economy, and the perceived costs of disinflation. It finds a significant effect of fiscal deficits on inflation, particularly (but not exclusively) in countries where the government securities market is not well developed. Other factors with significant effect on inflation include relative price changes, central bank independence, the exchange rate regime, and the degree of price liberalization; there is only limited evidence that other structural factors, such as those influencing the natural rate of unemployment, have a significant effect on inflation.

JEL Classification Numbers: E31, E42, E63

Keywords: inflation, fiscal policy, panel data

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[1]An earlier draft of this paper was presented at the conference on "Monetary Policy, Price Stability and the Structure of Goods and Labor Markets" held in Perugia on June 27-28, 1997, under the sponsorship of Banca d'Italia, IGIER and Centro "Paolo Baffi", Universita' Bocconi. The authors would like to thank the participants in the conference, and particularly Alex Cukierman, Juan Dolado, Charles Goodhart, and Eduart Hochreiter for helpful comments and suggestions. We are also grateful to Hashem Pesaran for suggesting the estimation technique used in Section III, and to Tarhan Feyzioğlu for his useful comments. Finally, we would like to thank the IMF desk economists who answered the questionnaire reported in Appendix I.

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SUMMARY

This paper explains inflation performance in a sample of 47 industrial and transition economies during 1993–96 by looking at the incentives that policymakers have to inflate the economy and at the perceived costs of disinflation.

After a brief literature review, panel-data econometric techniques are used to estimate the effect on inflation of several nonmonetary variables (such as the fiscal balance, the degree of development of the government securities market, and the unemployment rate) as well as a number of factors that may potentially affect the natural rate of unemployment, particularly in transition economies (such as the private sector share in GDP, price liberalization, and trade liberalization). It also looks at some standard institutional devices to lower inflation, such as central bank independence and exchange rate pegging.

The econometric results indicate a significant effect of fiscal deficits on inflation, particularly (but not exclusively) in countries where the government securities market is not well developed. Other factors with a significant effect on inflation include relative price changes, central bank independence, the exchange rate regime, and the degree of price liberalization. There is only limited evidence that other structural factors, such as those influencing the natural rate of unemployment (and hence the "unemployment motive" for inflation), affect inflation performance. The degree of openness of the economy is also not significant, although this may reflect the inclusion in the sample of many of the countries that were formerly part of the Soviet Union.

> Inflation does not happen out of a clear blue sky. It is serving some political economy purpose in each country where it continues. In seeking to end inflation, it is useful to try to understand what purpose its continuation serves in each particular case.
>
> Burton and Fischer (1997)

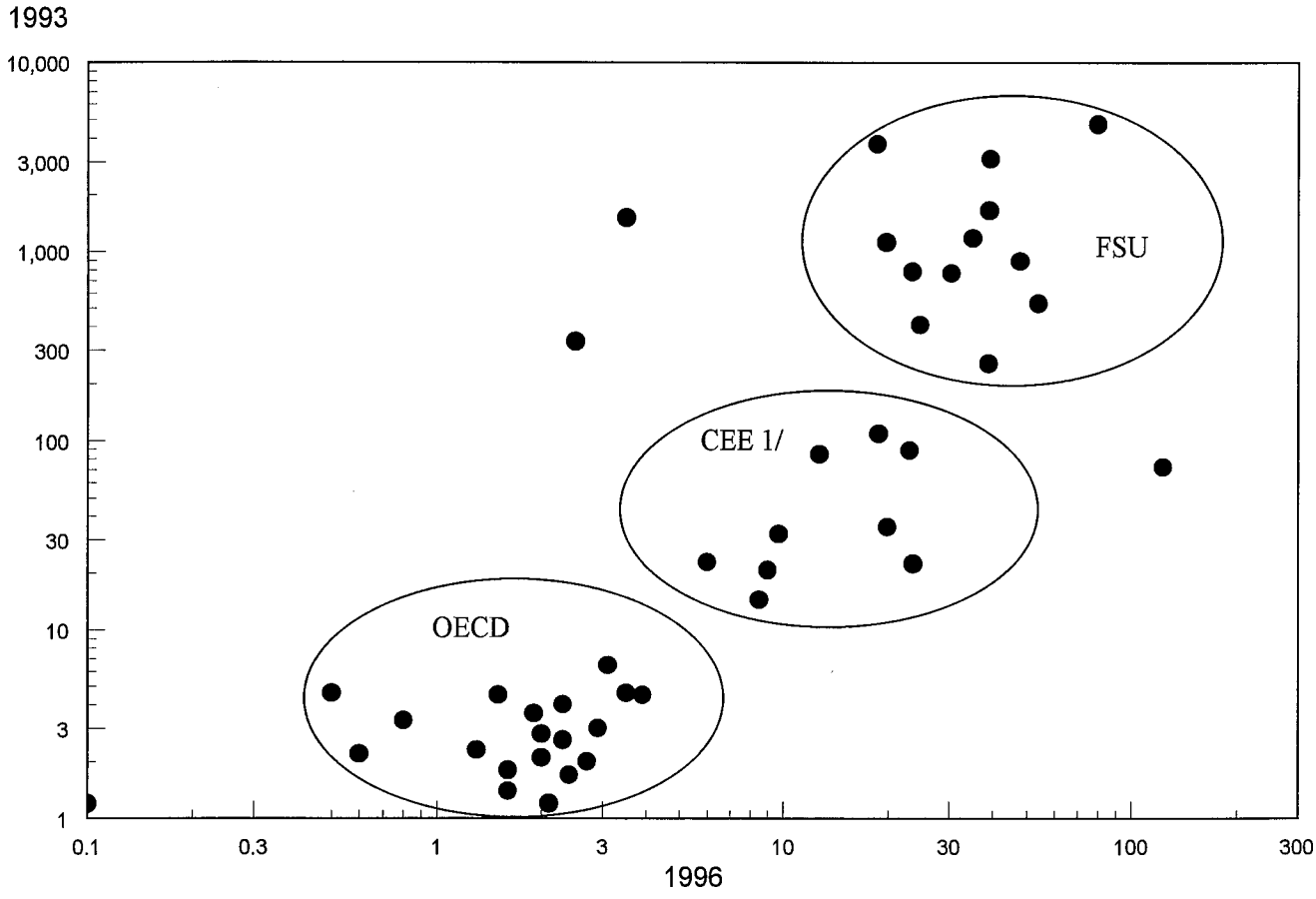
I. INTRODUCTION

Inflation is a monetary phenomenon: an increase in the money supply is regarded by most economists as a condition for inflation to persist in time. Thus, differences in inflation over time and across countries can be explained by differences in the growth rate of money. This, however, is not very interesting. The interesting question, from both an analytic and a normative standpoint, is: why do governments allow the money supply to expand and create inflation? Presumably governments inflate the economy in return for some perceived real benefits. And, even though money may be neutral in the long run, it may have powerful short run real effects. Thus, to understand why inflation differs across countries and over time, one must look at differences affecting the perceived benefits from inflation, as well as the perceived costs arising from disinflation.

Though the theoretical literature on the "motives" for inflation is sizable, only limited empirical work is available. Moreover, what is available focuses on only a few factors (e.g., openness of the economy, the degree of central bank independence, the exchange rate regime), often considered in isolation, without controlling for other variables that economic theory would regard as relevant.

This paper assesses the significance of various nonmonetary factors that have been thought to determine inflation. At an academic level, the paper can simply be seen as a test of alternative theories of the determinants of inflation. At a more practical level, the paper also tries to explain why inflation differs so much across countries. We are particularly interested in comparing the experience of transition economies with that of industrialized countries. Can structural differences explain the large and persistent differences in inflation rates across transition economies and why inflation tends to be so much higher than in industrialized countries (Figure 1)? If so, are there structural reforms that would improve the success and sustainability of disinflation?

