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# Post Stabilization Inflation Dynamics in Slovenia

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## Abstract

This paper investigates the inflation process in Slovenia through an examination of some commonly used determinants of inflation in transition economies. Granger causality tests and an analysis of unrestricted VAR models suggest a strong linkage between both growth in broader monetary aggregates and changes in the tolar–deutsche mark exchange rate on retail price inflation. While the growth in wages affects inflation, it appears that both changes in the exchange rate and growth in monetary aggregates provide the initial impulse. A discussion of the present money–exchange rate policy framework and its influence on inflation is also provided.

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## Contents

**Summary**

This paper investigates the inflation process in Slovenia through an empirical examination of some commonly used determinants of inflation in transition economies. The paper also reviews critical institutional and historical legacies leftover from Slovenia's previous centrally planned state, which should be taken into consideration in any analysis of inflation. These include administrative price adjustments, indexation mechanisms, sectoral wage formation behavior, and the relationship between tradable and nontradable productivity, all of which allow inflation to persist after stabilization has occurred. Using Granger causality tests and an analysis of unrestricted VAR models, our exploratory results suggest a strong linkage between both growth in broader monetary aggregates and changes in the tolar–deutsche mark exchange rate on retail price inflation. While the growth in wages affects inflation, it appears that both changes in the exchange rate and growth in monetary aggregates provide the initial impulse.

In general, Slovenia has made great strides in reducing inflation and inflationary expectations since the transition process began in late 1991. While money-based targets have been the centerpiece of these stabilization efforts, nominal exchange rate and core inflation targets have also been employed intermittently in a multiple anchor approach in subduing inflation. This approach has been developed in the face of persistent large capital inflow pressures, which have complicated policy formulation and implementation throughout the transition period. While this multiple anchor approach has been quite successful in the stabilization process and common in many transition economies, it has not facilitated the reform of the underlying structural framework of rigid price and wage determination mechanisms nor improved the level and efficiency of corporate governance in Slovenia. Without these reforms, the authorities will be hard pressed to reduce inflation to core European levels with the present policy mix.

## I. INTRODUCTION

Since independence in late 1991, Slovenia has made remarkable progress in reducing inflation and inflationary expectations through adherence to a tight money-based stabilization program. In addition, nominal exchange rate and core inflation targets have also been employed intermittently in a multiple anchor approach toward subduing inflation. However, as in many transition economies, inflation inertia has persisted in Slovenia—and it has become increasingly clear that the present multifaceted policy approach in the post-stabilization period requires an urgent re-evaluation before initiation of the next stage of necessary structural reforms.

The purpose of this paper is to investigate the inflation process in Slovenia through an empirical examination of some commonly used determinants of inflation in transition economies. The paper follows the previous work of Ucer (1997), in that no prior structure is assumed and that Granger causality tests and an analysis of theoretical VAR models are undertaken. At the outset, the exploratory nature of this analysis should be stressed, given the numerous structural shifts in the economy during the stabilization period and well-known data deficiencies in transition economies in terms of coverage, time span, and statistical properties. Still, an analysis of this type should allow us to flesh out the main factors behind the persistence of inflation and evaluate the policies that have been implemented during Slovenia's transition period. Section II provides a brief review of the literature on inflation dynamics in transition economies, while section III.A examines the behavior of inflation and related macroeconomic variables in Slovenia. Section III.B discusses the widespread use of indexation and wage formation, and section III.C presents the data and methodology used in the study. Section III.D presents the empirical results, while a brief conclusion with policy recommendations is provided in section IV.

## II. INFLATION DYNAMICS IN TRANSITION ECONOMIES

The literature on the determinants of inflation has traditionally identified various demand-pull and cost-push factors that have successfully explained the temporal behavior of inflationary processes. Classic demand-pull factors have included periodic episodes of money or credit growth expansion that have exceeded desired levels, as well as the familiar pattern of monetization of fiscal deficits, either of which creates a disequilibrium in money and goods markets that is eliminated over time through increases in the price level. On the other hand, cost-push factors of inflation have centered on wage growth in excess of productivity gains and on structural supply bottlenecks that tend to drive up price levels in the short run.

While inflation dynamics in transition economies can be described or modeled by the same basic factors that are used in market economies,[2] there are critical institutional and

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[2]Sahay and Végh (1995) found that despite significant differences in the economic structure

(continued...)

historical legacies from their previous centrally planned state which should be taken into consideration in any analysis of inflation. To varying degrees, an experience common to these economies has been rapid price increases at the onset of stabilization caused by accumulated monetary disequilibrium or monetary overhang—followed by moderate but persistent rates of inflation in the post-stabilization period.[3] Much of the focus in the literature on inflationary processes in transition economies has been on the second phase, evidence of persistent moderate inflation—usually defined as in the range of 10–40 percent a year—after the initial inflation shock has subsided. The source of this inertia has been linked to the traditional factors of excessive money and wage growth, but also to an underlying natural pressure for real exchange rate appreciation in the context of nominal exchange rate stability, and relative price adjustments coupled with downward price rigidities.

Coorey, Mecagni, and Offerdal (1996) as well as many others have described how some of the more common determinants of inflation may explain the stickiness of inflation in transition economies. At the start of stabilization, most experienced a sharp decline in output, decreased fiscal revenues, and increased transfer payments, resulting in burgeoning fiscal deficits that provided an impulse for inflation. In addition, bank credit to public enterprises increased sharply, reflecting their unreformed corporate structures and an implicit fiscal deficit substantially higher than reported by the general government. Similarly, it has been noted that it is far easier for wage pressures stemming from a poorly governed enterprise sector to lead to an expansion of credit and inflationary pressures in transition economies.[4,5] In addition, the economies that experienced high degrees of inflation before stabilization began usually contained deeply embedded, backward-looking wage indexation arrangements that further stymied attempts to reduce inflation inertia.

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[2](...continued)
and institutional framework, the inflationary experiences of market and transition economies were very similar. Monetary accommodation and the absence of fiscal discipline were viewed as critical in sustaining inflation, while wage policies were found to be more important in reducing inflation in transition economies than in market economies.

[3]Sahay and Végh (1995) discuss the creation of a monetary overhang and the repressed inflation evident in many formerly planned economies.

[4]Dayal-Gulati (1996) reports that inflationary pressures in the Czech Republic can be traced to rapid growth in wages, especially in the nontradable goods sector. She suggests that the underlying problem—weak corporate governance—should be addressed through an acceleration in the privatization and restructuring process of the enterprise sector.

[5]Bole (1997a) attributes persistent inflationary pressures in Slovenia to the growth in real wages, stemming from the inability of workers and management to agree to a "social contract" until 1995, and its related effects on nontradable prices. Šonje and Škreb (1997) point to a similar experience in Croatia.

In transition economies, real exchange rate appreciation has been a widely observed phenomenon.[6] Large capital inflows after stabilization set in caused countries with relatively stable nominal exchange rates to experience real appreciation, as these inflows influenced money growth and inflation. Countries with flexible nominal rates saw downward pressure on inflation concurrent with nominal and real appreciation. What factors are behind this observed tendency of real exchange rate appreciation? Richards and Tersman (1995) have suggested that the initial rate may have been undervalued, reflecting low domestic prices of tradable goods in relation to comparable goods in world markets. They also reported that differential productivity growth between tradable and nontradable sectors—the familiar Balassa effect—could lead to higher nontradable goods prices and therefore to a real appreciation. In a similar fashion, Bole (1997a) argued that rapid growth in nontradable prices was evident in Slovenia's post-stabilization experience due to increases in controlled prices, and through a "demonstration effect" of higher (productivity-induced) wages in the manufacturing sector filtering into service sector wages. In turn, each of these factors could be expected to affect inflation persistence through the real exchange rate. Šonje and Škreb (1997), in their study on Croatia's inflation experience, concluded that economies in transition should let the nominal and real exchange rates find their own levels (after nominal pegs have wrenched out the worst inflationary expectations), and that policymakers should not fear nominal appreciation.[7]

Theory and evidence have also shown that relative price adjustments in the context of downward rigidities can contribute to inflation inertia. In transition economies, the variance of the relative prices falls after stabilization but tends to remain higher than in advanced market economies; likewise, the distributions (components of CPI relative to CPI average) tend to remain positively skewed—lending credence to the theory that inflation persistence may be driven by a few relative price adjustments.[8] In this regard, administered price increases may have supported higher inflation rates in the context of downward sticky prices. Another explanation for the persistence of relative price variability in transition economies after comprehensive price liberalization can be traced to the cost recovery hypothesis—in which the pricing of services during the post-stabilization period starts to include the recovery cost of capital, which had previously been inherited for free from the state (Zavoico 1995).[9]

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[6]See Halpern and Wyplosz (1996).

