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Currency Crash and Exchange Rate Pass-Through

A Tale of Two Crises in Serbia

ABSTRACT: *This paper demonstrates that the two completely different inflation outcomes of the currency crises in Serbia in the 1980s and in 2008–9, namely high and low inflation, respectively, can be explained by two distinct economic policy stances that can be traced back to different institutional environments. Large second-round effects of currency depreciation on inflation are detected in the former but not the latter crisis, and the reported estimates suggest that these effects were propelled by monetary accommodation and wage indexation. A side result was that exchange rate pass-through into prices was moderate and slow in Serbia in the 2000s, remaining unchanged even in the currency crash of 2008–9. These findings are consistent with recent evidence for developing economies.*

Serbia, along with a number of other emerging markets, has experienced two large balance-of-payment crises that have led to currency crashes, albeit with starkly different inflation outcomes. The crisis of the 1980s, which Serbia (then part of the former Yugoslavia) "shared" with Latin American economies, triggered high inflation that in a number of countries, including Serbia, spilled over into hyperinflation. In contrast, the currency crash of 2008–9 left inflation low in most emerging economies, including Serbia.

This paper attempts to explain the two completely opposite effects that large currency depreciation has on inflation by exploring two currency crises in Serbia, one in the 1980s and the recent one in 2008–9. The conjecture we start from derives from

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an open economy model as advanced by Edwards (2006), which shows that wage indexation and/or an accommodative absorption policy can significantly enhance the initial pass-through from exchange rate depreciation to inflation. Thus different labor market configurations and policy responses might explain the contradictory impacts that currency depreciation has on inflation. Accordingly, we estimate both the initial and cumulative pass-throughs from the exchange rate to the price level while suggesting that the difference between them should capture second-round effects. Then we explore whether the size of these effects may be related to policy responses and the functioning of the labor market and, more generally, be traced to the different institutional setups.

Former Yugoslavia in the 1980s: Soft Budget Constraints and External Debt Crisis

Like a number of developing Latin American countries, Serbia (while still part of Yugoslavia) was hit by a foreign debt crisis in the early 1980s. This crisis, as well as the ensuing balance-of-payments crisis, triggered exchange rate depreciation and caused a full-scale currency crash.

Serbia's currency started to depreciate in the early 1980s, losing on average 50 percent nominally per year, and the loss accelerated, for example, to over 70 percent in one year through September 1983 (see Figure 1).[1] When the country was hit by a balance-of-payment crisis at the beginning of the 1980s, the real exchange rate depreciated almost 70 percent until 1984, then started to recover (see Figure 1).[2] This indicates that Serbia experienced a full-fledged currency crisis in the first half of the 1980s.

Triggered by large depreciation, inflation build-up started at the beginning of the 1980s, subsequently accelerated, and finally turned into short-lived hyperinflation in the last quarter of 1989 (see Figure 1). The inflation was briefly contained in 1990 by fixing a nominal exchange rate, albeit at the expense of sharp real appreciation (see Figure 1); nevertheless it started again in 1991. The latter coincided with the disintegration of Yugoslavia, which formally began in mid-1991. Average monthly inflation and currency depreciation were as high as 7 percent and money growth above 6 percent throughout this period, although they all varied considerably (see Figure 1).

