INFLATIONARY DYNAMICS OF A TRANSITION ECONOMY: THE CROATIAN EXPERIENCE*

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Abstract

This paper undertakes an exploratory analysis of the inflationary dynamics within the Croatian economy over the period January 1992 - December 1999. Recognizing the structural break in the inflationary process corresponding to the anti-inflationary stabilization program of October 1993, the analysis proceeds by estimating an augmented vector autoregressive (VAR) model of the log first-differences for the broad money supply, retail price index (RPI), nominal net wage per employee, and the nominal effective exchange rate (NEX) along with evaluating generalized forecast error variance decompositions to infer the empirical relationship among the four variables. The results show that inflation is positively related to wage growth and currency depreciation. Interestingly enough, lagged values of inflation are insignificant suggesting the absence of inflation inertia. Moreover, there appears to be feedback from wage growth, currency depreciation along with past money growth to current money growth. Wage growth is influenced by past wage growth and currency depreciation. Finally, currency depreciation is affected by money growth and past currency depreciations.

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1
INTRODUCTION

For many transition economies, the transformation towards a modern market economy has brought about inflationary consequences as price liberalization takes hold. The case of Croatia is unique to other transition economies, not only did Croatia face an inflationary environment like other transition economies but was establishing a sovereign economy while embroiled in a war and occupation of its territories. Following the conflict with Serbia and Montenegro, Croatia embarked upon a heterodox anti-inflationary stabilization program in October 1993. Unlike many transition economies that encountered persistent and moderate rates of inflation over their respective post-stabilization periods (Dornbusch and Fischer, 1993; Begg, 1996; Kutan and Brada, 1999 and Ross, 2000), the results of the Croatian stabilization program yielded an almost immediate deflation. In light of the Croatian success in curtailing inflation the task of this paper is to investigate the role of some common determinants of inflation found in transition economies in the case of Croatia.

Although institutional and economic structures may differ, Sahay and Vegh (1995) find that inflationary processes in transition economies are similar to their market counterparts. There are several common features inherent in the inflationary processes of transition economies. First, the initial impulse of inflation has been attributed to the monetization of fiscal deficits due to the inadequate and weak capital markets. Second, the presence of backward-looking wage indexation arrangements translate into wage growth exceeding labor productivity growth as well as playing a role in maintaining inflation inertia. Third, Pujol and Griffiths (1998) and Coorey, et. al. (1998) argue the distortion of relative prices along with the presence of downward price rigidities can adversely affect prices as some prices increase by relatively large amounts while other prices remain stable or increase by smaller amounts. This distortion of relative prices can result in a disproportionate effect on price indices. Fourth, as suggested by Nuti (1996), Richards and Tersman (1996), and Desai (1998), the initial "over" depreciation of the currencies of transition economies may induce inflationary pressures. In section II the Croatian stabilization experience is briefly discussed followed by the presentation of the data, methodology, and results in section III. Section IV provides concluding remarks.

2
THE CROATIAN STABILIZATION EXPERIENCE

Croatia inherited an inflationary environment from the former Yugoslavia when declaring independence in 1991. The ensuing war with Serbia and Montenegro simply added to the inflationary pressures as fiscal deficits were monetized due in part to the presence of weak capital markets and the absence of capital inflows from abroad. In addition to the inflationary pressures, the Croatian National Bank, hereafter CNB, did not have foreign exchange reserves due to the Serbian regime's control of international reserves. Though the CNB inherited zero foreign exchange reserves at the time of independence and in 1992 set forth regulations (later abolished) that required commercial banks to surrender a percentage of their total foreign exchange reserves, the monetary authorities were essentially following a policy of accommodating the rate of nominal depreciation by adjusting the growth rate of the money supply while maintaining an acceptable range of inflation. If inflation began to increase the monetary authorities would reduce the growth rate of the money supply and the rate of nominal depreciation. It could be argued that monetary policy was in some sense endogenous to exchange rate movements as a result of the monetary authorities desire to build up foreign exchange reserves.