[7]They point out that allowing nominal appreciation pressures to impact exchange rates enhances credibility by taking advantage of the indexation measures and other exchange rate–price transmission mechanisms developed during periods of high inflation.

[8]Coorey, Mecagni, and Offerdal (1996) found that broad money and wage growth were the most important determinants of inflation, with relative price variability having a smaller impact at moderate rates of inflation. In the case of Slovenia, the study revealed that relative price variability in the form of skewness measures tended to explain inflation.

[9]This hypothesis also has implications for the real exchange rate. It is assumed that price levels

(continued...)

What inferences can be drawn from this brief review of the literature? First, the normal monetary and fiscal impulses that affect inflation in advanced economies are evident in transition economies. Second, it is clear that the previous economic structures of these economies have left a heritage of rigid price and wage determination mechanisms, which critically affect the inflation process. Administrative price adjustments, sectoral wage formation behavior, and the relationship between tradable and nontradable productivity are important ingredients in the inflation transmission process in transition economies. Third, in many respects these relationships can be directly linked to the level and efficiency of corporate governance and, therefore, to the degree of enterprise restructuring and privatization in the economy. Without an extensive restructuring of these enterprises, inflation persistence can be expected to continue. Finally, there is some evidence that it may be possible to harness the pressures for real exchange rate appreciation, so prevalent in transition economies, to reduce inflation and inflationary expectations through an allowance of nominal exchange rate appreciation.

## III. EMPIRICAL EVIDENCE

### A. The Behavior of Inflation and Related Macroeconomic Variables

Table 1 presents the performance of inflation and a few other important macroeconomic variables over the 1992.1–1997.3 time frame. The four different types of inflation indices exhibit much of the typical behavior found in transition economies, with sharp increases in controlled and nontradable prices affecting the outcome of overall inflation (see Figure 1). Although growth in the retail price index (RPI) has slowed dramatically in recent years—reaching single digits in 1995 from close to 90 percent in 1992—persistent inflationary inertia appears to have stubbornly kept rates in an approximate 8–10 percent range.[10] While controlled or administered price increases on petroleum products and electricity have declined through greater attainment of full cost recovery, they consistently provided the impetus for

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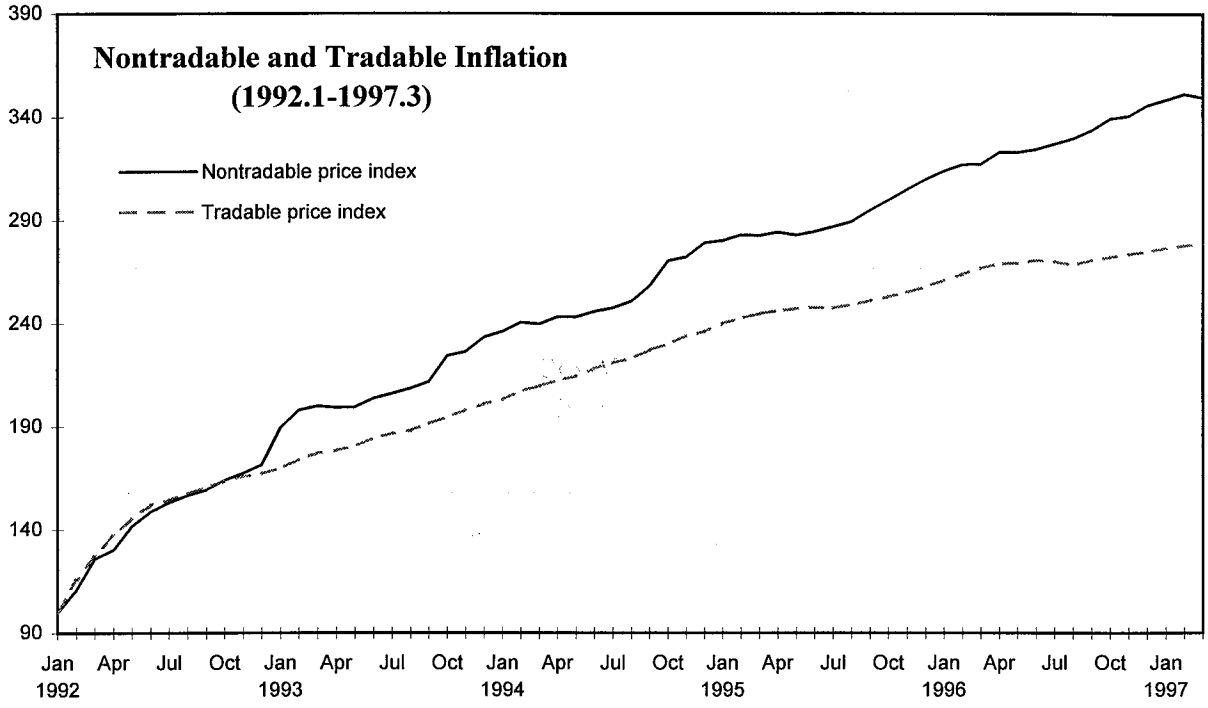
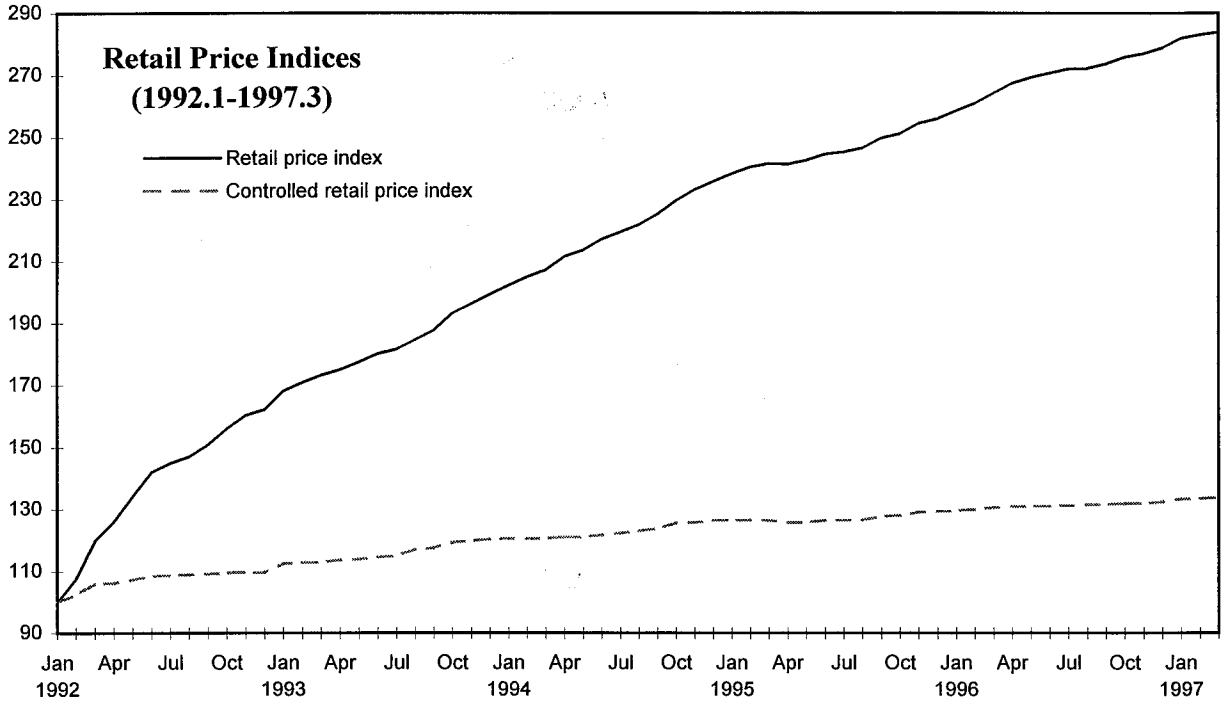
[9](...continued)
of services are below international PPP comparisons (suggesting an undervalued real exchange rate) and should tend to slowly rise as real incomes rise (suggesting that the real rate will appreciate more steeply, compared with advanced market economies). Zavoico concludes that the only way to reach a low inflation rate (below 10 percent) short of subsidizing capital-intensive nontradable industries is to allow a nominal appreciation to achieve the same appreciation of the real rate that would have taken place via domestic inflation.