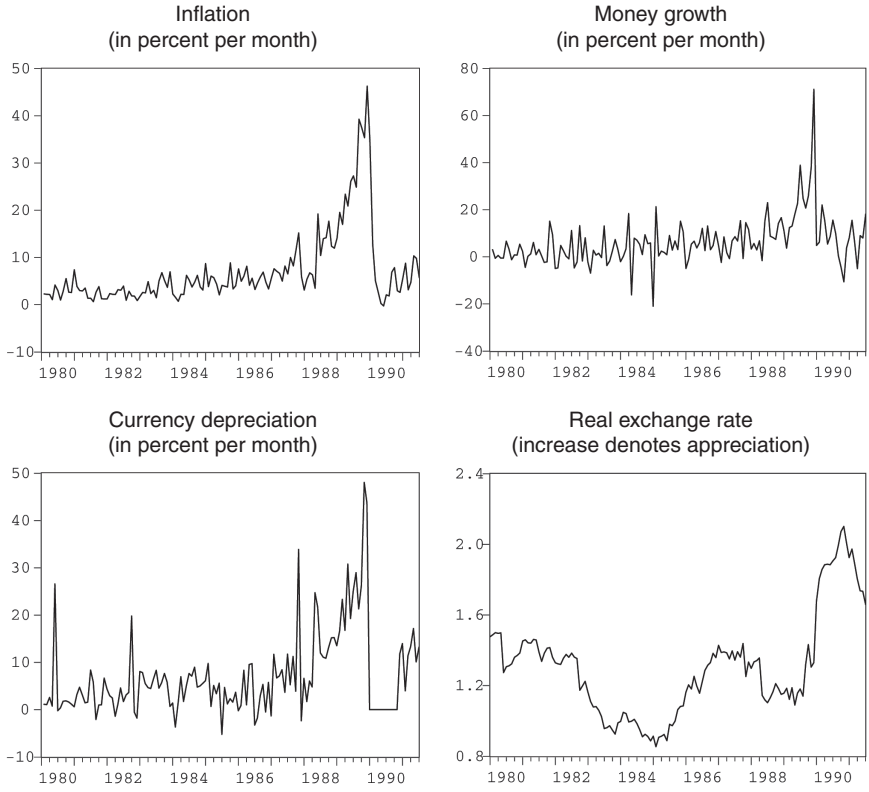
Against the background of Yugoslav inflation explained above, the following structural cointegrated system has been identified and estimated:[3]

$$p = 0.77w + 0.28e + u \tag{1}$$

$$m = 0.93w + u'. \tag{2}$$

The variables are logs of the retail price index (p), the wage rate (w), the exchange rate (e), and the money supply (m). The exchange rate (e) and the wage rate (w) turned out to be weakly exogenous in the first and second equations. Thus, a shock

Figure 1. **Evolution of Inflation, Money Growth, Currency Depreciation, and Real Exchange Rate in Yugoslavia** (January 1980–July 1991)



in the exchange rate triggered by a balance-of-payment crisis starts up a price-wage spiral (see Equation (1)), while the money supply (m) accommodates wage (w) increases (see Equation (2)).

The cointegration estimate of exchange rate pass-through to prices is 0.28, which is relatively low for a high-inflation episode such as the one we are looking at. However, the corresponding pass-through from wages to prices is quite high—0.77—pointing to strong interactions between wages and prices. In addition, since the wage rate is endogenous in Equation (1), the initial shock to the exchange rate triggers a wage change that feeds back into the price increase, thus leading to larger overall (equilibrium) pass-through. As the sum of the cointegrating coefficients on the wage rate (0.77) and exchange rate (0.28) is not significantly different from 1, the overall (equilibrium) pass-through might be complete, that is, equal to 1.[4] We now check this by estimating cumulative pass-through coefficients.

Cumulative pass-through is assessed using the exchange rate and price level impulse response functions in standard and structural vector autoregression (VAR) models. That is, the identified structural cointegrated systems (1) and (2) suggest similar contemporaneous, short-run relations between corresponding variables. Upon testing, the following two structural VAR models are not rejected by the data, where the estimated contemporaneous relations between corresponding variables read as follows:

$$\underset{(7.33)\quad(2.25)}{p = 0.22w + 0.09e} + u_1 \tag{3}$$

$$\underset{(1.40)}{w = 0.14e} + u_2 \tag{4}$$

$$\underset{(1.67)}{m = 0.15w} + u_3 \tag{5}$$

and

$$\underset{(2.75)}{p = 0.11e} + u_4 \tag{6}$$

$$\underset{(7.23)}{w = 1.23p} + u_5 \tag{7}$$

$$\underset{(1.67)}{m = 0.15w} + u_6, \tag{8}$$

where *t*-ratios are in parentheses (see Petrović and Mladenović 2000: 509–510).