Figure 1. Inflation
(logarithmic scale)



Source: World Economic Outlook.

1/ Central and Eastern European transition economies.

The structure of the paper is the following. After reviewing briefly the empirical evidence on cross-country differences in inflation performance, Section II provides some theoretical underpinnings to our econometric work, identifying a broad set of variables that, according to economic theory, could explain differences in inflation performance across countries and time. Section III presents the data and the econometric methodology and discusses the econometric results. Section IV draws some conclusions.

II. Why Do Governments Inflate? Empirical Literature and Theoretical Underpinnings

A. Empirical Literature

The empirical literature addressing the issue of why inflation differs across countries has concentrated primarily on the effectiveness of different precommitment devices in containing pressures for inflation. Economists have focussed on two main institutional devices: central bank independence and pegging the exchange rate. Both of these can be seen as means of precommitting the authorities to a low inflation monetary policy, allowing them to overcome any tendency to inflate. In particular, setting up an independent central bank, and making it accountable expressly for the goal of price stability, can counteract the inflationary bias of discretionary monetary policy (see Section B). Alternatively, precommitment could take the form of pegging the exchange rate to a low inflation currency: the additional cost for the authorities of abandoning the exchange rate peg and the competitiveness loss arising from inflation in the presence of a pegged exchange rate lessens the attractiveness of surprise inflation.

Empirical evidence points to a strong negative correlation between inflation and central bank independence for industrialized countries (Grilli, Masciandaro and Tabellini (1991) and Cukierman (1992)), but the evidence is more mixed for other countries. Cukierman (1992) finds a much weaker relationship, if any, between inflation and central bank independence in developing countries. However, Loungani and Sheets (1997) show that the association between central bank independence and inflation holds also in transition economies. But a simple negative correlation need not imply causation: countries that have an underlying aversion to inflation may also be more likely to establish independent central banks to ensure that inflation is kept under control.[2] In addition, Fuhrer (1997) argues that central bank independence has little power explaining cross-country differences in inflation, once additional macroeconomic variables, such as unemployment and interest rates, are included. This points at the need of controlling for a wide range of variables in studying the determinants of inflation.

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[2]For example, Posen (1995) argues that countries with a dominant financial sector will have stronger political opposition to inflation, making them more likely to create independent central banks to fight inflation.

There is also considerable evidence on the role of the exchange rate regime in determining inflation. In perhaps the most exhaustive study, Ghosh et al. (1995), examining the experience of more than 100 countries over three decades, conclude that pegged exchange regimes are typically associated with lower inflation.

Campillo and Miron (1996) have extended the approach of these early papers to include a role for economic fundamentals in determining inflation. Using a cross section of more than 60 countries, they find a lesser role for central bank independence and the exchange rate regime, once structural variables such as openness to trade, political stability, and optimal tax considerations are taken into account. However, their sample includes only two transition economies, whereas we are interested in extending their approach to the determinants of inflation in a wider set of transition economies, and assessing how their experience contrasts with that of industrial countries.

Two recent papers have examined the determinants of inflation in transition economies. Coorey, Mecagni and Offerdal (1996) consider the effect of relative price changes on inflation in transition economies. They find that, while money and wage growth were the most important determinants of inflation, relative price variability had a sizable impact during the high inflation associated with the initial liberalization, with a more modest effect at moderate inflation rates. Using a panel of transition economies, Fischer, Sahay and Végh (1996) find that fixed exchange rates, lower fiscal deficits and a number of structural variables are associated with lower inflation rates.

Our contribution differs from the above papers in three main respects. First, we focus on a sample of both transition economies (Eastern Europe and FSU) and industrial countries. In particular, we are interested in the extent to which structural and economic differences can account for the much higher inflation rates observed in transition economies, or whether these must instead be attributed to unobserved differences in countries' relative preference for inflation. Second, instead of limiting ourselves to cross-section data, we use a panel of annual data from 1993 to 1996, to increase the amount of information and to strengthen the focus on more recent inflation experience. Third, we use a comprehensive range of explanatory variables. These variables and their relation with inflation are discussed next.

B. Theoretical Underpinnings

To measure the role of underlying economic factors in determining inflation, we first need a framework that explains why governments might choose to inflate the economy. Cukierman (1992) provides such a framework, identifying four main motives for inflationary policies.

The Employment Motive

First, consider Cukierman's employment motive, which reflects the ability of central banks to temporarily raise output and employment above their natural level through unanticipated inflation. If the NAIRU is high (above the socially desired level of unemployment) and

nominal rigidities are significant (so that the output gain from an unanticipated monetary expansion is large), the authorities have a greater incentive to inflate the economy. True, if private sector agents recognize this and change their price-setting behavior accordingly, the inflation will be anticipated and so fail to increase employment. But the temptation for the authorities to inflate remains, thus raising the equilibrium inflation rate even though the goal of higher employment is not achieved.

The employment motive provides a rationale for including in our regressions measures of the unemployment rate, and more precisely of the NAIRU, together with structural variables that may affect it.[3] It also justifies including structural variables that relate to the existence of nominal rigidities, as the latter would enhance the effect of a monetary expansion.

Other things equal, higher structural unemployment rates will tend to increase the equilibrium inflation rate: the marginal benefit of unemployment reduction is likely to be greater, increasing the incentive for surprise monetary expansion. As to the structural variables affecting the NAIRU, our hypothesis is that the more competitive the economy (measured in terms of price liberalization, privatization, enterprise restructuring, etc.), the closer will be output to its socially desirable level, and thus the lower the incentive to inflate. These structural aspects are of particular relevance to transition economies. To measure these effects, we rely on the EBRD, which publishes numerous measures of progress in the transition to a market economy. These include the private sector share of GDP; progress in privatization and enterprise restructuring; the extent of market liberalization, as measured by price liberalization, foreign trade liberalization and the stance of competition policy; financial market liberalization, and legal reform.

A key structural variable affecting labor market mechanisms and, potentially, the NAIRU is the degree of centralization of the wage bargaining system. However, the wage bargaining system may have complicated effects on the employment motive (Calmfors and Driffill (1988)). In a completely decentralized system, output may be close to the socially optimal outcome, reducing the incentive to inflate. Conversely, a completely centralized system may also produce socially desirable outcomes, by internalizing the unfavorable externalities of wage push by individual unions. An intermediate system may produce the least desirable outcome of all, creating greater incentives for surprise inflation.

Another structural feature of the labor market—wage indexation—may also have ambiguous effects on inflation. In one sense, increased indexation would seem to reduce the benefits of surprise monetary expansion, because the resulting inflation would be higher. But this would depend on the indexation lag. Backward-looking indexation can raise the output costs of a disinflation program: with nominal wages depending on past inflation but actual inflation

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[3]In principle, if one could measure the NAIRU precisely there would be no need to include the latter set of variables. However, the NAIRU can only be estimated roughly, particularly in transition economies (see below).

coming down, real wages will increase, which will tend to reduce labor demand and output. In addition, greater indexation may reduce the social costs of inflation, and so weaken the economy's aversion to inflation (Fischer and Summers (1989)). In addition, extensive indexation may be the manifestation of labor market rigidities, such as real wage resistance, which would tend to raise the natural rate of unemployment above the socially desired unemployment rate, and so increase the incentive for surprise monetary expansion

The above factors focus on the temptation that the monetary authorities have to inflate the economy to boost employment. The employment motive can, however, explain why monetary authorities do not resist inflationary pressures arising from within the economic system. One reason for inflationary pressures on which the economic literature has focused recently is the need for large relative price changes. This is of particular relevance to transition economies, where the price mechanism has substituted for central planning as the means of allocating scarce resources, giving rise to dramatic changes in the structure of relative prices. Of course, if prices are perfectly flexible, such relative price changes need not produce inflation. But if prices are sticky downwards—or, alternatively, if there are "menu costs" to changing prices coupled with a skewed distribution of relative price shocks—large relative price increases will raise the general price level.[4] This effect can interact with the employment motive: if the authorities accommodate the price increase by increasing the money supply—out of concern for depressed demand and lower employment—the inflationary impact of the relative price shock is augmented. To measure the extent of relative price adjustment, we use two measures of relative price variability, the variance and the skewness of the distribution of individual relative price changes.