[10]Delays in administered price increases in the first quarter of 1997 allowed the year-on-year inflation rate to drop to 7.4 percent in March. However, when these controlled price increases took effect in May and June, annualized inflation increased to 10.1 percent by September.

Figure 1
SLOVENIA
Inflation




Source: Bank of Slovenia.

Table 1. Slovenia: Macroeconomic Variables, 1992–1997

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 1/ |
|---|---|---|---|---|---|---|
| | (Annual percentage change) | | | | | |
| RGDP | -5.5 | 2.8 | 5.3 | 4.1 | 3.1 | 2.2 |
| Industrial production | -13.2 | -2.8 | 6.4 | 2.0 | 1.0 | 0.1 |
| Retail price index | 88.2 | 22.9 | 18.3 | 8.6 | 8.8 | 7.4 |
| Retail price index controlled | 9.6 | 9.8 | 5.0 | 2.3 | 2.4 | 2.5 |
| Non-tradable price index | 71.4 | 36.1 | 19.6 | 11.1 | 11.7 | 10.2 |
| Tradable price index | 67.1 | 20.3 | 17.5 | 9.2 | 6.8 | 4.7 |
| Reserve money | 128.6 | 38.5 | 57.6 | 25.2 | 15.6 | 16.9 |
| M2 | 147.6 | 63.5 | 60.4 | 25.5 | 23.3 | 25.0 |
| M2x | 127.0 | 63.7 | 42.4 | 27.9 | 21.4 | 19.2 |
| Real broad money | 20.7 | 33.2 | 20.3 | 17.8 | 11.6 | 11.0 |
| Real private sector credit | 3.2 | 8.7 | 11.6 | 32.4 | 8.4 | 3.7 |
| Nominal wages | 130.9 | 31.5 | 23.9 | 11.5 | 16.7 | 12.5 |
| Real wages | 30.5 | 7.2 | 4.7 | 2.7 | 7.3 | 7.1 |
| Productivity 2/ | 5.3 | 12.8 | 6.2 | 3.1 | 5.4 | 3.7 |
| Tolar per U.S. dollar (end-period) | 98.7 | 131.8 | 126.5 | 126.0 | 141.5 | 158.0 |
| Tolar per DM (end-period) | 61.2 | 76.4 | 81.6 | 87.9 | 91.0 | 91.3 |
| Nominal effective exchange rate (1993=100, average) | 126.7 | 100.0 | 87.9 | 88.6 | 79.4 | 76.1 |
| Real effective exchange rate (RPI based, 1993=100, average) | 98.9 | 100.0 | 102.8 | 113.8 | 109.3 | 108.4 |
| Real effective exchange rate (ULC based, 1993=100, average) | 85.5 | 100.0 | 101.7 | 114.2 | 108.6 | 108.7 |
| | (In percent of GDP) | | | | | |
| General government fiscal balance | 0.2 | 0.3 | -0.2 | 0.0 | 0.3 | 0.0 |
| Trade balance | 6.3 | -1.2 | -2.3 | -5.1 | -4.6 | ... |
| Current account | 7.4 | 1.5 | 3.8 | -0.2 | 0.3 | ... |
| Capital and financial account | -2.3 | -0.6 | 0.6 | 1.4 | 2.9 | ... |
| Gross foreign exchange reserves 3/ | 1.2 | 1.3 | 2.1 | 2.0 | 2.6 | 2.9 |

Sources: Bank of Slovenia; and Fund staff estimates.

1/ 1997 figures are first quarter results.

2/ In months of imports of goods and services.

3/ In months of imports of goods and services.

further growth in the retail price index. Likewise, growth in nontradable prices in relation to the tradable sector furnishes evidence that the Balassa and spillover demonstration effects discussed by previous authors are impacting inflation dynamics.

The growth in monetary aggregates exhibits a deliberately tight money base stabilization program undertaken by Slovenia at the onset of liberalization and impressively demonstrates discipline in implementing monetary policy. Moreover, unlike many other transition economies, the overall general government balance figures in Table 1 convey the absence of inflationary pressures stemming from profligate fiscal spending. However, the nominal and real effective exchange rates shown in Figure 2 reveal a tendency toward implicit nominal pegging of the tolar–deutsche mark exchange rate over the last three years, while the trend real exchange rate appreciation in Slovenia has been below that of its Visegrad neighbors. This would suggest that the Slovene authorities have followed a dual objective, money and exchange rate based policy,[11] in which monetary aggregates and the nominal exchange rate are targeted simultaneously through sterilized intervention of capital inflows.[12] It also highlights the fact that while the tight monetary program has probably limited price level increases, blocking the effect of capital inflows on the nominal exchange rate has forced the natural real appreciation of the exchange rate to take place through higher inflation.[13] Finally, while the pattern of growth in real wages and productivity displayed a parallel path during 1993–95, during the last 1½ years real wage growth spurted past gains in productivity, placing additional upward pressure on inflation.

### B. Indexation, Wage Formation, and Inflation

The prolonged bouts of hyperinflation that plagued the former Yugoslavia (SFYR) resulted in the widespread use of indexation mechanisms in financial and labor contracts throughout Slovenia. In fact, indexation of financial contracts has become so common in Slovenia that nominal contracting has all but disappeared. In the banking system, all tolar deposits are subject to indexation—either linked to the RPI ("R" clause) or the tolar/deutsche mark exchange rate ("D" clause). Most tolar deposits are linked to the R clause, while banks'

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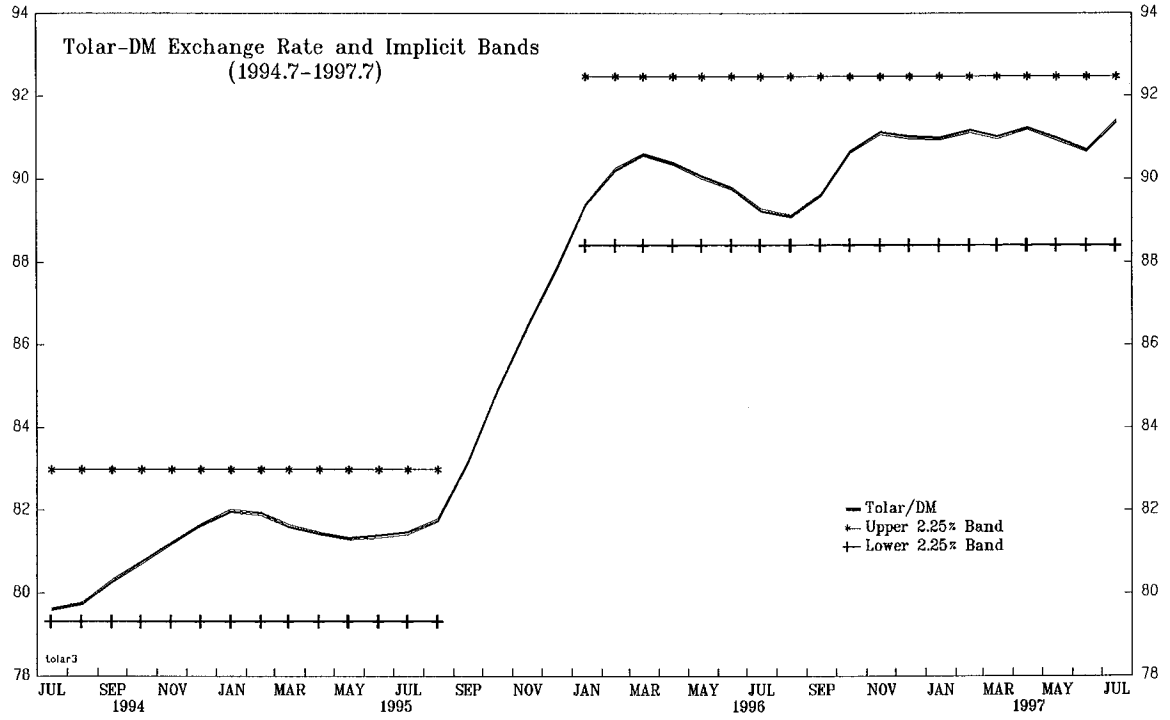
[11]The authorities have also emphasized the importance of achieving certain inflation targets.