In December 1991, the Croatian government introduced the Croatian dinar with a one-to-one parity with the Yugoslav dinar accompanied by a fixed exchange rate regime. Though inflation slowed in the first quarter of 1992, the fixed exchange rate regime was abandoned in March 1992. From mid-1992 to October 1993, the exchange rate floated and began to depreciate fueling higher inflation in the range of 20 to 40 percent per month. In response, the Croatian government embarked upon a stabilization program to reduce the prevailing inflationary environment. Before the official announcement of the stabilization program, the CNB began to undertake restrictive monetary policy actions. However, on October 4, 1993, the Croatian anti-inflation stabilization program was officially introduced (Babić, 1998).

Šonje and Nestić (1994) and Anušić, et. al. (1995) outline the main features of the stabilization program. The main anchor of the stabilization program was a crawling peg of the Croatian dinar to the Deutsche mark. The announcement of the program established an upper intervention point of 4444 Croatian dinars per Deutsche mark. The announcement of the exchange rate implied a nearly 21 percent depreciation

of the Croatian dinar in relation to the exchange rate at the beginning of October. The logic for this one-time depreciation was to allow for the alignment of relative prices and wages by the end of October. The rate of change of the nominal exchange rate in November was established at 3.5 percent, setting an upper intervention point of 4600 Croatian dinars per Deutsche mark while for December the upper intervention point was set at 4750, a 3.3 percent increase. The policy of a diminishing crawling peg rate reflected the expected path of inflation convergence toward its structural component (Anušić, et. al. 1995, pp. 47-48). In addition to the exchange rate anchor, a new foreign exchange law was passed which liberalized the foreign exchange market and introduced internal convertibility.

With respect to monetary policy, the growth of the monetary base was set at 17 percent for October while the growth of the monetary base was set in line with the rate of change in the nominal exchange rate of 3.5 percent for November and 3.3 percent for December. This monetary policy stance was not a firm rule but allowed for discretion. Indeed, if the nominal exchange rate rose (depreciated) resulting in inflationary pressures, the CNB would restrict the monetary base via foreign exchange operations. In addition to the growth of the monetary base, the CNB discount rate for October was set at 21 percent with a reduction in the discount rate to 7 percent on the day the internal convertibility of foreign exchange was announced. Although no specific percentage was set, the discount rate for November and December was to be less than 7 percent.

Given the built in rigidities of the labor market, an incomes policy rule was announced in which the wage bill for the state sector in October may increase by no more than 24.9 percent with respect to the wage bill in September. For November and December the allowed increase was 4 percent with respect to the previous month. This wage path was set in line with the expected disinflation in order to maintain average real wages. Along side the anti-inflationary stabilization policy the announcement of the long-run target of a balanced budget fiscal policy was introduced.

In summary, the anti-inflationary program initiated in October 1993 focused on several points: implement restrictive monetary policy, liberalize the foreign exchange market, control public sector wage growth, realign prices of public utilities in order to eliminate losses, and pass a balanced budget.

The stabilization program was perceived as credible and a success as the average monthly inflation rate went from 20 to 40 percent a month to close to zero percent. From Table 1 the average monthly inflation (DLRPI) was around 22.42 percent with a standard deviation of 5.38 percent

in the pre-stabilization period whereas in the post-stabilization period average monthly inflation was .25 percent with a standard deviation of .56 percent. The inflation rate was reduced and more stable in the post-stabilization period relative to the pre-stabilization period. In particular, the liberalization of the foreign exchange market was an important ingredient in the success of the stabilization program. Given the pre-existing holdings of foreign exchange deposits along with depressed income levels, liberalization of the foreign exchange rate did not result in huge purchases of foreign exchange and further depreciation but the purchase of domestic currency (reverse currency substitution) in order to finance current consumption (Kraft, 1996). As a result the nominal exchange rate underwent an appreciation. The perceived credibility of the stabilization program generated net capital inflows (workers remittances from abroad along with the purchase of domestic currency from residents) resulting in appreciation of the exchange rate and lower inflation. The emergence of reverse currency substitution increased real money demand along with a further appreciation of both the nominal and real exchange rate.