Both specifications capture well the inflation dynamics of the 1980s and are consistent with the structural cointegrated system (1) and (2). Nevertheless, it seems that the second specification, besides being statistically superior, gives a better explanation of the inflation dynamics in the 1980s. Namely, it plausibly implies that an initial shock in the exchange rate passes through into prices, and subsequently wages are indexed to the latter. In addition, the estimated contemporaneous relations indicate that the short-run exchange rate pass-through is 0.09 and 0.11 over one month.

Estimates of cumulative pass-through, reported in Table 1, are the ratios of respective impulse responses (p_{t+j}/e_{t+j}) obtained using both estimated structural VAR models and ordinary ones.[5]

Pass-through estimates are almost identical across various VAR specifications, thus suggesting the robustness of the estimates. The short-run pass-through, over one month, of 0.14 is close to the corresponding estimates obtained above. The size of the pass-through increases rapidly over time, thus being 50 percent for three months and becoming almost complete, that is, equal to 1, over eighteen months. Thus the above conjecture that the small initial impact of the exchange rate on prices (0.28) is enhanced by the resulting increase in wages, leading to complete

Table 1. **Cumulative Pass-Through from Exchange Rate to Prices: Impulse Response (p_{t+j}/e_{t+j}), January 1980–July 1991**

Ordering	1 month	3 months	6 months	9 months	12 months	15 months	18 months	24 months
Structural VAR I	0.14	0.50	0.69	0.74	0.82	0.89	0.97	1.11
Structural VAR II	0.14	0.51	0.70	0.75	0.83	0.90	0.98	1.11
Cholesky *e*, *w*, *m*, *p*	0.14	0.52	0.69	0.72	0.80	0.87	0.96	1.15
Cholesky *e*, *p*, *w*, *m*	0.14	0.52	0.69	0.72	0.80	0.87	0.96	1.12

overall (equilibrium) pass-through, is borne out by the obtained estimates. These findings indicate the presence of considerable second-round effects.

Serbia in the 2000s: Pursuing Transition and Experiencing Currency Crisis in 2008–2009

Like other emerging European countries in the 2000s, Serbia received large inflows of foreign capital but on a relatively much higher scale, as shown by its huge current account deficit—above 15 percent of the gross domestic product (GDP).[6] The latter is comparable only to deficits in Bulgaria and the Baltic countries. Great capital inflows led to additional appreciation of domestic currency in Serbia but also in other emerging European countries.[7] After the outbreak of the world financial crisis in September 2008 and the consequent sudden stop of the capital inflows, the currency depreciated sharply against the euro in a number of emerging European countries. Thus in Serbia, the currency depreciated nominally 22.6 percent in the five months from October 2008 through February 2009. In the same period, the currency depreciated 11.2 percent in the Czech Republic, 20.4 percent in Hungary, 30.9 percent in Poland, 19.4 percent in Romania, 37.4 percent in Ukraine, and so forth. Nevertheless, sharp depreciation did not trigger inflation.[8] Since most of these economies also experienced a considerable loss in foreign currency reserves, these episodes qualify as currency crashes.

Currency crises are defined in floating regimes as substantial depreciation—for example, more than 15 percent (Reinhart and Rogoff 2008) or 25 percent (Frankel and Rose 1996) annually, while in the case of managed float it is defined as considerable depreciation combined with the loss of central bank foreign currency reserves (Calvo 2006; Kaminsky et al. 1998). Serbia suffered both a large currency depreciation of 22.6 percent and a loss of its foreign currency reserves equal to 13 percent, hence it underwent a full-blown currency crisis in 2008–9.