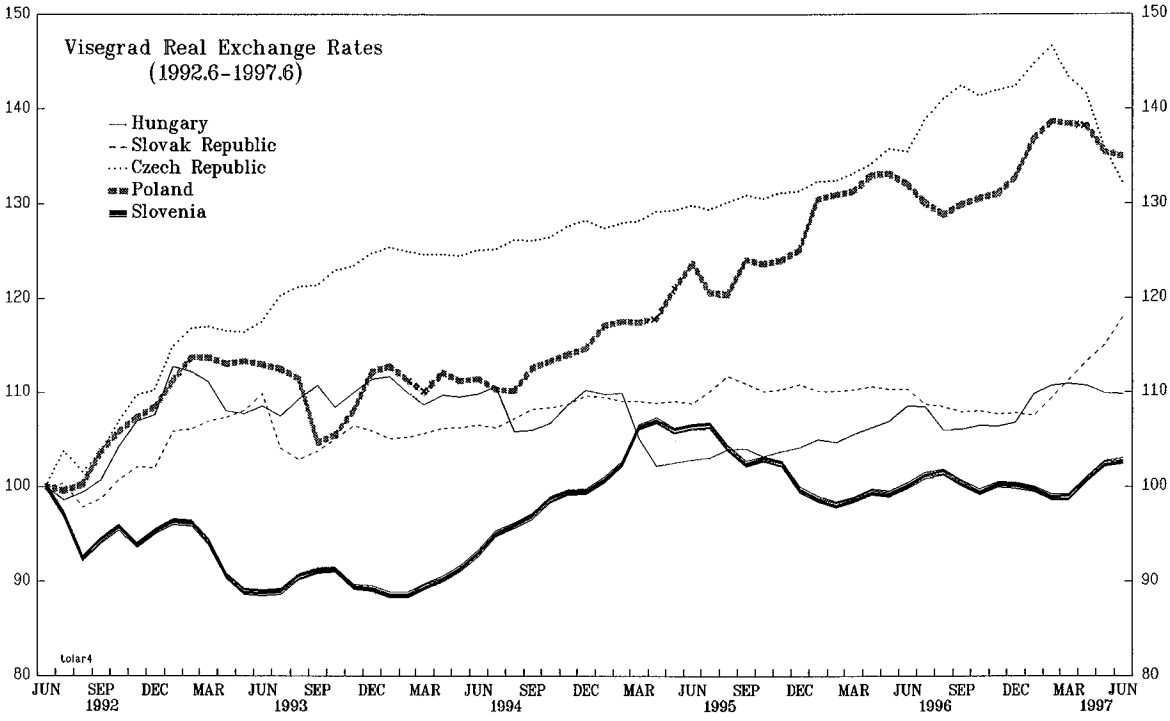
[12]The Slovenian authorities use a complicated array of monetary policy instruments to control liquidity in the economy. One of the main instruments is the Bank of Slovenia (BOS) foreign exchange bills, which are denominated in deutsche marks, with a maturity ranging from two months to one year. While issuance of these foreign exchange bills reduces pressure on the tolar to appreciate, domestic operations are undertaken to offset the expansionary impact on base money. The authorities also directly intervene in the foreign exchange market if the bank-enterprise rate exceeds a 60-day moving average by 1.25 percent (Coats et. al., 1997).

[13]Bole (1997b) describes Slovenia's experience with sterilized intervention and the implementation of capital controls to limit the real appreciation of the tolar over the 1992–96 period.

FIGURE 2

# SLOVENIA
## Exchange Rates




Sources: Bloomberg and INS, Information Notice System.

assets are generally linked to the D clause, or revaluation rate.[14] While the real component has shown little movement, administered price increases have created a substantial amount of variability in the RPI, which has been passed on to the R clause component, and therefore onto the nominal rate. Thus, movements in the retail price index and exchange rate have implications for the balance sheet of the banking system and should affect nominal monetary aggregates as economic agents attempt to hold targeted amounts of real money balances. In addition, given the relative stability of the exchange rate over various periods, these different indexation mechanisms may also help to explain the wide interest rate spreads found between lending and deposit rates.[15]

In a similar fashion, labor contracts in Slovenia are indexed to the retail price index, in line with the R revaluation clause used in financial contracts. Prior to June 1995, the R clause was set to the previous month's rate of inflation. Since then the indexation period has been lengthened several times, so that by May 1997 it was set to the previous 12 months' rate of inflation.[16] Within this type of system any growth in the retail price index would naturally affect the growth of wages with a short lag and feed back into inflationary pressures almost immediately. With these indexation measures deeply embedded in the Slovene economy, one would expect to find that movements in inflation, wages, and monetary aggregates are closely related.

Wage formation behavior, with roots in the unique market socialism of the SFRY, has been guided by the annual tripartite Social Agreement between government, labor unions, and employers. While the Agreement has compulsory coverage and sets the overall tone of labor market conditions, General Collective Agreements for both the market and nonmarket sectors spell out specific monthly pay scales. Unfortunately, these centralized pay scales have not been effective in reining-in wage increases, nor have the Agreements been successful in slowing the growth in nonwage allowances. It has been noted that this relatively centralized system does not force enterprises to take full responsibility for their labor costs, nor does it allow differential sectoral or enterprise-specific productivity gains to be reflected in greater wage

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[14]Given the continuous observation of the exchange rate, the D adjustment clause does not involve an indexation lag; however, the R adjustment has an indexation lag that could have a substantial effect on the outcome of contracts. Feldman (1995) fully describes indexation mechanisms in Slovenia.

[15]With a majority of deposits and liabilities indexed to two different arrangements, differing degrees of stability in the revaluation rates could lead to widening spreads as financial intermediaries pass on the increased relative volatility to deposit and lending rates.

[16]The revaluation clause was adjusted to the previous three months' inflation rate in June 1995, lengthened to the previous four months' inflation rate in February 1996, and set to the previous six months' inflation rate by December 1996, before the final change in May 1997.

dispersion.[17] In essence, these mechanisms exacerbate the Balassa effect and positively affect inflation, as "any" productivity gain can propagate wage increases that must be passed on to the rest of the work force in an effort not to allow any segment of the population to fall behind.

## C. Data and Methodology

The empirical methodology used in this study is that of an unrestricted vector autoregressive (VAR) model, which includes the following monthly variables over the 1992.10–1997.3 time frame. All variables have been logged and are from the BOS's *Monthly Bulletin*.

| | |
|---|---|
| Monetary aggregates: | $RM_t$ (Reserve Money), $M2_t$ and $M2x_t$ |
| Retail price index: | $RPI_t$ |
| Total wages and other remunerations: | $TOT_t$ |
| Nominal SIT/DM exchange rate: | $DM_t$. |

The three different monetary aggregates are examined in model specification to see which provides a better explanation for the transmission of inflation.[18] The theoretical framework for the choice of these four variables stems from Bruno (1993). In general, each VAR model can be expressed as

$$x_t = c + \sum \Phi x_{t-1} + \varepsilon_t, \qquad (1)$$

where c is a vector of constants; $x_{t-1}$ is a vector of variables specified for each model; $\Phi$ is a time invariant matrix of autoregressive coefficients; and $\varepsilon_t$ is a vector of white noise residuals. The Akaike Information Criteria (AIC) was used to determine the lag structure in specifying the VAR model.[19] The appealing aspect of VAR systems is that no a priori assumptions

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[17]OECD Economic Surveys, 1997.

[18]Given that currency substitution has been in the range of 30–40 percent of total deposits, exchange rate changes will directly affect M2x, effectively biasing our results. However, it is important to examine the relationship between the broadest monetary aggregate and inflation, while keeping this limitation in mind.

[19]The application of the AIC resulted in a model with four lags. Given the short time span and without loss of generality, we report results using two lags. Typically, VAR models specified in levels are tested for cointegration among the variables and, if found, the VAR system is respecified to include an error correction term. However, the results of our stationarity tests reported below suggested the exclusion of key variables in any vector error correction model (VECM) and our attempts at specifying a VECM proved problematic, as slight changes in lag

(continued...)

concerning the exogeneity of policy variables are placed on the model and they provide a convenient means to summarize the empirical channels with respect to economic relationships. The estimated systems can be utilized to evaluate the strength of these relationships based upon variance decompositions and impulse response functions.

Variance decompositions originate from the moving average representation of the VAR model. Often called innovation accounting, variance decompositions show the portion of the forecast error variance for each variable that is attributable to its own innovations and to shocks with respect to the other system variables.[20] Impulse response functions, which also originate from the moving average representation of the VAR model, show the estimated response of each variable to a one standard deviation impulse in one of the innovations. These dynamic multipliers tell us how new information in one of the variables causes revisions in the forecast of another variable. The impulse response functions are graphed with a two standard deviation confidence interval band estimated through Monte Carlo integration.