In light of the common factors triggering inflation in transition economies, the Croatian inflationary experience can be attributed to both demand-pull and cost-push factors. The primary demand-pull factor was associated with the initial monetization of fiscal deficits which generate excessive growth in the money supply. On the cost-push side, changes in the exchange rate were important in the price dynamics of Croatia (Šonje and Škreb, 1995). Given the high import content of domestic production, a depreciation of the exchange rate and the corresponding price effects of imported goods are transmitted to domestic prices. Second, in relative high inflation countries, there is usually widespread foreign exchange indexation in price contracts which transmit changes in the exchange rate to domestic prices. Moreover, the presence of excessive wage growth due in part to backward wage indexation along with the presence of inflation inertia has inflationary consequences.

3
DATA, METHODOLOGY, AND RESULTS

Monthly data for the period 1992:01 to 1999:12 obtained from the database of the Ekonomski institut, Zagreb will be used in the analysis. Following Bruno (1993), Kutan and Brada (1999), Haderi, et. al. (1999), and Ross (2000) a vector autoregressive (VAR) model is estimated to gain some insight into the interrelationships of the following four variables: inflation (DLRPI), wage growth (DLNW), broad money growth (DLM4), and currency depreciation (DLNEX).[1]

Before the estimation of the VAR model and given the known structural break associated with the October 1993 stabilization program, Perron's (1989) unit root tests for structural change will be estimated as follows[2]:

$$(1) \qquad y_t = \alpha + \beta t + \gamma_1 DP_t + \gamma_2 DL_t + \delta y_{t-1} + \sum_{i=1}^{n} \theta_i \, \Delta y_{t-i} + \varepsilon_t$$

where t is a linear time trend; DP_t=1 for 1993:11 and 0.0 otherwise, DL_t=1 for all t ≥ 1993:11 and 0.0 otherwise. The null hypothesis is a unit root process given by the following $\beta=0$, $\gamma_1 \neq 0$, $\gamma_2=0$ and $\delta=1$. The alternative hypothesis is a permanent one-time break in the trend stationary process given by the following: $\beta \neq 0$, $\gamma_1=0$, $\gamma_2 \neq 0$ and $\delta<1$. Table 2 presents the results of Perron's unit root tests in light of the structural break. The linear trend term, β, is significant only for wage growth (DLNW) and currency depreciation (DLNEX) whereas the pulse dummy variable (DP_t) is significant in all equations except for money growth. The dummy variable (DL_t) for a permanent one-time break is negative and significant in all four equations. Finally, the δ coefficient is significantly less than one for each of the variables, suggesting the respective time series are trend stationary with a break in the trend stationary model.

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[1] *The data definitions are as follows: M4 is the broad money measure defined as M1 (cash outside the banks plus deposits with central bank by other banking institutions and other domestic sectors plus deposit money banks' demand deposits) plus savings and time deposits, foreign currency deposits, bonds and money market instruments; RPI is the retail price index with 1997 as the base; NW is the nominal monthly net wage per employee; and NEX is the nominal effective exchange rate index with December 1989 as the base (Croatian kuna /foreign currencies).*

[2] *The Perron unit root tests performed assume that the date of the structural break is known. However, if the date of the structural break is unknown the paper by Perron and Vogelsang (1992) should be consulted.*

Based on the unit root tests we follow Sims (1980) in estimating a vector autoregressive model (VAR)[3]. The VAR model includes 3 lags each of the four variables. Note that estimation of additional lags would create degrees of freedom problems. Table 3 displays the VAR results. Moreover, the adjusted R^2 values and overall F-statistics suggest the equations have good explanatory power. The Box-Pierce Q-statistics suggest the residuals are free of autocorrelation. The summation of the respective coefficients of the independent variables are reported above the corresponding partial F-statistics and associated p-values for ease in the interpretation of the Granger-causality tests.