The Revenue Motive

Governments may have a revenue motive for inflation, so as to create seigniorage. Countries with large disequilibria in public finances (the deficit net of seigniorage revenues) will have a greater incentive to use the inflation tax to help ease their fiscal problems. This is particularly likely to be true in countries where the base for seigniorage (e.g., demand for base money) is high,[5] or where the tax system is particularly distorted, which raises the welfare cost of

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[4]Ball and Mankiw (1995) revive and refine this argument. Pujol and Griffiths (1996) apply this analysis to transition economies, finding considerable support for the role of relative price adjustment in explaining Polish inflation since 1989.

[5]However, causality might run the other way: low inflation rates may raise the demand for money and with it the ratio of base money to GDP.

increased tax rates.[6] One additional aspect linking fiscal with monetary developments is the possibility of financing the deficit with nonmonetary instruments: given the deficit, the money supply will be higher if government securities markets are less developed (thus, the deficit might also interact with the state of development of the government securities market).[7]

We use a number of variables to capture the revenue motive, including the domestic debt-to-GDP ratio, the general government deficit as a share of GDP, the share of base money relative to GDP, as well as a variable measuring the development of the market for government securities (see below).

The Balance of Payments Motive

Governments may be tempted to use devaluation to solve their balance of payments problems. A nominal devaluation will eventually put pressure on domestic prices, but will—at least temporarily—lower real wages and boost export supply. This motive should be particularly strong for countries with limited access to international capital markets, and who are thus unable to borrow their way out of balance of payments difficulties. To capture this motive, we include the current account deficit as a share of GDP as a potential explanation of inflation.

The Financial Sector Motive

The central bank's concern for the stability of the banking system may give rise to a financial sector motive for inflation. For example, the central bank may avoid raising interest rates, as needed to contain inflationary pressures, if these increases are likely to hurt financial

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[6]Another aspect is whether the interest paid by the government on its debt is set in real terms (as in the case of full price, and to some extent financial, indexation) or in nominal terms. In the latter case, inflation can erode the value of government debt. The corresponding gain for the government can be regarded as "seigniorage" in a broad sense, although its magnitude is not related to the demand for base money, but rather to the outstanding amount of nonindexed government debt (Kenc, Perraudin, and Vitale (1997)).

[7]This aspect has also to do with the cost of financing government expenditure. The effect of the absence of a government securities market can be regarded as equivalent to that of an infinitely high interest rate on government debt, which would force the government to finance the deficit by printing money.

institutions engaged in maturity transformation (i.e., borrowing short-term and investing long-term).[8] In order to capture the financial motive, we include a measure of the health of the banking system, based on the assessment of IMF country economists (see below).

Countervailing Forces

Though the above framework explains why central banks may choose to inflate the economy, there are also countervailing forces that lessen the incentive to inflate. The recent literature has identified openness as one of these countervailing forces. The argument—originally due to Romer (1993)—is that, the more open the economy, the smaller the real benefits of higher output from surprise monetary expansion, and thus the lower the equilibrium rate of inflation. As domestic output expands, the terms of trade deteriorates: the more open the economy, the greater the fraction of foreign goods in domestic consumption, and the greater the welfare loss from the terms of trade loss. In addition, the more open is the economy to foreign finance, the smaller is the need for surprise inflation to lower the current account deficit. In short, more open economies may be blessed with a lower propensity to inflate.[9] To capture this effect, we include in our econometric regressions the ratio of imports and exports to GDP. In addition to openness, we also include the countervailing forces identified at the start of this section, namely the classification of a country's exchange rate regime, and the degree of central bank independence (which we measure for industrialized countries by using the standard indices in the literature; for transition economies we use the results of a survey of IMF country economists).

Past Inflation

Finally, our list of regressors includes lagged inflation. Past inflation can work in two different ways: high past inflation may involve lower current inflation if people have realized how costly inflation can be (e.g., German dislike for inflation); on the other hand, it may reveal a

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[8]This assumes that lending rates are stickier than deposit rates. Sticky bank rates are also important to evaluate the employment motive. If nominal bank rates react slowly to changes in money market interest rates, an initial decline in inflation and money market rates will be accompanied by an increase in the real cost of borrowing and the remuneration of bank deposits.

[9]Lane (1995) provides an alternative explanation of the inflation-openness link, which would also apply to countries too small to effect their terms of trade. Take an economy with monopolistic competition and sticky prices in the nontraded sector: in equilibrium, output is below the level given by perfect competition. Thus, there is an incentive for surprise monetary expansion, to raise output in the economy toward the perfectly competitive equilibrium. This incentive is greater the less open the economy, and thus the larger the relative size of the imperfectly competitive nontraded sector.

preference for inflation. Moreover, if inflation expectations are backward looking, high inflation in the past would make disinflation more costly, thus resulting in a higher inflation equilibrium.

III. Empirical Results

A. Data Description

Our paper uses annual data from 1993 to 1996 for 47 countries: 22 industrialized OECD countries, 10 countries from Central and Eastern Europe, and 15 countries from the Former Soviet Union. Macroeconomic data have been taken mainly from IMF data sources, including the IMF's International Financial Statistics and the IMF's World Economic Outlook Database. Structural variables came from two separate sources: (i) a questionnaire completed by IMF country economists (see Appendix I); and (ii) EBRD indices of structural reform for transition economies (see Appendix II).[10]

Not all the data were available for all the 47 countries and for the entire sample period. In practice the econometric results were based on four data sets:

- The first and largest data set (G47 data set) contains core macroeconomic data (the current account, the fiscal deficit, the exchange rate regime, and the degree of openness—measured by import ratio or import plus export ratio) for all the countries in the sample. In addition, this data set includes the results of the IMF questionnaire providing information on six structural factors: whether there is indexation (0–1 dummy); the degree of centralization in the wage bargaining system (0–1 dummy); the degree to which monetary policy is constrained by the lack of a government securities market (taking values of 1 to 10); the degree of independence or, rather, subordination of the central bank (taking values of 1 to 10); the extent of problems in the banking sector (taking values of 1 to 10); and data on government domestic debt (Appendix I).

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[10]The exchange rate regime is described by a dummy variable, constructed by the authors, which takes the value of one whenever there is a fixed or preannounced exchange rate regime. We also used an index of "economic freedom" for both transition and industrial economies compiled by the Heritage Foundation. The index is a composite indicator measuring the extent to which countries' economies are free from government interference. It incorporates trade policy, taxation, government intervention, monetary policy stance, openness to foreign investment, degree of competition in the banking sector, extent of wage and price controls, property rights' status, degree of government regulation, and the size of the shadow economy. However, the results obtained using this index were rather poor.

- In addition to the above data, the second data set (G40 data set) includes information on the unemployment rate and base money. The sample period is the same but data are available for only 40 countries.