Against the backdrop described above, we examine the size and speed of exchange rate pass-through in Serbia in the 2000s. The relationship used for the 1980s (Equation (1)) is augmented by the price of oil in U.S. dollars (*p$oil*) since this price varied significantly throughout the 2000s, greatly affecting inflation in emerging economies. The other relationship (Equation (2)) is skipped as it broke down in the 2000s (see International Monetary Fund 2008: 83–128).

An assessment of the pass-through coefficient is obtained using cointegration analysis. The monthly sample employed starts in July 2001 to avoid the impact on the price level of the large administrative price adjustments and extensive tax reform that occurred in the first half of 2001. It ends in August 2009, thus encompassing the large currency depreciation triggered by the sudden stop in the last quarter of 2008. The results, obtained using the Johansen (1996) cointegration procedure, are given in Table 2.

The tests reported above show the presence of cointegration, giving the following estimate of a long-run price equation:

Table 2. **Cointegration Among the Price Level (*p*), Exchange Rate (*epe*), Wage Rate (*w*), and Price of Oil (*p$oil*), July 2001–August 2009**

Rank	$r = 0$	$r \leq 1$
Eigenvalue	0.532	0.069
Trace test	70.61	6.81
Cointegrated vector		
p_t	1	
epe_t	–0.235	
w_t	–0.324	
$p\$oil_t$	–0.114	
t (July 2008)	–0.01	
Constant	0.146	

Notes: $epe = e + pe$, i.e., the log of dinar/euro exchange rate (e) plus the log of foreign (EU) price level (pe). Cointegration analysis is performed within a partial VAR model such that wages and oil prices are treated as weakly exogenous variables. Weak exogeneity of these two variables is detected in the first step of the cointegration analysis when an ordinary VAR model is used. Cointegration space accounts for the break in the trend function such that it includes nonzero values $1, 2, ...$ from July 2008 onward. A constant term enters the VAR model unrestrictedly. There are three lags in the VAR model. The model contains eleven dummy variables. Seven of them take a nonzero value 1 for July 2002, December 2004, January 2005, July 2006, October–November 2006, October–November 2008, and May 2009, while four of them account for transitory blips, such that they take nonzero values 1/–1 for the following months: March–April 2007, January–April 2008, and values –1/1 for October–November 2007, and December 2008–January and February 2009. The 5 percent critical values for the trace test are simulated using CATS in RATS (Dennis 2006). Critical values are as follows: 32.21 ($r = 0$) and 16.53 ($r \leq 1$).

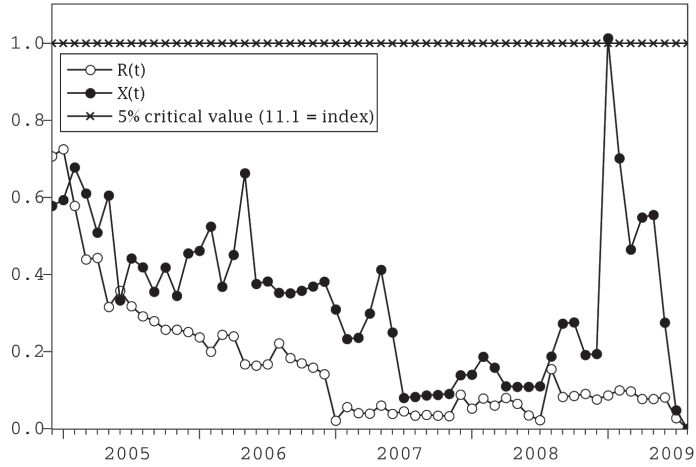
$$p = 0.24epe + 0.32w + 011p\$oil + 0.01t(2008.07) - 0.146 + u''. \quad (9)$$

Thus, the cointegrating price Equation (9) holds throughout the 2000s, including the currency crash of October 2008–February 2009, albeit with a trend variable (t) from July 2008 onward.

Moreover, a thorough inspection of the estimated relation in Equation (9) indicates that its coefficients are stable. The stability of cointegration parameters is assessed by two recursively computed tests: one that tests that the subsample of cointegration parameters are equal to the full sample cointegration parameters (see Figure 2), and the max test of constant cointegration parameters (see Figure 3) (see Hansen and Johansen 1999; Juselius 2006).