In addition to past money growth, there appears to be feedback effects from wage growth and currency depreciation to current money growth (DLM4). Inflation (DLRPI) is positively influenced by wage growth and currency depreciation[4]. However, what is surprising in light of the evidence of other transition economies is the absence of persistence and inflation inertia given the insignificance of the lagged values of inflation. The lack of inflation inertia in the Croatian inflationary process can be attributed to the success of the anti-inflationary stabilization program to reduce inflationary expectations. Wage growth (DLNW) is influenced by past wage growth and currency depreciation. Moreover, lagged values of inflation do not affect wage growth signaling perhaps the reduction in backward looking wage indexation so prevalent in the pre-stabilization period. Finally, currency depreciation (DLNEX) is positively related to money growth and past values of currency depreciation. As money growth increases, upward pressure on domestic prices weaken the kuna. Increases in currency depreciation will induce further depreciations unless the monetary authorities intervene.

In addition to the Granger-causality results reported in Table 3, the moving average representation of the VAR model allows one to trace out the path of the various shocks to the variables in the system, called innovation accounting, which is useful in examining the relationships among the variables. In particular, the forecast error variance decompositions generated from the moving average representation of the VAR model describes the proportion of the forecast error variance for each variable that is due to its own innovations and to shocks with respect to other variables in

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[3] *There is some debate in the time series literature concerning the relevance of testing for cointegration in light of the time period and frequency of the data observations as in the case of transition economies (Hakkio and Rush, 1991). Therefore, in light of the time horizon of this study the analysis proceeds using unrestricted vector autoregressive models rather than vector error correction models. In some sense, the analysis is focusing on the short-run dynamics.*

[4] *The introduction of a VAT in January 1998 induced a jump in the price level.*

the model. However, dynamic VAR analysis is usually performed by using the orthogonalized impulse responses, where the underlying shocks to the VAR model are orthogonalized using the Choleski decomposition. The drawback of this approach to orthogonalization is that the results are sensitive to the ordering of the variables in the VAR (Lutkepohl, 1991). However, Koop, et. al. (1996) and Pesaran and Shin (1998) propose generalized impulse responses which do not require orthogonalization of shocks and is invariant to the ordering of the variables in the VAR. The difference between the orthogonalized and generalized forecast error variance decompositions is that in an orthogonalized forecast error variance decomposition the percentage of the forecast error variance of a variable which is accounted for by the innovation of another variable in the VAR will sum to one across all variables whereas this is not the case for generalized forecast error variance decompositions. The generalized forecast error variance decomposition allows one to make robust comparisons of the strength, size, and persistence of shocks from one equation to another. The cost is that one cannot evaluate the percentages of the forecast error variance explained by each variable in absolute terms, only in relative terms[5].

Table 4 displays the generalized forecast error variance decompositions for the VAR model estimated in Table 3. Panel A reports the relative percent of the forecast error variance attributed to each variable for an one standard deviation shock to broad money growth. As the forecast horizon lengthens, inflation, wage growth, and currency depreciation increase their influence upon money growth with wage growth and currency depreciation contributing more than inflation. These results coincide with the results of the Granger-causality tests. In Panel B, currency depreciation along with wage growth contribute more than money growth to inflation. In Panel C, forecast error variance decompositions mimic the results of the Granger-causality tests in that neither money growth nor inflation explain as much of the forecast error variance decomposition of wage growth as currency depreciation. Finally, the forecast error variance decomposition results for currency depreciation differ somewhat from the Granger-causality results in that inflation appears to have a relatively larger, impact on currency depreciation than money growth.