Before implementation of the VAR models, the respective time series are analyzed to determine the existence of stationarity and examined through some basic descriptive statistics. We utilize the well-known augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) unit root tests.[21] From a simple AR process $A(L)\, u_t = \varepsilon_t$, where A(L) denotes a polynomial in the lag operator, the stationarity of the process depends upon the roots of the polynomial equation A(L)=0. If all roots are outside the unit circle, the process is stationary. If any root is equal to 1 in absolute value the process is not stationary and is said to be integrated of order one or I(1) and must be differenced in order to ensure stationarity. Finally, a set of common bivariate Granger causality tests is estimated.

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[19](...continued)
structure provided substantially different results. Therefore, we do not include a cointegrating vector.

[20]Since no contemporaneous terms enter the VAR system, any contemporaneous correlations are reflected in the cross-equation residual correlation. The Choleski factorization of the variance-covariance matrix of estimated variables is used to eliminate the cross-equation residual correlations among any given innovation series and those series that appear prior in the ordering. Thus the choice of variable ordering does affect the estimation of the VAR variance-covariance matrices—therefore various orderings are examined.

[21]When the underlying data generating process is more complicated than a simple AR(1) process, the ADF test augments the basic Dickey-Fuller test by including additional higher order lagged terms to capture autocorrelation in the error term. The PP test applies a non-parametric correction in the estimation of the variance of the error term.

## D. Empirical Results

As a prelude to examining the Granger causal relations and the VAR analysis, some basic descriptive statistics, correlations, and unit root tests are performed. The results of the unit root tests are presented in Table 2. The null hypothesis of one unit root cannot be rejected for the inflation rate and M2x series at the 5 percent level under either the ADF or PP test. While the null hypothesis of one unit root cannot be rejected for the exchange rate under the PP test, the ADF test cannot reject the hypothesis of two unit roots. As mentioned above, this probably represents a more complicated and persistent error process in the calculation of the variance, which is more easily handled by the nonparametric adjustment of the PP test. Therefore, we can assume that the exchange rate is an I(1) process, that is rendered stationary in first differences. The unit root tests on the reserve money and total wage series, however, suggest that both are stationary in levels. This finding was consistent over various lags and visual checks of the residuals. Given the exploratory nature of this study and the need to ensure uniformity among variables, we will work with the first differenced data.

The descriptive statistics of all variables in log first differences are displayed in Table 3. The most striking item in this table is that the Ljung-Box Q-tests reject the null hypothesis of zero autocorrelation—conclusive proof that these series contain a large degree of persistence and indicative of (near) unit root processes. Additionally, the Jarque-Bera normality tests show that inflation and the exchange rate contain sizable non-normal distributions. Interestingly, among the monetary aggregates, the reserve money series contains a relatively dispersed distribution, while the M2x series shows signs of excess kurtosis. Similarly, the inflation series exhibits excessive skewness and kurtosis, as would be expected in view of the discussion on relative price increases and inflation inertia. The correlation matrices in Table 4 demonstrate a strong contemporaneous correlation of inflation with the exchange rate and the broader monetary aggregates, M2 and M2x. Although there is a surprising negative correlation of inflation with total wages, the correlation between lagged total wages and inflation is quite strong, reflecting the backward indexation process in Slovenia. Besides the correlation between broader monetary aggregates and inflation, the correlation between M2x and total wages also stands out.

The results of the Granger causality tests are reported in Table 5. The monetary block reveals that of the three monetary aggregates examined, there is strong evidence that M2x growth Granger causes retail price inflation and that M2 growth Granger causes total wage growth. These results hold up across most lags and the various $F$-tests are significant at least at the 5 percent level. Regarding the wage growth block, there is some evidence that lagged total wage growth impacts inflation, particularly in the first period, and that total wage growth affects various monetary aggregates at different lags. The strongest results emanate from the depreciation block of $F$-tests, as there is persuasive evidence that depreciation in the tolar–mark exchange rate causes inflation and wage growth. However, as mentioned above, these results are to be expected, given the existing pervasive indexation in Slovenia, which would quickly pass through changes in the exchange rate to inflation and on to wages.

Table 2. Slovenia: Unit Root Tests

| | Levels | | Differences | |
|---|---|---|---|---|
| | ADF 1/ | PP 2/ | ADF 1/ | PP 2/ |
| lrm | -2.41 | -4.91 ** | -5.20 *** | -16.90 ** |
| lm2 | -1.38 | -3.16 | -2.63 | -5.94 ** |
| lm2x | -2.83 | -2.63 | -3.80 ** | -5.92 ** |
| lrpi | -0.60 | -2.30 | -3.95 *** | -4.05 ** |
| ldm | -2.28 | -2.35 | -2.13 | -4.45 ** |
| ltot | -2.85 | -4.62 ** | -6.08 *** | -10.62 ** |

1/ All ADF regressions in levels contain a constant, a linear trend, and four lags of the dependent varia sample period covers 1992:10-1997:3; all series are in logs; (*), (**), (***) indicate rejection of the null hypothesis at significance levels of 10, 5, and 1 percent, respectively.

2/ Levels include a trend and an intercept, while first differences include an intercept only.

Table 3. Slovenia: Descriptive Statistics 1/

| | lrm | lm2 | lm2x | lrpi | ltot | ldm |
|---|---|---|---|---|---|---|
| Mean | 0.027 | 0.040 | 0.028 | 0.012 | 0.018 | 0.009 |
| Standard deviation | 0.108 | 0.030 | 0.018 | 0.007 | 0.065 | 0.010 |
| Skewness | 0.018 | 0.591 | 0.409 | 1.278 | -0.438 | 0.868 |
| Kurtosis | 3.037 | 2.997 | 3.466 | 5.075 | 3.109 | 2.952 |
| Jarque-Bera 2/ | 0.006 | 3.086 | 1.992 | 24.387 | 1.750 | 6.784 |
| (p-value) | 0.997 | 0.214 | 0.369 | 0.000 | 0.417 | 0.034 |
| Ljung-Box Q-statistic 3/ | 21.502 | 28.721 | 29.995 | 38.719 | 12.394 | 59.061 |
| (p-value) | 0.001 | 0.000 | 0.000 | 0.000 | 0.056 | 0.000 |

1/ All series are log first differences. Skewness and kurtosis of a normal distribution are 0 and 3, respectively.
2/ Under the null hypothesis of normality, the Jarque-Bera statistic is distributed as a chi-square with 2 degrees of freedom.
3/ The Ljung-Box Q-statistic tests for autocorrelation and is distributed as chi-square, with degrees of freedom equal to the number of autocorrelations, 6 lags.

Table 4. Slovenia: Correlation Matrices 1/

| | lrm-lm2-lm2x 2/ | lrpi | ltot | ldm |
|---|---|---|---|---|
| lrm | 1.000 | | | |
| lrpi | 0.121 | 1.000 | | |
| ltot | 0.399 | -0.021 | 1.000 | |
| ldm | 0.155 | 0.446 | 0.241 | 1.000 |
| lm2 | 1.000 | | | |
| lrpi | 0.493 | 1.000 | | |
| ltot | 0.113 | -0.021 | 1.000 | |
| ldm | 0.401 | 0.401 | 0.241 | 1.000 |
| lm2x | 1.000 | | | |
| lrpi | 0.323 | 1.000 | | |
| ltot | 0.620 | -0.021 | 1.000 | |
| ldm | 0.498 | 0.446 | 0.241 | 1.000 |

1/ All series are log first differences.
2/ Related monetary aggregates are stated in corresponding matrix row.