The values of both test statistics are divided by the respective 5 percent critical value; the obtained magnitudes, which are less than 1, suggest parameter stability. It follows that the null hypothesis implying the constancy of cointegration parameters throughout the whole sample cannot be rejected (Figures 2 and 3).

Figure 2. **Recursively Computed Test to Determine Whether Subsample Cointegration Parameters Are Equal to the Full-Sample Cointegration Parameters**



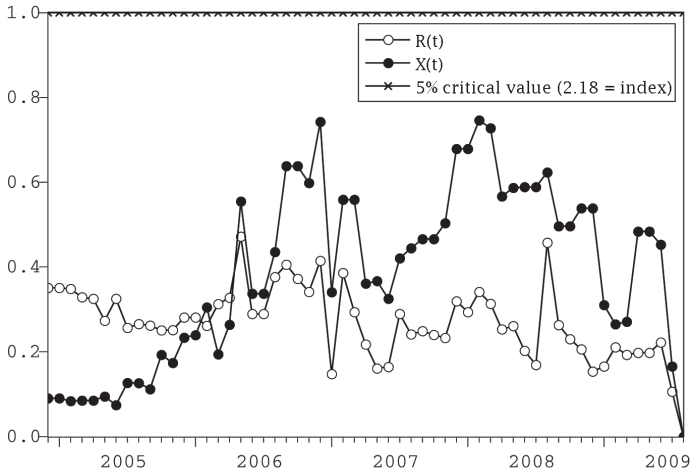
Notes: X stands for the model with the original variables, while R denotes results based on variables corrected for short-term dynamics and interventions (see Juselius 2006). The 5 percent critical value is associated with χ^2_5 distribution.

Thus the cointegration estimate of exchange rate pass-through to domestic prices turns out to be low in Serbia in the 2000s: 0.24. In addition, the estimated pass-through coefficient, as demonstrated in Figures 2 and 3 and particularly in Figure 4, remains stable in Serbia even in a period of sharp currency depreciation (October 2008–February 2009). Namely, estimates of the pass-through coefficient presented in Figure 4 indicate that its value does not change for the sample that excludes the crisis period (i.e., through summer 2008) or the sample that includes it (i.e., through summer 2009).

In addition to spilling over directly into the price level, exchange rate depreciation can trigger second-round effects, thus increasing its impact on domestic prices. This cumulative pass-through of exchange rate into prices can be captured by their respective impulse response functions obtained from the estimated VAR model containing variables entering the cointegrating relation above. Results are reported in Table 3.

Estimates of cumulative pass-through in the 2000s show that it is modest, slow, and incomplete. Thus, within a year less than 30 percent of depreciation had been passed through to price increases, and pass-through reached 60 percent only after four years. Moreover, estimates of cumulative pass-through are not that different from the long-run estimate obtained within the cointegration framework (0.24):

Figure 3. **Recursively Computed Max Test of Constant Cointegration Parameters**



Notes: X stands for the model with the original variables, while R denotes results based on variables corrected for short-term dynamics and interventions (see Juselius 2006). The 5 percent critical value is provided by simulation as in Dennis (2006), since this test statistic has a nonstandard distribution.