- In addition to the data included in the first data set, the third data set (G18 data set) contains a measure of relative prices but only for 18 transition economies for the period 1993–95.[11]

- In addition to the variables included in the G47 data set, the final data set (G25 data set) contains seven structural indicators from EBRD but only for the 25 transition economies for the period 1994–96. The seven variables are: private sector share in GDP; indicators of large and small scale privatization; a measure of enterprise restructuring; an indicator of the degree of price liberalization; an assessment of trade and exchange system reform; and a measure of banking sector reform.

B. Econometric Methodology

Panel data econometric techniques were used in order to exploit both the cross-country and time dimensions of our data sets. The dynamic model to be estimated can be written as:

$$P_{i,t} = \alpha_i + \beta P_{i,t-1} + \gamma X_{i,t} + \epsilon_{i,t} \qquad (1)$$

where P is the logarithm of inflation;[12] **X** is a matrix of explanatory variables; ϵ is the error term; i=1, ...,N is the cross-section dimension; and t=1, ...,T is the time dimension. The econometric estimation of this model is complicated by the inclusion of the lagged dependent variable in the right hand side of the equation.

The literature on dynamic panel data models (e.g., Nickell (1981), Sevestre and Trognon (1996)) indicates that both the fixed effect and random effect estimators of (1) result in biased estimates. This problem is particularly serious when the time dimension is small, as in our case, as it is not possible to rely on the asymptotic properties of the OLS estimator. The solution advocated in the literature is to take first differences, thus eliminating the α_i's which are the cause of the problem, and estimate the following regression: [13]

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[11]This variable is from Coorey et al. (1996) and was kindly provided by Mauro Mecagni.

[12]Using the logarithm of inflation is preferable in light of the inclusion in the sample of countries with very high inflation rates, as a way of reducing the risk of heteroskedasticity of residuals.

[13]Taking first differences also eliminates the problems related to the initial conditions of the sample (Hsiao (1986), p. 89).

$$\Delta P_{i,t} = \beta \Delta P_{i,t-1} + \gamma \Delta X_{i,t} + \Delta \epsilon_{i,t} \qquad (2)$$

However, this introduces two other complications: the correlation between $\Delta P_{i,t-1}$ and $\Delta \epsilon_{it}$; and the autocorrelation of $\Delta \epsilon_{it}$. Arellano and Bond (1991) suggest an instrumental variable technique to correct for these problems when T is small. Here we use a modified version of the Arellano and Bond estimator suggested by Pesaran (1997) which employs the seemingly unrelated regression equations (SURE) technique. This method essentially involves two steps: (i) instrumenting ΔP for each cross-section t, using lagged levels of P as well as current and lagged levels of X's; and (ii) running a restricted SURE for each cross-section in the panel, i.e., estimating (2) for each t separately and restricting the coefficients β and γ to be the same across time. An added advantage of estimating (2) with our data sets is that many of the level variables, particularly the subjective cardinal rankings, are highly correlated across countries. This is much less of a problem with first differences.

C. Empirical Results

Table 1 gives the results of panel regressions using the above restricted SURE technique on the G47 data set. As we are differencing the variables, only those which have sufficient variation across time can be used. Fortunately, in the G47 data set only one variable (the degree of centralization in the bargaining system) did not have sufficient variation across time.[14] Our largest sample includes 188 observations (N=47, T=4), which is reduced to 141 after first differencing. The dependent variable in all the regressions is the change in the log of inflation; t-statistics are given in brackets. Among the explanatory variables only the lagged dependent variable and the import ratio are in logs. In all the equations, the lagged dependent and the exchange rate regime variables have been instrumented.[15]

The lagged dependent variable is always significant with a positive sign and with an elasticity of between ¼ and ⅓, indicating that high past inflation makes it more difficult to reduce current inflation.

Together with the lagged dependent variable, equation 1 includes all the variables in the data set. Four variables are significant. First, the fiscal deficit, which is in fact one of the most robust variables across all data sets. In this respect, the regression confirms the visual evidence of negative correlation between inflation and the magnitude of the fiscal balance, which is

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[14]In principle, it is possible to estimate the coefficient of this variable in the model by substituting the estimated coefficients from the difference equation into the level regression and then estimating the level regression.

[15]The lagged dependent variable was instrumented as explained in section B above. The exchange rate regime variable was instrumented using the fitted values of a probit regression of the change in exchange regime on the lagged levels of the exchange rate regime as well as lagged levels of the other exogenous variables in Table 1.

Table 1. Panel Data Estimates Using the G47 Data Set 1/

(Instrumental variable SURE technique)

Dependent Variable: Δ Log (Inflation)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	-0.13	-0.14	-0.15	...	-0.17	-0.27	-0.14
	(-2.22)	(-2.30)	(-2.38)		(-2.76)	(-2.40)	(-2.37)
Δ log (inflation) $_{-1}$ 2/	0.28	0.27	0.26	0.36	0.22	0.24	0.27
	(3.77)	(3.47)	(3.35)	(4.97)	(3.14)	(2.78)	(3.97)
Δ current account deficit	0.01	0.01	0.01	0.01	...	...	...
	(0.89)	(1.05)	(1.00)	(0.78)			
Δ fiscal deficit 2/	0.04	0.03	...	...	...	...	...
	(2.92)	(2.48)					
Δ primary deficit	...	...	0.03	0.03	0.02	0.02	0.02
			(2.12)	(3.01)	(1.90)	(1.90)	(1.97)
Δ primary deficit x Dummy 3/	...	...	...	...	...	...	0.02
	...	...	...	...	...	...	(1.83)
Δ log (import ratio)	0.45	0.45	0.44	0.39	...	...	...
	(1.42)	(1.40)	(1.35)	(1.19)	...	...	...
Δ fixed exchange regime 2/	-1.53	-1.58	-1.55	-1.68	-1.77	-1.50	-1.74
	(-3.81)	(-3.91)	(-3.79)	(-4.17)	(-5.01)	(-3.89)	(-5.03)
Δ wage indexation	1.11	1.17	1.15	0.99	1.09	1.25	1.02
	(2.80)	(2.88)	(2.83)	(2.38)	(2.63)	(3.05)	(2.55)
Δ absence of government securities market	0.01	0.01	0.02	0.01	...	...	...
	(0.01)	(0.19)	(0.24)	(0.08)			
Δ subordination of central bank	0.23	0.24	0.25	0.29	0.28	0.22	0.24
	(2.75)	(2.73)	(2.91)	(3.28)	(3.86)	(2.54)	(3.20)
Δ problems in the banking system	0.02	0.03	0.03	0.03	...	...	...
	(0.29)	(0.37)	(0.42)	(0.39)			
Δ domestic government debt	-0.02	-0.01	-0.01	-0.01	...	...	...
	(-0.20)	(-0.05)	(-0.11)	(-0.04)	...	...	...
N	141	141	141	141	141	75	141
R^2	0.37	0.40	0.39	0.32	0.38	0.49	0.38

1/ T-statistics are given in brackets.

2/ Instrumented.

3/ The dummy takes the value of 1 when the absence of a government securities market is thought to constrain the conduct of monetary policy (i.e., a value of 6 or more in question 3 of the IMF questionnaire, see Appendix I).

stronger for transition economies (Figure 2).[16] Second, the exchange rate regime variable indicates that those countries with a preannounced exchange rate regime tend to have lower inflation relative to those with flexible regimes. It may be argued that countries have moved to a preannounced or fixed regime only after their economic fundamentals, including inflation, have improved. However, here we control for a number of other economic and institutional variables and also instrument the exchange rate variable. A third significant variable is the dummy for wage indexation: countries with a wage indexation mechanism appear to have a significantly higher inflation than those without it. Finally, central bank independence is also found to be significant: the more subordinate a central bank is, the higher the inflation appears to be.