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[5] *This difference is due to the non-zero covariance between the non-orthogonalized shocks (see Pesaran and Shin, 1998 for details). Orthogonalized and generalized forecast error variance decompositions will be the same for the first variable in the VAR or when the covariance matrix of the shocks, Σ, is diagonal.*

4
CONCLUDING REMARKS

This paper applied some of the common factors underlying the inflationary processes of transition economies to the case of Croatia. With monthly inflation rates in the range of 20 to 40 percent abruptly dropping with the implementation of an anti-inflationary program in October 1993, an exploratory VAR analysis of broad money growth, inflation, wage growth, and currency depreciation was undertaken. The analysis shows that wage growth and currency depreciation have a positive and significant impact upon inflation. However, lagged values of inflation were insignificant, signaling perhaps the absence of inflation inertia. The evidence suggests there are feedback effects from wage growth and currency depreciation to money growth. Likewise, past values of wage growth and currency depreciation have a positive impact on current wage growth. Currency depreciation is affected by money growth and past values of currency depreciation. The relationship between money growth and currency depreciation is not surprising given the CNB has followed since January 1994 (though unannounced) an exchange rate band wide enough to pursue discretionary monetary policy to offset any adverse movements in the exchange rate triggered by capital flows (Šonje, 1999). Moreover, the significance and importance of the nominal exchange rate as a factor in the inflationary process parallels the findings of Kutan and Brada (1999) in the cases of the Czech Republic, Hungary, and Poland, Haderi, et. al. (1999) in the case of Albania and Ross (2000) for Slovenia.

Table 1

DESCRIPTIVE STATISTICS AND CORRELATION MATRICES

Panel A: Full Period 1992:01-1999:12				
	Descriptive Statistics			
	DLM4	DLRPI	DLNW	DLNEX
Mean	.0559	.0515	.0586	.0448
Standard Deviation	.1138	.0959	.0926	.0916
	Correlation Matrix			
	DLM4	DLRPI	DLNW	DLNEX
DLM4	1.000			
DLRPI	.5824	1.000		
DLNW	.5833	.8543	1.000	
DLNEX	.6861	.8921	.8379	1.000
Panel B: Pre-Stabilization Period 1992:01-1993:10				
	Descriptive Statistics			
	DLM4	DLRPI	DLNW	DLNEX
Mean	.1622	.2242	.2076	.2027
Standard Deviation	.2033	.0538	.0858	.0699
	Correlation Matrix			
	DLM4	DLRPI	DLNW	DLNEX
DLM4	1.000			
DLRPI	.3983	1.000		
DLNW	.3848	.2258	1.000	
DLNEX	.7113	.0280	.3275	1.000
Panel C: Post-Stabilization Period 1993:11-1999:12				
	Descriptive Statistics			
	DLM4	DLRPI	DLNW	DLNEX
Mean	.0246	.0025	.0163	-.42E-4
Standard Deviation	.0292	.0056	.0289	.0160
	Correlation Matrix			
	DLM4	DLRPI	DLNW	DLNEX
DLM4	1.000			
DLRPI	-.2917	1.000		
DLNW	.0103	-.0973	1.000	
DLNEX	.0115	-.1170	-.1535	1.000

Table 2

PERRON'S UNIT ROOT TESTS (1992:01-1999:12)

Variable	α	β	γ_1	γ_2	δ	Adj. R^2	F	Q (24)
DLM4	.2394 (9.03)[a]	-.0006 (-3.12)[a]	-.0402 (-1.20)	-.1785 (-8.85)[a]	.0071 (-9.04)[a]	.864	83.01 (.000)[a]	26.26 (.340)
DLRPI	.2177 (17.27)[a]	.0001 (1.49)	.0886 (5.16)[a]	-.2183 (-18.47)[a]	.0927 (-18.41)[a]	.970	416.05 (.000)[a]	25.65 (.371)
DLNW	.1675 (5.46)[a]	.53E-6 (.002)	-.1705 (-3.97)[a]	-.1582 (-5.68)[a]	.3147 (-5.43)[a]	.810	55.86 (.000)[a]	12.98 (.966)
DLNEX	.2694 (11.88)[a]	.0002 (1.96)[c]	-.1021 (-4.64)[a]	-.2815 (-12.21)[a]	-.2723 (-12.21)[a]	.939	200.50 (.000)[a]	13.87 (.950)

Notes: Three lags were used in the estimation of the unit root tests. The appropriate t-statistics are in parentheses and p-values are in brackets. For α, β, γ_1, γ_2 the null hypothesis is that the coefficient is equal to zero. For δ the null hypothesis is δ=1. Critical values for the null hypothesis δ=1 are given in Perron (1989, Table IV.B, p. 1376) for λ=.2: 1% (-4.39), 5% (-3.77), and 10% (-3.47). All the estimated values of are significantly different from unity at the 1% level. Significance levels are denoted as follows: a (1%), b (5%), and c (10%).