Figure 4. **Recursive Estimation of the Exchange Rate Pass-Through Coefficient**

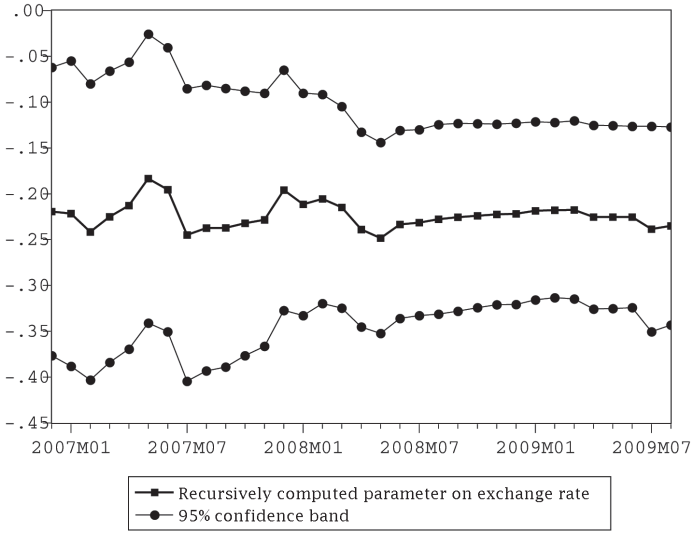


Table 3. **Cumulative Pass-Through from Exchange Rate to Prices: Impulse Response (p_{t+j}/e_{t+j}), July 2001–August 2009**

Ordering	3 months	6 months	12 months	18 months	24 months	36 months	48 months
p$oil, w, epe, p	0.1	0.2	0.28	0.34	0.39	0.49	0.59
p$oil, w, p, epe	0.05	0.16	0.26	0.33	0.39	0.5	0.6

Notes: Estimates are derived from a VAR model of order 4 that contains five impulse dummy variables that take only the nonzero value 1 for July 2002, April 2003, January 2005, July 2006, and October–November 2008, and seasonal dummy variables for December and January. In addition, another dummy is included that takes the values of –1 for December 2008, 1 for January–February 2009, and 0 otherwise.

at a one-year horizon they are very close: 0.28 versus 0.24, and they still do not deviate strongly after two years. These comparisons of respective pass-through estimates suggest that the impact of second-round effects was not strong in Serbia in the 2000s.

Assessing the Role of Wage Indexation and Monetary Accommodation in the Two Currency Crises

A comparison of the size of the exchange rate pass-through obtained in the two currency crises that Serbia has experienced shows that while the cointegration estimates are almost equal in both episodes, the cumulative estimates diverge sharply (see Table 4). As to the latter, the results show that in the 2000s, the cumulative impact of depreciation is slow and incomplete, which is quite the opposite of the swift and complete cumulative pass-through in the 1980s. This suggests that second-round effects were small in the former episode and highly pronounced in the latter.

The large discrepancy between the cointegration and cumulative pass-through estimates in the 1980s could be due to wage behavior and monetary policy that triggered sizable second-round effects. Specifically, an open economy model (e.g., Edwards 2006) shows that if currency depreciation sets off a rise in wages and/or an accommodative absorption policy, prices of nontradables will increase and therefore the total pass-through from the exchange rate to domestic prices will go up (Edwards 2006: 5–6). We explore whether this is the case in the 1980s episode by assessing the degree to which wages and the money supply accommodate exchange rate depreciation. If exchange rate depreciation has a heavy impact on wages and money supply, the result would be pronounced wage indexation and monetary accommodation leading to large second-round effects.

Table 4. **Exchange Rate Pass-Through in Two Currency Crises**

	Cointegration estimates	Cumulative impulse response	
		3 months	18 months
1980s	0.28	0.5	1
2000s	0.24	0.1	0.34

Technically, the cumulative exchange rate pass-through to wages and the money supply over different time horizons are calculated from the very same VAR models already used for determining pass-through to the price level (Table 1). The results are reported in Tables 5 and 6.

The results obtained are almost uniform across various VAR specifications and orderings, showing that wages and the money supply react strongly to exchange rate depreciation. Thus, exchange rate pass-through to wages is almost the same as to prices, and the impact on the money supply is only somewhat lower (see Tables 5 and 6). All this indicates the presence of widespread wage indexation and monetary accommodation in the 1980s.

In the 2000s, second-round effects sharply decreased as the cumulative pass-through was close to the cointegration pass-through (see Table 4). The latter indicates that accommodative policy has been significantly reduced.