Table 5. Slovenia: Granger Causality Tests 1/

| | Lag length in number of months | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **Money Growth** | | | | | | |
| RM growth--> RPI inflation | 0.1 | 0.3 | 0.3 | 0.2 | 0.2 | 0.3 |
| M2 growth--> RPI inflation | 3.6 ** | 2.2 | 0.6 | 0.9 | 0.9 | 1.0 |
| M2X growth--> RPI inflation | 10.3 *** | 5.3 *** | 3.9 ** | 1.9 | 2.9 ** | 3.3 ** |
| RM growth--> Wage growth | 1.2 | 1.0 | 0.8 | 0.8 | 1.3 | 2.0 |
| M2 growth--> Wage growth | 1.6 | 0.7 | 7.5 *** | 10.9 *** | 9.0 *** | 6.6 *** |
| M2X growth--> Wage growth | 6.0 *** | 3.1 ** | 1.7 | 2.1 | 1.2 | 1.8 |
| RM growth--> Depreciation | 0.5 | 0.6 | 1.2 | 1.0 | 0.9 | 2.1 * |
| M2 growth--> Depreciation | 1.6 | 4.4 ** | 2.6 * | 1.4 | 1.2 | 0.4 |
| M2X growth--> Depreciation | 0.0 | 0.9 | 0.2 | 2.3 * | 0.8 | 1.2 |
| **Wage Growth** | | | | | | |
| Wage growth-->RPI inflation | 6.4 *** | 1.2 | 1.6 | 0.7 | 2.4 * | 2.1 * |
| Wage growth-->RM growth | 2.9 ** | 2.9 ** | 2.0 | 1.5 | 1.4 | 1.1 |
| Wage growth-->M2 growth | 0.0 | 0.0 | 0.2 | 1.1 | 0.7 | 0.5 |
| Wage growth-->M2X growth | 0.5 | 4.3 ** | 2.9 ** | 1.9 | 1.5 | 1.2 |
| Wage growth-->Depreciation | 0.6 | 0.5 | 2.9 ** | 1.8 | 1.9 | 1.8 |
| **Depreciation** | | | | | | |
| Depreciation-->RPI inflation | 9.4 *** | 3.9 ** | 3.2 ** | 4.0 *** | 3.1 ** | 3.2 ** |
| Depreciation-->Wage growth | 4.0 *** | 5.5 *** | 3.9 *** | 3.3 ** | 3.7 *** | 3.0 ** |
| Depreciation-->RM growth | 5.3 *** | 4.2 *** | 2.8 ** | 1.9 | 1.5 | 1.0 |
| Depreciation-->M2 growth | 4.9 *** | 0.9 | 0.1 | 0.1 | 0.2 | 0.4 |
| Depreciation-->M2X growth | 2.3 * | 0.9 | 0.3 | 0.4 | 0.7 | 0.7 |
| **Inflation** | | | | | | |
| RPI inflation-->RM growth | 2.5 | 2.8 * | 2.0 | 2.4 * | 2.2 * | 4.0 *** |
| RPI inflation-->M2 growth | 1.4 | 1.8 | 1.4 | 0.7 | 0.9 | 0.5 |
| RPI inflation-->M2X growth | 7.1 *** | 2.6 * | 1.1 | 0.5 | 0.6 | 0.7 |
| RPI inflation-->Wage growth | 6.3 *** | 4.1 ** | 3.3 ** | 3.3 ** | 3.6 *** | 3.1 ** |
| RPI inflation-->Depreciation | 1.4 | 4.6 ** | 1.9 | 1.6 | 0.5 | 0.8 |

1/ Standard *F-tests*; (*), (**), (***) indicate rejection of the null hypothesis at significance levels of 10, 5, and 1 percent, respectively. The null hypothesis is "no Granger causality"; "-->" indicates direction of causality.

Finally, the inflation block of Granger causality tests repeats the strong evidence of bi-directional causality between inflation and wages, and suggests that inflation growth may be accommodated through higher growth in reserve money.[22]

The variance decompositions are presented in Tables 6–8, using the causal ordering of monetary aggregate growth, RPI inflation, growth in total wages, and changes in the exchange rate.[23] The rationale for this ordering is simply that changes in monetary aggregates affect inflation through the normal channels, which feeds into wage growth through indexation. Changes in the exchange rate are assumed to be affected by inflation through a PPP effect. The results shown in Table 6 demonstrate that most of the forecast error variance in reserve money and inflation can be attributed to their own innovations at various horizons. The forecast error variance of wage growth and changes in the exchange rate can be attributed, to some extent, to innovations in reserve money growth and inflation. In contrast, using M2 growth in place of reserve money growth (Table 7), demonstrate that a substantial percentage of the forecast error variance in inflation and depreciation can be attributed to M2 innovations. Variance decompositions using M2x growth (Table 8) exhibit an even greater importance of M2x innovations in explaining the forecast error variance in inflation, wage growth and changes in the exchange rate. Also, it is quite surprising that innovations in wage growth and M2x dominate the exchange rate's own innovations in determining forecast error variance.

The impulse response functions shown in Figures 3–5 employ the same causal orderings as the variance decompositions and apply the same three monetary aggregates. The first column of each figure shows the responses of each variable to a one standard deviation shock or innovation in the respective monetary aggregate. While innovations in reserve money and M2x growth sharply impact wage growth within one period and quickly subside, innovations in M2 growth tend to affect the exchange rate with a lag of three to five months and the inflation rate within two months. From the second column, across all three VAR formulations, there is evidence that a one standard deviation shock to inflation positively impacts wage growth and the exchange rate within two to four months. Finally, from the last column, the innovations in the exchange rate appear to affect the inflation rate, using a VAR model with the reserve money aggregate, and wage growth and inflation under a VAR model with the M2x aggregate. In addition, the response of inflation to a one standard deviation shock in the exchange rate exhibits a slow decay or persistence.

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[22]These results closely mimic the findings of Ucer (1997), who used reserve money growth in examining the determinants of inflation in Slovenia.

[23]The results that follow were surprisingly robust across various orderings in the VAR models. However, as expected, moving the inflation rate and monetary aggregates further apart in the VAR orderings tended to weaken the statistical relationships. The following other orderings were examined: (1) growth in money aggregate, depreciation, inflation, and wage growth; and (2) inflation, wage growth, depreciation, and growth in money aggregate.

Figure 3
SLOVENIA
Response to One S.D. Innovations ± 2 S.E.

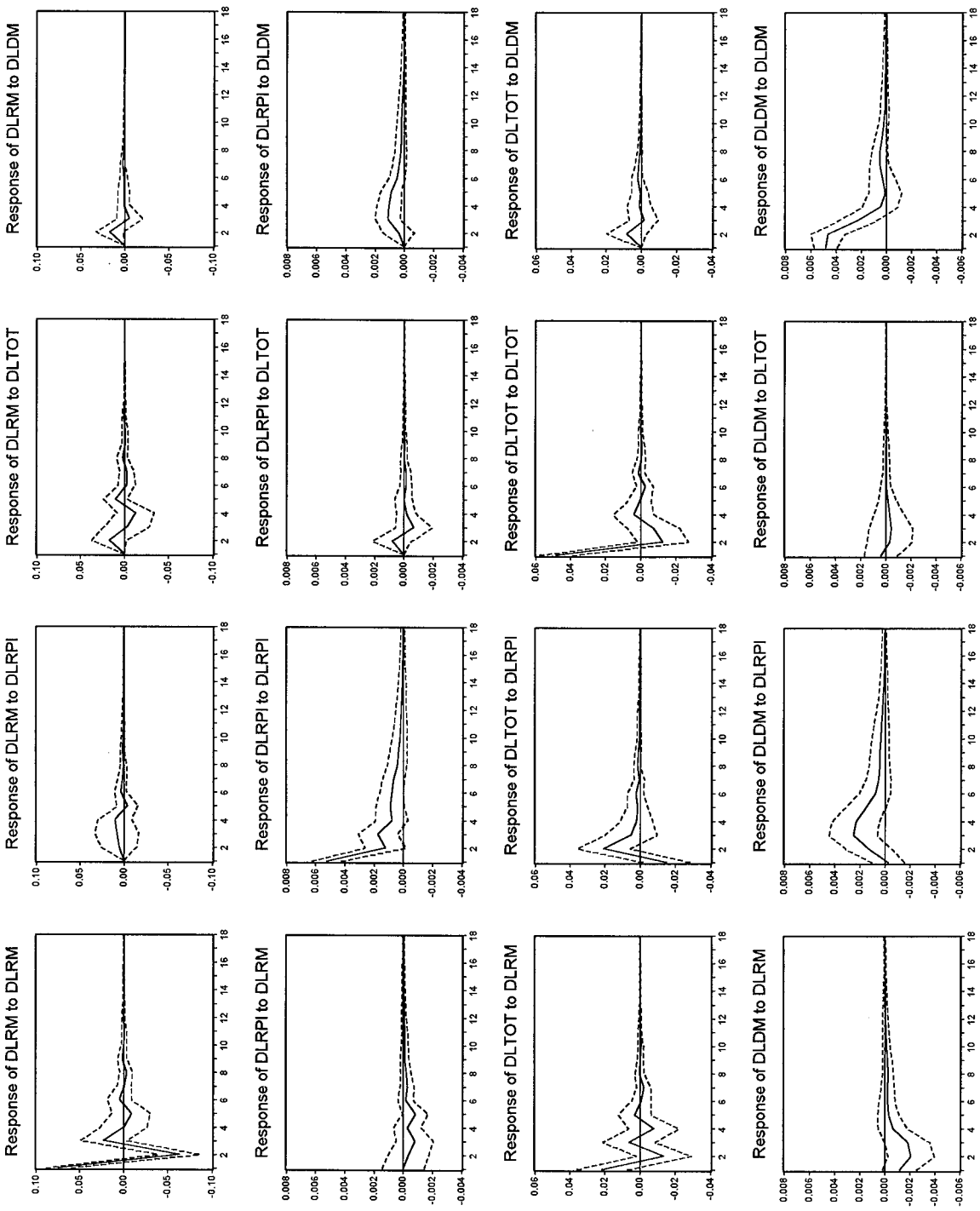

Figure 4
SLOVENIA
Response to One S.D. Innovations ± 2 S.E.