Table 3

VAR RESULTS GRANGER-CAUSALITY TESTS
1992:01-1999:12 (p-values in parentheses)

Dependent Variables	Independent Variables						
	DLM4	DLRPI	DLNW	DLNEX	Adj. R^2	F	Q (24)
DLM4	.1637 3.54(.019)[b]	-.0132 1.23(.306)	.3659 4.08(.010)[a]	.3225 2.51(.065)[c]	.810	28.62 (.000)[a]	18.44 (.781)
DLRPI	.2420 1.43(.240)	.0890 .864(.463)	.2081 3.55(.018)[b]	.5334 9.58(.000)[a]	.927	84.09 (.000)[a]	20.16 (.688)
DLNW	.1090 1.91(.136)	-.3222 .790(.503)	.5285 3.68(015)[b]	.7101 3.79(.014)[b]	.778	23.83 (.000)[a]	25.01 (.405)
DLNEX	.1130 2.47(.069)[c]	-.0818 .425(.735)	.2143 2.11(.106)	.7448 8.96(.000)[a]	.838	34.66 (.000)[a]	16.25 (.879)

Notes: Given the limited number of observations 3 lags were used in the estimation of the VAR. F is the overall F-statistic. Q(24) is the Box-Pierce Q-statistic at 24 lags distributed as λ^2_{24}. The intercept terms, linear time trend, and structural dummy variables were included in the augmented VAR model but not reported to conserve space. The summation of the respective coefficients of the independent variables are reported above the corresponding partial F-statistics and p-values. Significance levels are denoted as follows: a (1%), b (5%), and c (10%).

Table 4

GENERALIZED FORECAST ERROR VARIANCE DECOMPOSITIONS BASED ON VAR MODEL

Panel A: One Standard Deviation Shock to Money Growth (DLM4)				
Percent of Forecast Error Variance Attributed to Each Variable				
Horizon	DLM4	DLRPI	DLNW	DLNEX
1	.79842	.21126	.17083	.35514
6	.59414	.31536	.29746	.53537
12	.49495	.36718	.36219	.62218
18	.45051	.39090	.39096	.66211
24	.42540	.40429	.40720	.68467
Panel B: One Standard Deviation Shock to Inflation (DLRPI)				
Percent of Forecast Error Variance Attributed to Each Variable				
Horizon	DLM4	DLRPI	DLNW	DLNEX
1	.27496	.81546	.25972	.77285
6	.26863	.60289	.38706	.80652
12	.27381	.56082	.42685	.81117
18	.27459	.54309	.44427	.81269
24	.27501	.53356	.45364	.81351
Panel C: One Standard Deviation Shock to Wage Growth (DLNW)				
Percent of Forecast Error Variance Attributed to Each Variable				
Horizon	DLM4	DLRPI	DLNW	DLNEX
1	.05500	.16130	.94526	.19350
6	.11837	.28809	.73913	.46412
12	.16909	.34973	.66441	.57545
18	.19134	.37719	.63124	.62527
24	.20386	.39266	.61255	.65333
Panel D: One Standard Deviation Shock to Currency Depreciation (DLNEX)				
Percent of Forecast Error Variance Attributed to Each Variable				
Horizon	DLM4	DLRPI	DLNW	DLNEX
1	.22730	.56121	.24539	.92881
6	.27814	.53076	.33098	.90091
12	.27888	.51573	.38631	.87395
18	.27851	.50887	.41102	.86207
24	.27832	.50505	.42476	.85546

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