In support of the foregoing, we found that in the 2000s, the cumulative impact of the exchange rate on wages is just 10 percent over one year and 33 percent over two years (see Table 7). Moreover, estimates suggest that an exchange rate shock does not spill over completely to wages even after four years. These results hold, notwithstanding significant, rapid depreciation during the currency crash of 2008–9. The low wage accommodation in the 2000s greatly contrasts with corresponding wage adjustments in the 1980s: 80 percent in one year; and complete (104 percent) spillover over two years (see Table 5).

Two Currency Crises: Institutional and Policy Background

The econometric evidence presented above supports our conjecture that wage indexation and monetary accommodation can account for the starkly different inflation outcomes in the aftermath of the two currency crises considered. We now examine whether monetary and wage setting regimes and, more broadly, the policy and institutional backdrop of the two episodes, can explain the differing money supply and wage responses to currency crashes.

The institutional setups in Serbia during the 1980s (as part of Yugoslavia) and the 2000s differed widely.[9] With its labor-managed market economy, Yugoslavia in the 1980s can be regarded as a country in early transition.[10] Serbia in the 2000s

Table 5. **Pass-Through from the Exchange Rate to Wages: Impulse Response (w_{t+j}/e_{t+j}), January 1980–July 1991**

Ordering	1 month	3 months	6 months	9 months	12 months	15 months	18 months	24 months
Structural VAR I	0.15	0.44	0.56	0.68	0.80	0.87	0.94	1.04
Structural VAR II	0.17	0.46	0.57	0.69	0.80	0.87	0.94	1.04
Cholesky *e*, *w*, *m*, *p*	0.15	0.43	0.54	0.66	0.78	0.86	0.93	1.04
Cholesky *e*, *p*, *w*, *m*	0.15	0.43	0.54	0.66	0.78	0.86	0.93	1.04

Table 6. **Pass-Through from the Exchange Rate to the Money Supply: Impulse Response (m_{t+j}/e_{t+j}), January 1980–July 1991**

Ordering	1 month	3 months	6 months	9 months	12 months	15 months	18 months	24 months
Structural VAR I	0.03	0.34	0.44	0.52	0.58	0.69	0.79	1.01
Structural VAR II	0.04	0.35	0.46	0.54	0.59	0.7	0.7	1
Cholesky *e*, *w*, *m*, *p*	0.19	0.37	0.46	0.5	0.55	0.66	0.77	1.01
Cholesky *e*, *p*, *w*, *m*	0.19	0.37	0.46	0.5	0.55	0.66	0.77	1.01

had undertaken extensive structural reforms that instituted a full-fledged market economy.

The main features of the Yugoslav labor-managed system that were relevant to its monetary and wage setting regimes in the 1980s were the socialization of losses instead of risk-bearing by individual firms, an inefficient and unusually rigid labor market (see Estrin 1991; Estrin and Uvalic 2008), and the endogeneity of the money supply, which basically validated firms' wage, price, and investment decisions (see Tyson 1980). Thus when the balance-of-payment crisis hit Yugoslavia at the beginning of the 1980s, the consequent sharp, swift depreciation led to inflation. Since the labor market was unable to contain the wage rise on its own and firms were not yet financially accountable, there was room for a wage-price spiral. Domestic banks were forced to validate this wage indexation and support firms that would otherwise go bankrupt, thus causing large unemployment and social unrest.[11] However, since the sudden stop had dried up the inflow of foreign loans previously used to support the economy, banks had to resort to central bank credits to socialize the losses of the enterprise sector in order to prevent widespread bankruptcy.[12] Faced with a crisis that lasted the whole decade, the government did not opt for structural reforms to address it but, rather, to keep the system going while monetizing its losses (i.e., running a quasi-fiscal deficit) with an ever-increasing money supply. Consequently, a dependent central bank responded positively to domestic banking sector demands for additional loans, thus increasing the money supply to accommodate the wage-price spiral and finance the enterprise sector's quasi-fiscal deficit.[13] Obviously, all this led to high, persistent inflation that lasted for all of the 1980s (see Petrović and Mladenović 2000).