A number of variables are not statistically significant although they all have the expected sign: the current account deficit (despite the apparent relationship in Figure 3),[17] the variable measuring the weakness of the government securities market, and the variable measuring the existence of problems in the banking system.

The import ratio, measuring openness, is significant; however, it has a positive coefficient, consistent with the visual evidence of Figure 4. A positive relation may suggest that the balance of payments motive for inflation is at work and dominates one of the "countervailing forces" mentioned in Section II.B above: in very open countries the effect of a devaluation has a commensurately stronger impact on the current account. However, this explanation is at odds with the fact that the external current account deficit is not significant. An alternative possibility is that the results were influenced by a number of high inflation FSU economies, which—because of their dependence on interregional trade within the FSU—had high measured import and export ratios, which, however, were unrelated to market mechanisms.

Finally, the government debt variable is not significant. Its negative sign may perhaps reflect the fact that many transition economies started off with no or low domestic debt; moreover, the nonindexed debt created subsequently was wiped out by high inflation.

The results of equation 1 do not take into account that the deficit-to-GDP ratio is not independent from inflation: if nominal interest rates on government debt are, at least to some extent, affected by inflation, interest payments and, hence, the deficit-to-GDP ratio increase with inflation. To correct for this problem, in equation 2 of Table 1, we instrument the fiscal deficit (using lagged levels of this variable), and in equation 3 we use the primary deficit (that

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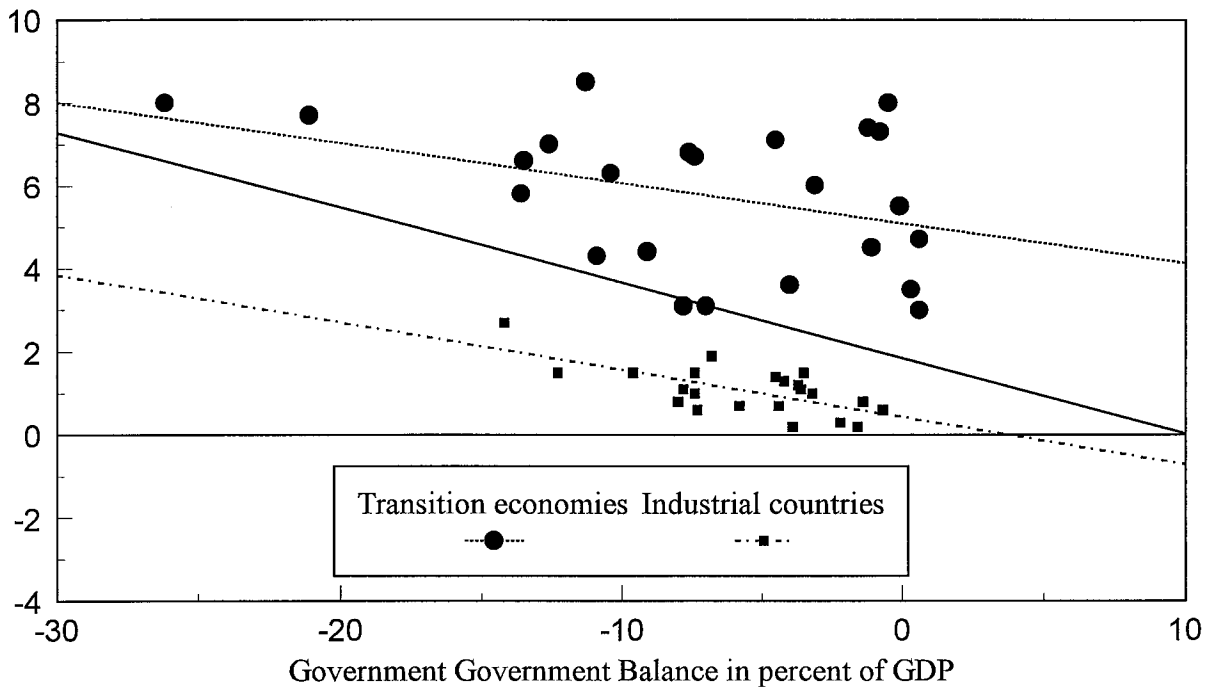
[16]Note that in the figure inflation is plotted against the government balance (hence the negative correlation), while the regressions in Table 1 include the deficit as a regressor (hence the positive sign of the coefficient).

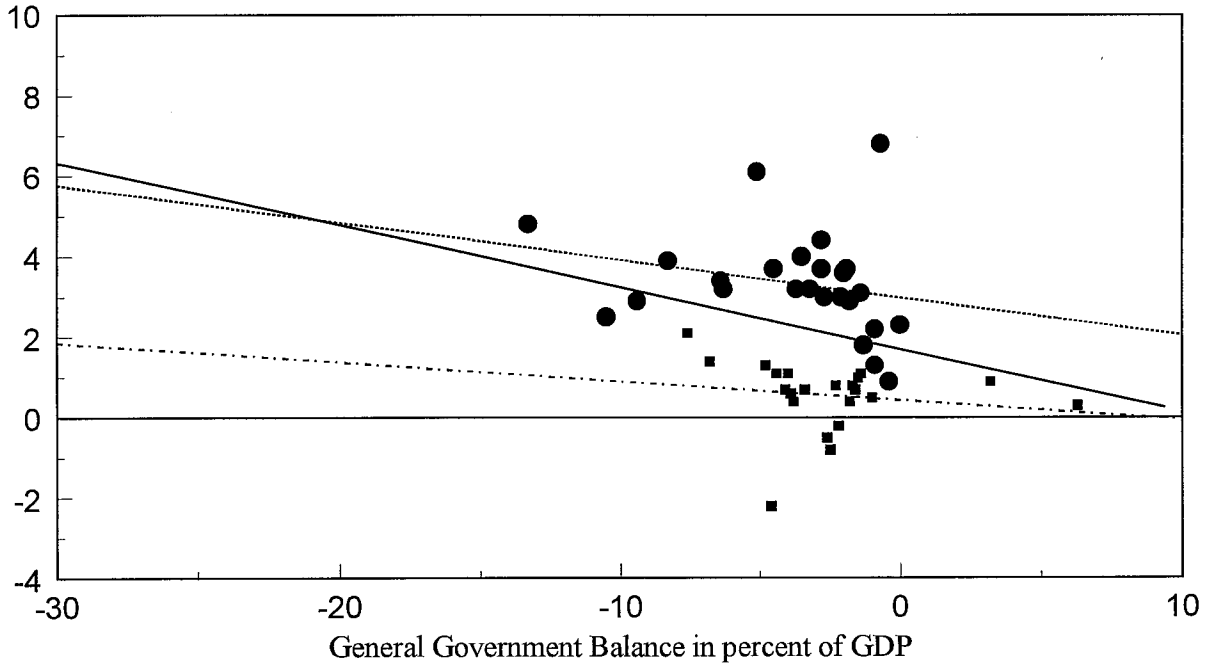
[17]The regression line in Figure 3 reflects the influence of high current account-high inflation outliers, such as Armenia and Belarus in 1993, but this is less the case in 1996, where observations lie closer to the regression line.