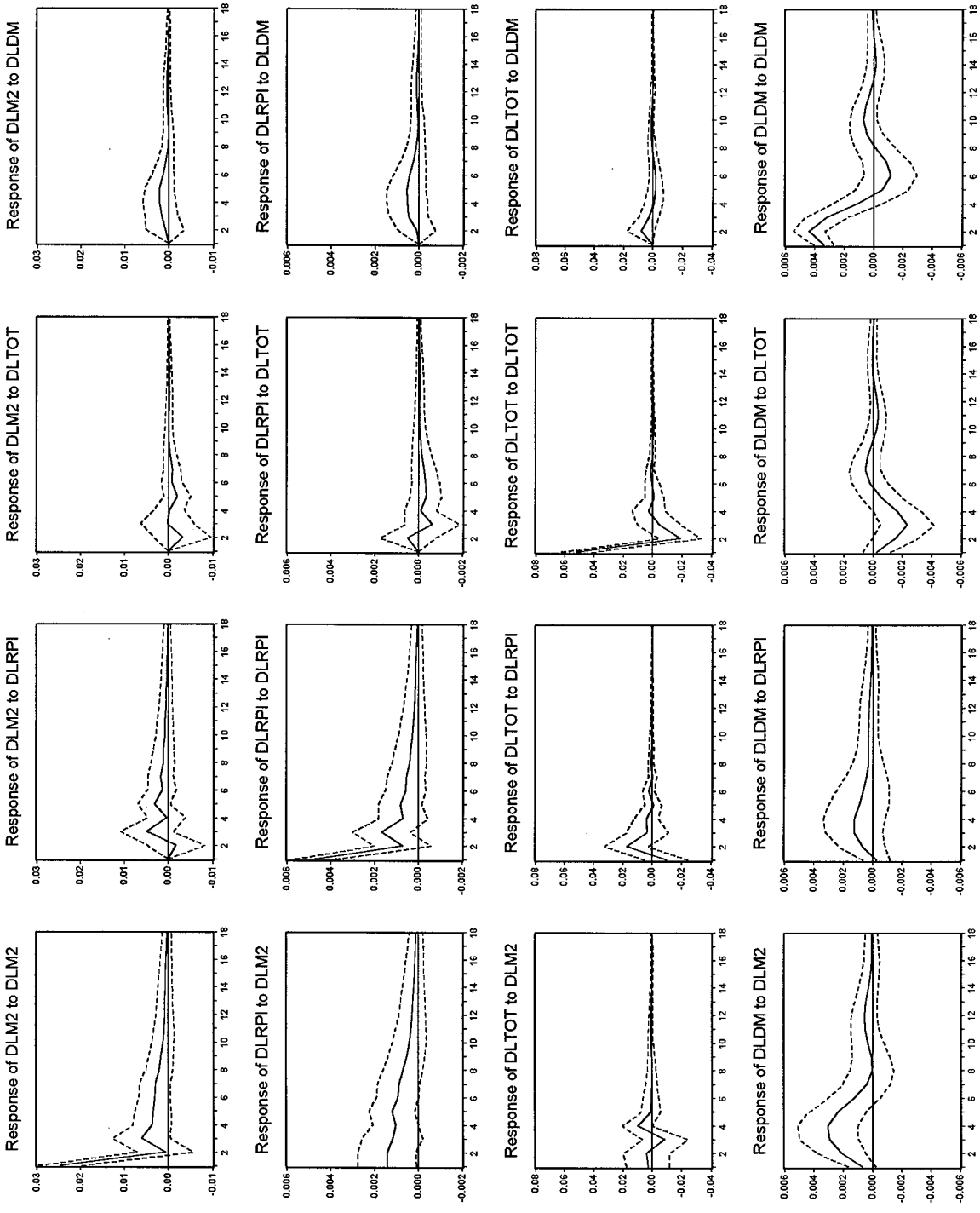

Figure 5
SLOVENIA
Response to One S.D. Innovations ± 2 S.E.

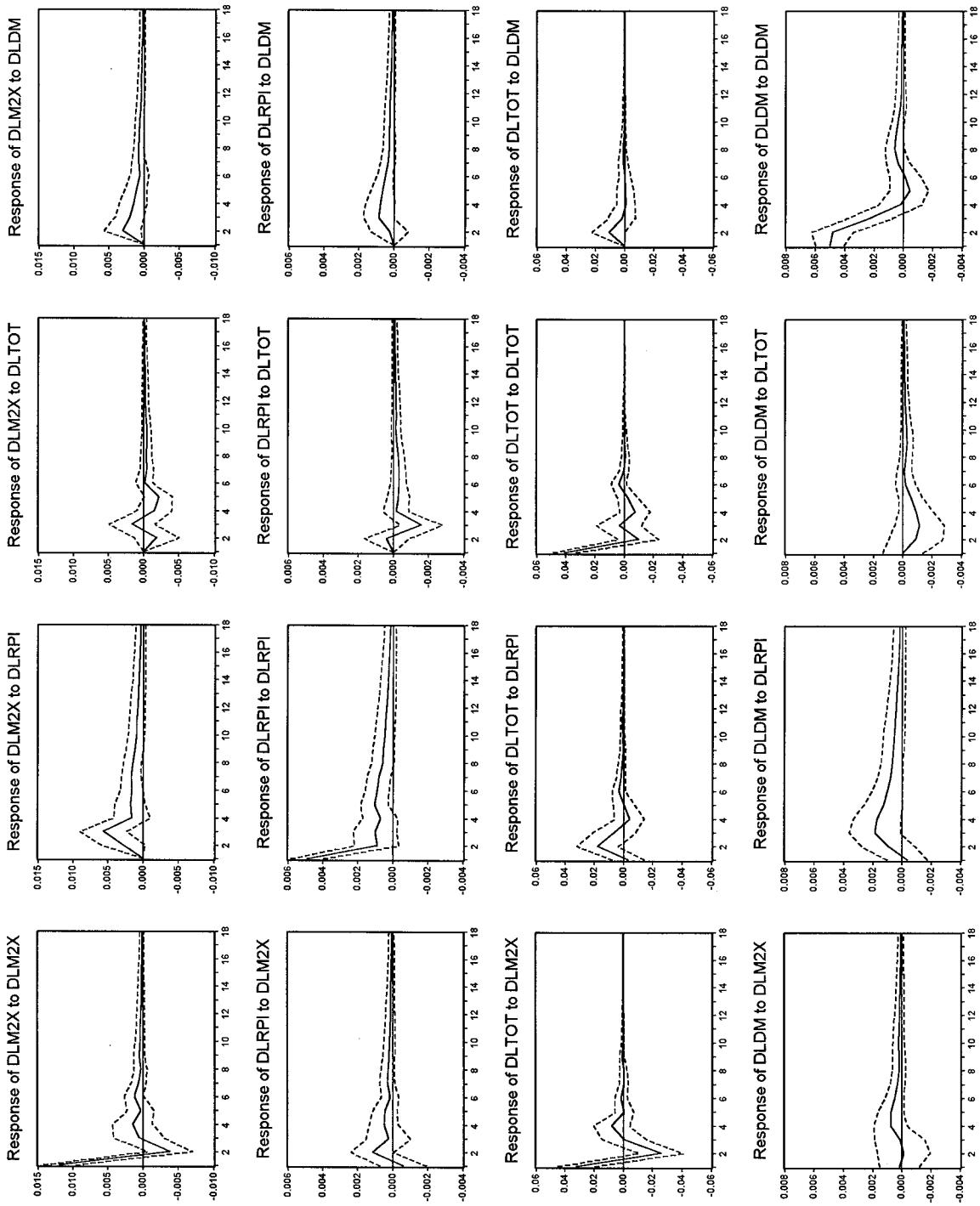

Table 6. Slovenia: Variance Decompositions
(First ordering, using Reserve Money growth)

| Variable | Lags | RM growth | RPI inflation | Wage growth | Depreciation |
|---|---|---|---|---|---|
| RM growth | 1 | 100.0 | 0.0 | 0.0 | 0.0 |
| | 6 | 89.9 | 2.0 | 5.2 | 2.9 |
| | 12 | 89.7 | 2.1 | 5.3 | 3.0 |
| | 18 | 89.7 | 2.1 | 5.3 | 3.0 |
| RPI inflation | 1 | 0.0 | 100.0 | 0.0 | 0.0 |
| | 6 | 4.1 | 84.4 | 2.8 | 8.7 |
| | 12 | 4.4 | 83.8 | 2.8 | 9.1 |
| | 18 | 4.4 | 83.7 | 2.8 | 9.1 |
| Wage growth | 1 | 15.4 | 7.4 | 77.2 | 0.0 |
| | 6 | 18.5 | 16.9 | 62.7 | 1.9 |
| | 12 | 18.5 | 17.0 | 62.6 | 1.9 |
| | 18 | 18.5 | 17.0 | 62.6 | 1.9 |
| Depreciation | 1 | 5.8 | 0.3 | 0.6 | 93.3 |
| | 6 | 13.0 | 21.0 | 0.8 | 65.3 |
| | 12 | 13.0 | 21.5 | 0.8 | 64.7 |
| | 18 | 13.0 | 21.6 | 0.8 | 64.6 |