Figure 2. Inflation vs. General Government Balance in Percent of GDP

1993



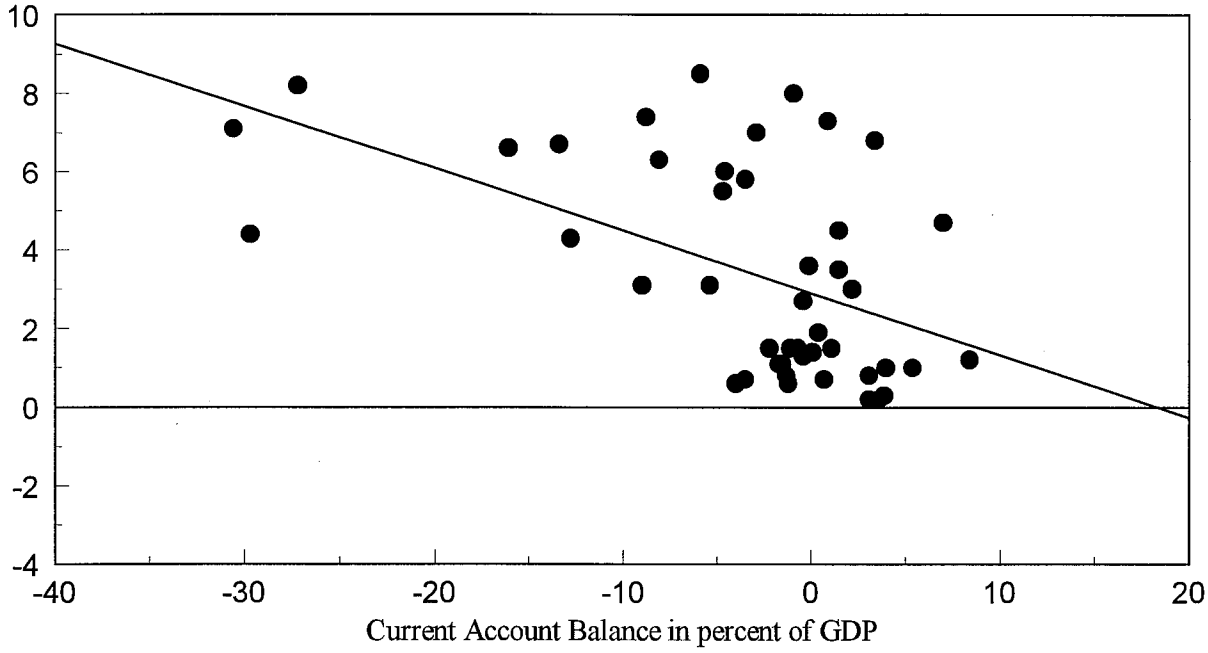
1996



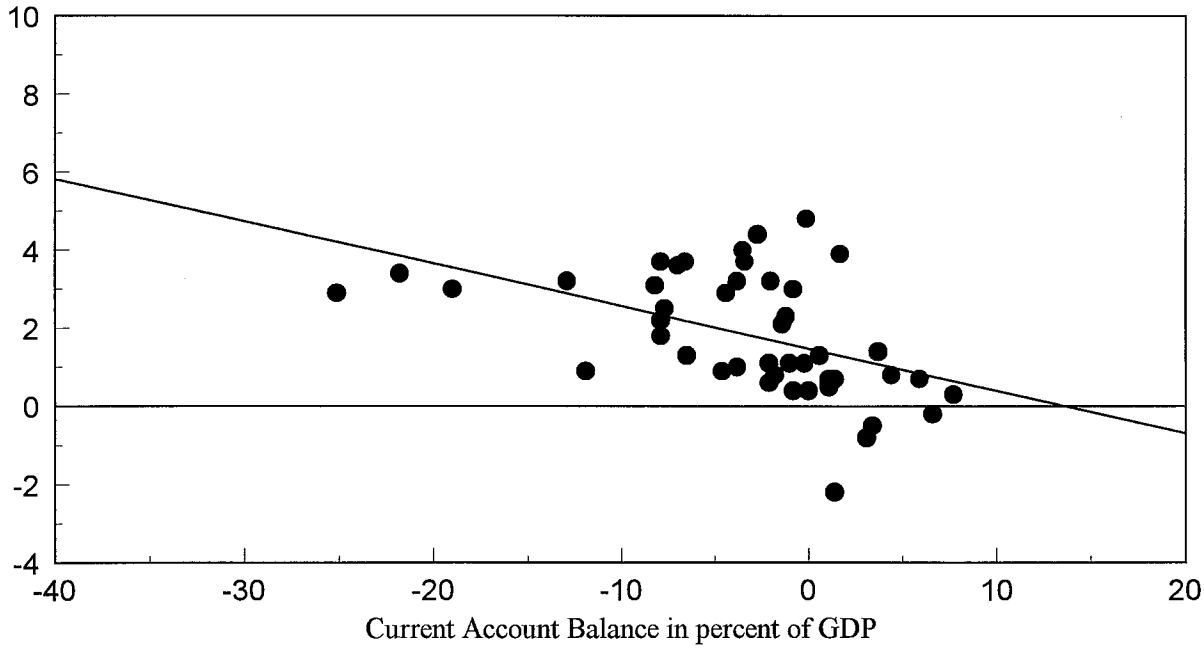
Source: World Economic Outlook.

Figure 3. Inflation vs. Current Account Balance in Percent of GDP

1993



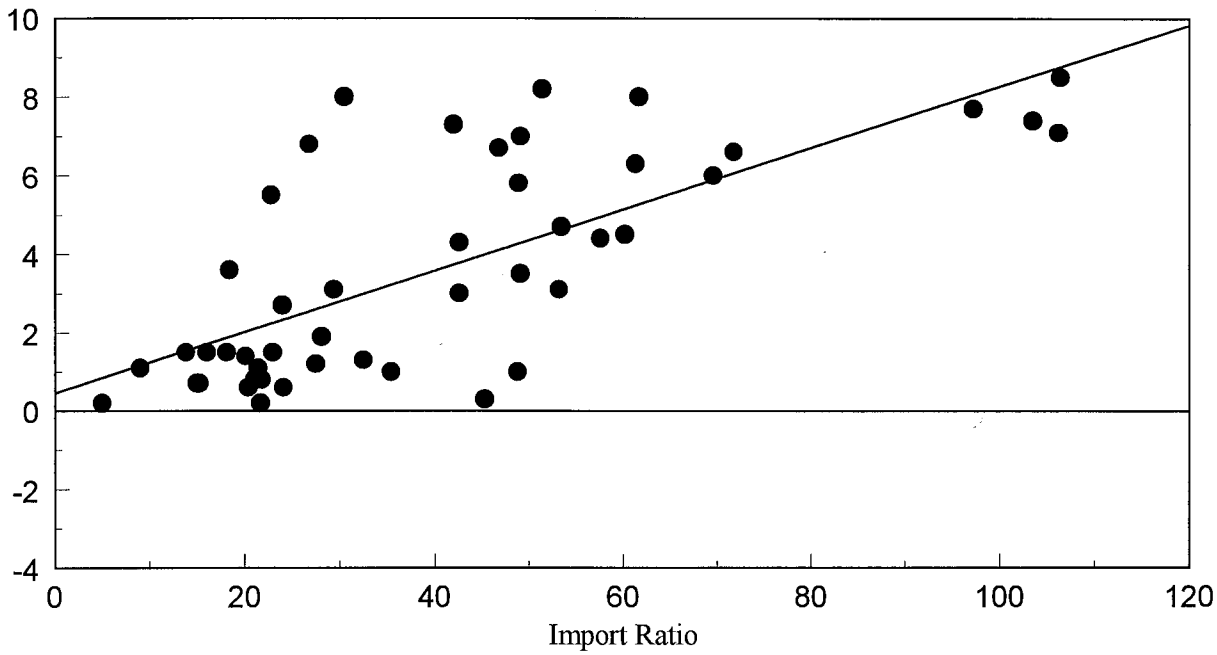
1996



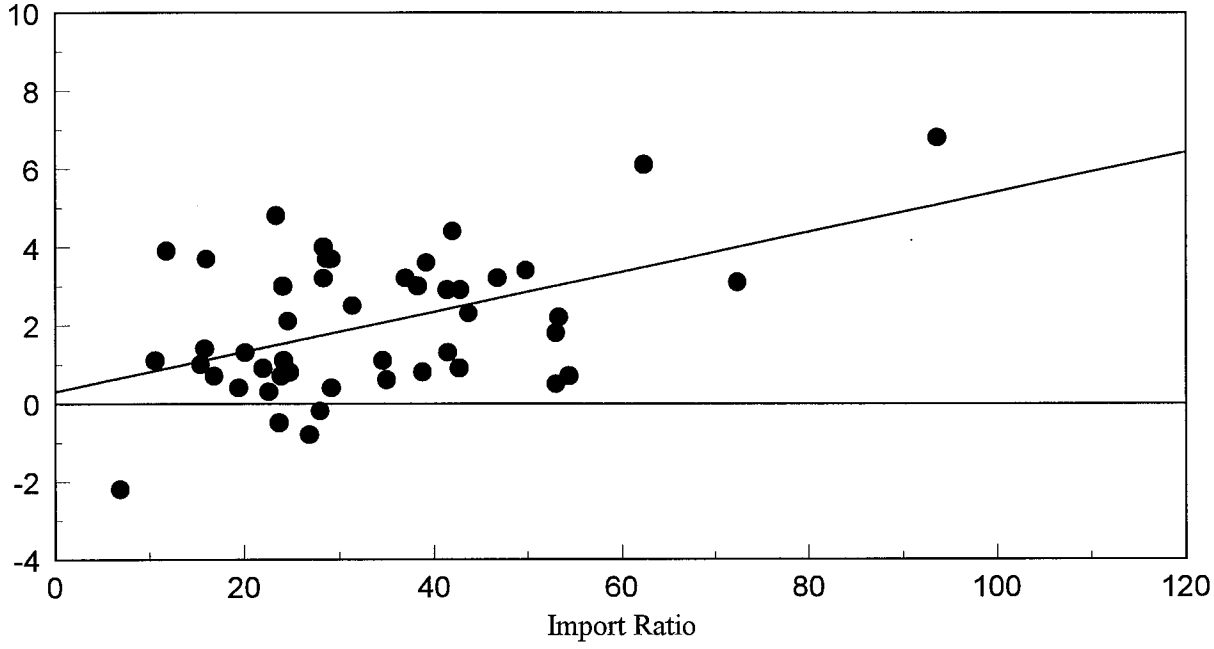
Source: World Economic Outlook.

Figure 4. Inflation vs. Openness

1993



1996



Source: World Economic Outlook.

is, the deficit net of interest payments) instead of the total fiscal deficit. The results of equations 2 and 3 are almost identical to equation 1 both in terms of the estimated coefficients and their significance.

Equations 1–3 also include a constant which can be viewed as a time trend for the equivalent level equation. However, the inclusion of a constant does not affect the results much. The constant term is dropped in equation 4 which includes all the other variables contained in equation 3. In terms of the significance of the variables, equation 4 is identical to equation 3 . The coefficients also change little: the coefficients for the lagged dependant variable, the exchange rate regime, and central bank independence increase a little, while that on wage indexation declines somewhat. Finally, equation 5 excludes all the nonsignificant variables, without major changes in the coefficients and t-statistics.[18]

It is also interesting to assess whether the results reported in the first five columns hold separately for transition and industrial countries. Given the limited cross-country variability of some of the variables in the industrial country group, equation 5 could be re-estimated only for the transition country group. The results are reported in equation 6 (75 observations for 25 countries). The coefficients again remain very similar to those in equation 5, but the fit of the equation is significantly better. We also included a 0–1 dummy for transition economies in equation 5, to assess whether, after controlling for the structural variables included in Table 1, transition economies had an inherent bias towards inflation. This dummy, however, was not significant. All this suggests that, while the approach followed to explain differences in inflation across countries fits better the experience of transition economies, the main differences in the inflation level between transition and nontransition countries can be explained by the regressors in Table 1.

Why does the fiscal deficit affect inflation performance? One reason could be that, in the absence of a developed market for government securities, fiscal deficits have to be financed by printing money. In Table 1, the variable capturing the degree of development of a government securities market is not significant. However, to explore further this issue, equation 7 enters the variable measuring the development of the government securities market in multiplicative form. More specifically, in equation (7) the primary fiscal deficit enters also multiplied by a 0–1 dummy which takes the value of 1 when the absence of a government securities market is thought to constrain the conduct of monetary policy.[19] Both the deficit variables and the

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[18] In equations 1–5 the residuals for Japan—where inflation was very low during the sample period—were rather large. When Japan was dropped from the sample, the coefficients and their t-statistics remained unchanged, while the R^2 increased to 0.41.

[19]This has been constructed from the IMF country economists questionnaire reported in Appendix I. Whenever the answer to the question was more than 5, the dummy takes the value of 1.

deficit multiplied by the dummy are significant and have almost equal coefficients indicating that fiscal policy has a much higher impact on inflation in countries where the government securities market is less developed.

Table 2 reports the results of estimates based on the G40 data set and G18 data sets. All significant variables from Table 1 are also included in the regressions of Table 2 with the exception of the indexation variable which had to be dropped because it did not vary sufficiently in the second sub-sample. Equation 1 of Table 2 includes both the unemployment rate and base money. Neither variable is significant. The base money variable has in fact the wrong sign and the unemployment variable has the usual Phillips Curve negative sign, not a positive sign which would have indicated the authorities' bias to inflate the economy to bring unemployment below its natural or structural level. One possible reason for this result could be the use in equation 1 of total unemployment, rather than its structural component. Thus, equation 2 replaces the unemployment rate with a trend unemployment rate to remove its cyclical element. The results remain unchanged. Equation 3 includes the trend unemployment rate but not base money whereas equation 4 includes base money but not the unemployment rate. The results of equations 1–2 remain unchanged.

The relative price variable is included in equation 5 of Table 2. This variable enters with a lag given its possible endogeneity.[20] The relative price variable is highly significant and it eliminates the significance of the central bank independence variable. Moreover, the fit of the regression is rather high. However, these results have to be interpreted cautiously as the regression is based on only 36 observations.

Finally, Table 3 reports the results of the panel regressions using the EBRD indices of progress on structural reform in transition economies (see Appendix II). The larger any EBRD index, the more advanced the structural reform process is regarded to be in any transition economy; therefore, we would expect all the coefficients for EBRD indices to be negative. Equation 1 includes all the 7 EBRD indices together with the significant variables from Table 1.[21] While most of the signs are as expected, in this more limited sample, only the fiscal variable, the lagged dependent variable, and the EBRD variable capturing price liberalization appear to be significant. In spite of running the regressions in first differences, a problem here may be the high degree of correlation between the indices. Therefore, we tried including the EBRD indices one by one together with the significant variables from Table 1. Only two of the EBRD variables were found to be significant in this way: the degree of price liberalization (reported in equation 2), and the progress made in bank restructuring (equation 3).

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[20]The lagged dependent variable was dropped from this equation because of collinearity problems.

[21]The indexation variable does not vary sufficiently in the sub-sample to be included.