Note: ordering is RM, RPI inflation, total wages, and depreciation.

Table 7. Slovenia: Variance Decompositions
(First ordering, using M2 growth)

| Variable | Lags | M2 growth | RPI inflation | Wage growth | Depreciation |
|---|---|---|---|---|---|
| M2 growth | 1 | 100.0 | 0.0 | 0.0 | 0.0 |
| | 6 | 91.1 | 5.1 | 2.0 | 1.8 |
| | 12 | 90.3 | 5.9 | 2.1 | 1.8 |
| | 18 | 90.2 | 5.9 | 2.1 | 1.8 |
| RPI inflation | 1 | 8.4 | 91.6 | 0.0 | 0.0 |
| | 6 | 23.2 | 71.8 | 2.3 | 2.6 |
| | 12 | 26.2 | 68.7 | 2.4 | 2.7 |
| | 18 | 26.5 | 68.4 | 2.4 | 2.7 |
| Wage growth | 1 | 0.3 | 3.5 | 96.2 | 0.0 |
| | 6 | 5.1 | 11.4 | 81.4 | 2.0 |
| | 12 | 5.2 | 11.4 | 81.3 | 2.1 |
| | 18 | 5.2 | 11.4 | 81.3 | 2.1 |
| Depreciation | 1 | 4.1 | 0.6 | 0.5 | 94.7 |
| | 6 | 33.6 | 5.5 | 12.2 | 48.7 |
| | 12 | 33.1 | 5.8 | 12.5 | 48.6 |
| | 18 | 33.2 | 5.9 | 12.4 | 48.4 |

Note: ordering is M2 , RPI inflation, total wages, and depreciation.

Table 8. Slovenia: Variance Decompositions
(First ordering, using M2x growth)

| Variable | Lags | M2x growth | RPI inflation | Wage growth | Depreciation |
|---|---|---|---|---|---|
| M2x growth | 1 | 100.0 | 0.0 | 0.0 | 0.0 |
| | 6 | 67.1 | 20.1 | 5.6 | 7.1 |
| | 12 | 64.1 | 22.5 | 5.7 | 7.6 |
| | 18 | 63.6 | 22.9 | 5.8 | 7.7 |
| RPI inflation | 1 | 58.2 | 29.5 | 5.3 | 7.0 |
| | 6 | 56.6 | 29.8 | 6.1 | 7.5 |
| | 12 | 56.2 | 30.2 | 6.1 | 7.5 |
| | 18 | 56.1 | 30.2 | 6.1 | 7.5 |
| Wage growth | 1 | 39.8 | 3.3 | 56.1 | 0.7 |
| | 6 | 43.6 | 10.9 | 42.3 | 3.2 |
| | 12 | 43.6 | 11.0 | 42.2 | 3.2 |
| | 18 | 43.6 | 11.0 | 42.2 | 3.2 |
| Depreciation | 1 | 43.3 | 10.9 | 42.0 | 3.8 |
| | 6 | 42.9 | 11.0 | 41.7 | 4.4 |
| | 12 | 42.9 | 11.1 | 41.6 | 4.4 |
| | 18 | 42.9 | 11.1 | 41.6 | 4.4 |

Note: ordering is M2x , RPI inflation, total wages, and depreciation.

## IV. CONCLUSIONS

Understanding and disentangling the process of price formation and inflation in Slovenia is a complicated and empirically difficult task. Ubiquitous indexation procedures quickly pass on price and exchange rate changes on to wages and most financial assets, which directly filter back into inflation. Exogenous wage growth stemming from labor market rigidities or from the lack of decentralized bargaining arrangements can propagate price pressures, which again are fed almost immediately into price indices and demands for additional wage increases, in a vicious circle. In addition, administered price increases are layered on top of an underlying price impulse, which could stem from excessive growth in money aggregates or wage demands, increasing the variability of inflation. Peeling away these effects to acquire an understanding of basic inflationary pressures is not a trivial task.

Our attempt at understanding this process through Granger causality tests and estimated unrestricted VAR models found a strong linkage between both growth in broader monetary aggregates and changes in the tolar–deutsche mark exchange rate on RPI inflation. As expected, the strength of the exchange rate pass-through effect was robust. While our results suggest that wage growth affects inflation, it appears that changes in both the exchange rate and growth in monetary aggregates place the initial pressure on wage movements to impact inflation. Excessive wage demands by labor alone do not appear to individually drive inflation; however, we would stress that the indexation measures and statistical properties of the data do not allow us to make a conclusive statement. We also found that our brief examination of the behavior of controlled and nontradable price growth suggested that many of the inflationary channels discussed in our review of the literature, and experienced in many other transition economies, are also in effect in Slovenia. Therefore, we would not underestimate the importance that structural rigidities have on inflation dynamics in Slovenia.

Based upon what we have learned, what policy recommendations can be prescribed? First, any attempt to lower inflation to Western European levels through tight monetary policy alone will not succeed without severely contracting economic activity. This policy can reduce core inflation levels, but until the process of administrative price increases has played itself out and strict indexation mechanisms are eliminated, persistent overall inflation will remain. Thus, we would strongly caution against any attempt to fight inflation through monetary policy alone.

Second, the dual money and nominal exchange rate targeting policies of the BOS—necessitating the pervasive use of sterilization and capital control measures—retard the disciplining effects of foreign capital inflows on overall private sector governance. As discussed by Wagner (1997), the privatization and restructuring process in Slovenia has not resulted in major structural changes in corporate ownership from that prevailing in the previous SFRY, nor has overall corporate performance substantially improved. Elimination of these capital controls and a policy of welcoming the positive effects of foreign capital inflows would go a long way in truly restructuring and modernizing Slovene corporate enterprises, as well as expediting the development of financial markets. This policy would also play a catalytic role in the removal of indexation and accelerate the integration of labor and financial

markets with those in Western Europe. All of these items are key ingredients in the formation of a common currency area and the desired entrance of Slovenia into the European Union and its Exchange Rate Mechanism (ERM)—*the* main medium-term economic objective of the country.

While pursuit of multiple macroeconomic objectives is not rare in transition economies,[24] it is becoming increasingly apparent that the authorities need to choose between conflicting targets. Besides the financial costs of sterilization, the real output costs suffered in achieving the inflation targets mentioned above, as well as the potential cost of lost central bank credibility, the multiple objective system and its requirement to shield the economy from the effects of foreign capital are a major deterrent to the implementation of fundamental market reforms. If Slovenia wants to go forward and enjoy the advantages of a market-based economy, it must shed its reliance on old-style "market socialism" and allow market mechanisms to produce correct price signals, in spite of the distributional effects. Only then will inflation dynamics in Slovenia truly reflect the underlying supply and demand conditions. With an overall *medium-term* objective of ERM attainment within four to five years, our results would suggest the use of a money-based anchor in the *near term*, which permits capital inflows to lead to an appreciation the nominal exchange rate and increase the money supply. As there is substantial evidence that monetization levels are below those of other Visegrad countries, monetary targets would have to be adjusted accordingly and policymakers would need to vigorously pursue de-indexation and other price liberalization policies prior to (or simultaneously with) this relaxation of policy. However, while they are in effect, these rigidities would help to dampen inflationary pressures emanating from the re-monetization process as the exchange rate appreciation is passed through to the whole economy.

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[24]See Begg (1996).

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