Table 2. Panel Data Estimates Using the G40 and G18 Data Sets 1/

(Instrumental Variable Restricted SURE Method)

Dependent Variable is Δ log (inflation)	(1)	(2)	(3)	(4)	(5)
Δ log (inflation)$_{-1}$ 2/	0.18	0.18	0.20	0.18	...
	(2.93)	(2.97)	(3.40)	(2.87)	...
Δ primary deficit	0.07	0.07	0.07	0.07	0.09
	(2.90)	(2.85)	(2.84)	(2.86)	(2.03)
Δ fixed exchange regime 2/	-1.66	-1.64	-1.64	-1.68	-1.11
	(-4.82)	(-4.76)	(-4.75)	(-4.92)	(-1.88)
Δ subordination of central bank	0.39	0.40	0.38	0.40	0.07
	(6.20)	(6.13)	(6.06)	(6.35)	(0.53)
Δ trend unemployment rate	-0.02	-0.02	-0.02	...	...
	(-0.55)	(-0.62)	(-0.58)	...	...
Δ base money/GDP	-0.02	-0.02	...	-0.02	...
	(-0.90)	(-0.93)	...	(-0.91)	...
Δ relative price$_{-1}$	...	...	...	...	0.08
	...	...	...	...	(3.35)
N	120	120	120	120	36
R^2	0.19	0.21	0.21	0.21	0.49

1/ T-statistics are given in brackets.
2/ Instrumented.

Table 3. Panel Data Estimates Using the G25 Data Set 1/

(Instrumental Variable Restricted SURE Method)

Dependent Variable is Δ log (inflation)	(1)	(2)	(3)
Constant	-0.23 (-1.01)	-0.29 (-1.59)	-0.13 (-0.72)
Δ log (inflation)$_{-1}$ 2/	0.29 (2.41)	0.22 (2.03)	0.30 (2.43)
Δ primary deficit	0.07 (2.82)	0.07 (3.08)	0.04 (2.03)
Δ fixed exchange regime 2/	-0.71 (-1.00)	-0.69 (-1.01)	-1.29 (-1.92)
Δ subordination of central bank	0.13 (1.03)	0.12 (0.93)	0.21 (1.72)
EBRD Variables:			
Δ private sector share of GDP	-0.03 (-0.10)	...	...
Δ large scale privatization	0.20 (0.61)	...	...
Δ small scale privatization	-0.72 (-0.53)	...	...
Δ enterprise restructuring	-0.09 (-0.25)	...	...
Δ price liberalization	-1.31 (-2.44)	-1.35 (-2.75)	...
Δ trade and exchange liberalization	0.21 (0.85)	...	...
Δ banking restructuring	-0.39 (-0.97)	...	-0.65 (-1.91)
N	50	50	50
R^2	0.41	0.41	0.39

1/ T-statistics are given in brackets.
2/ Instrumented.

IV. Conclusions

Several conclusions can be drawn from the above evidence:

- The approach followed seems to be able to explain a fairly large share of the variance of inflation in the country sample. Moreover, the econometric results appear to be fairly robust to specification (in terms of significance and coefficient estimates). The results, however, fit better the transition country group, possibly because of the higher variation of the data in this group.

- Overall, they support the view that fiscal policy has a significant effect on inflation, particularly in countries where government securities markets are less developed. However, there is evidence of a relation between inflation and fiscal deficits also in other countries.

- There is instead limited evidence that the "unemployment motive" is important. Direct measures of the unemployment rate, or of its trend component, were not significant. There was also limited success in including a number of structural variables that could be regarded as affecting the structural level of unemployment. However, the degree of price liberalization did appear to be a significant factor behind differences in inflation: a higher degree of price liberalization is associated with lower inflation.

- At the same time, it was shown that relative price changes affect inflation significantly, at least in the more limited sub-sample of countries for which data were available. The implication of this is that, while price liberalization is likely to cause an increase in inflation in the short run, it eventually leads to lower inflation, a conclusion in line with the recent experience of many transition economies in Eastern Europe.

- Unlike other studies, we could not find any evidence that the degree of openness of the economy (nor its external current account position) affect inflation performance. This, however, may reflect the nature of our sample which includes many countries which were once part of the former Soviet Union. For these countries, the standard measures of openness may assume different meaning than in industrial countries.

- It has also been shown that institutional devices to counter the dynamic inconsistency problem (like central bank independence and a pegged exchange rate) seem to be effective in lowering inflation, as found in other studies. Other institutional features of the economy (such as indexation) have also shown to be relevant.

The above results should, of course, be interpreted with caution on account of data limitations. In particular, the data variability across transition economies is much larger than that for industrial countries, and, therefore, our estimates are likely to reflect primarily features of the former country group. Moreover, some of the variables that have been used in this study (such as structural unemployment) are not directly observable and proxies are not easy to find. Finally, in estimating our model we had to deal with severe simultaneity problems, in most of the cases through the use of instrumental variables, with a likely loss of efficiency.

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1. Is there a formal wage indexation mechanism in place? Has it changed between 1993-96? Please explain.	1993 Yes 1994 Yes 1995 Yes 1996 Yes	1993 No 1994 No 1995 No 1996 No		
2. How do you describe the wage bargaining system?	Centralized	Intermediate	Decentralized	
3. To what extent does the absence of a primary government securities market constrain monetary policy (i.e. to what extent would a higher budget deficit lead to a higher supply of money).	Not a Constraint 1993 1 2 3 4 5 6 7 8 9 10 1994 1 2 3 4 5 6 7 8 9 10 1995 1 2 3 4 5 6 7 8 9 10 1996 1 2 3 4 5 6 7 8 9 10			Major Constraint
4. Is the central bank independent (e.g. in terms of control of instruments of monetary policy, providing direct financing to the government, pursuing the goal of price stability, the ability of the government to dismiss the central bank governor)?	Independent 1993 1 2 3 4 5 6 7 8 9 10 1994 1 2 3 4 5 6 7 8 9 10 1995 1 2 3 4 5 6 7 8 9 10 1996 1 2 3 4 5 6 7 8 9 10			Subordinate
5. How do you describe the state of the banking system?	Sound 1993 1 2 3 4 5 6 7 8 9 10 1994 1 2 3 4 5 6 7 8 9 10 1995 1 2 3 4 5 6 7 8 9 10 1996 1 2 3 4 5 6 7 8 9 10			Crisis
6. Please provide the domestic debt/GDP ratio.	1993	1994	1995	1996

Progress in Transition in Eastern Europe, the Baltics and the CIS, 1993

Countries		Enterprises			Markets and Trade		Financial Institutions
	Private Sector Share of GDP in Percent	Large-Scale Privatisation	Small-Scale Privatisation	Enterprise Restructuring	Price Liberalisation and Competition	Trade and Foreign Exchange System	Banking Reform
Albania	50	1	3	2	3	4	2
Bulgaria	40	2	2	2	3	4	2
Croatia	40	3	4	2	3	4	3
Czech Republic	65	4	4	3	3	4	3
FYR Macedonia	35	2	4	2	3	4	2
Hungary	55	3	4	3	3	4	3
Poland	55	3	4	3	3	4	3
Romania	35	2	3	2	3	4	2
Slovakia	55	3	4	3	3	4	3
Slovenia	30	2	4	3	3	4	3
Armenia	40	1	3	1	3	2	1
Azerbaijan	20	1	1	1	3	1	1
Belarus	15	2	2	2	2	1	1
Estonia	55	3	4	3	3	4	3
Georgia	20	1	2	1	2	1	1
Kazakstan	20	2	2	1	2	2	1
Kyrgyzstan	30	3	4	2	3	3	2
Latvia	55	2	3	2	3	4	3
Lithuania	50	3	4	2	3	4	2
Moldova	20	2	2	2	3	2	2
Russia	50	3	3	2	3	3	2
Tajikistan	15	2	2	1	3	1	1
Turkmenistan	15	1	1	1	2	1	1
Ukraine	30	1	2	1	2	1	1
Uzbekistan	20	2	3	1	3	2	1

Source: European Bank for Reconstruction and Development (EBRD), Transition Report October 1994.