Therefore, the aforementioned stylized facts on institutions, policies, and the related monetary and wage-setting regimes of the 1980s support our econometric evidence that suggests the presence of monetary accommodation and wage indexation (see above). Moreover, the policy response to and dynamics of the crisis of the 1980s outlined above concur with econometric evidence indicating a large, swift exchange rate pass-through to wages and the money supply (see above).

As a latecomer, Serbia commenced comprehensive economic reforms at the beginning of the 2000s, which included macroeconomic stabilization, trade and price liberalization, privatization, bank restructuring, and fiscal and labor market reforms. After almost a decade of abundant inflow of capital in the 2000s, Serbia again experienced a sudden stop and consequent currency crash in 2008–9. However, due to the changed institutional setup, the impact of this crisis sharply differs from the one in the 1980s.

Wage indexation was muted during the 2008–9 crisis since the strong, swift currency depreciation (see discussion above) did not set off an increase in wages: nominal depreciation of 22.6 percent in five months (October 2008 to February 2009) was followed by a moderate increase in the average nominal wage of only 3.5 percent throughout 2009.[14] This is consistent with the econometric evidence for the whole 2001–9 sample (see Table 7), which indicates a small pass-through from

Table 7. **Pass-Through from the Exchange Rate to Wages: Impulse Response (w_{t+j}/epe_{t+j}), July 2001–August 2009**

	3 months	6 months	9 months	12 months	18 months	24 months	36 months	48 months
p$oil, w, epe, p	–0.19	–0.01	0.04	0.10	0.23	0.35	0.56	0.75
p$oil, w, p, epe	–0.19	–0.01	0.04	0.09	0.21	0.33	0.56	0.76
p$oil, epe, w, p	–0.29	–0.08	–0.03	0.03	0.16	0.27	0.48	0.67

Notes: Estimates are derived from a VAR model of order 4 that contains five impulse dummy variables (that take only the nonzero value of 1 for July 2002, April 2003, January 2005, July 2006, and October–November 2008) and seasonal dummy variables for December and January. Another dummy is also included that takes the values of –1 for December 2008, 1 for January–February 2009, and 0 otherwise.

the exchange rate to the wage rate. Increased financial accountability and a relatively flexible labor market precluded the emergence of a wage-price spiral in the private sector. This sector adjusted to the balance-of-payment crisis mainly by increasing unemployment and partly by containing the wage rise: The unemployment rate had risen from 14 percent in April 2008 to 20.1 percent in April 2010, while the average wage in the private sector increased 6.5 percent nominally over 2009.[15] On the contrary, due to the absence of an effective (flexible) labor market, the main adjustment in the public sector was a drop in real wages (and pensions) as the government froze nominal wages and pensions in the wake of the crisis. This impeded wage (and pension) indexation, demonstrating even further the sharp turnaround in the government policy stance compared to that of the 1980s.

The monetary response to the 2008–9 crisis, contrary to that of the 1980s, was not accommodative. Broad money (M2) abruptly reversed its trend in 2008–9 by sharply decreasing nominal growth below its precrisis level, from approximately 40 percent per year to 15 percent. This severe slowdown in M2 growth was mainly due to a rapid halt in bank lending in 2009, itself caused by a sudden stop in foreign capital inflow, and some withdrawal of domestic deposits from the banks. The banks' response was mitigated by regional coordination through the so-called Vienna initiative, which prevented outflow of capital. The National Bank of Serbia responded to sharp currency depreciation by swiftly increasing its policy interest rate by two percentage points (to 17.75 percent) in November 2008 and by keeping it very high through March 2009 (16.50 percent), that is, until the exchange rate had stabilized. Accordingly, both the central bank and the banking system in Serbia reacted to the crisis in 2008–9 with monetary contraction. Again this stands in sharp contrast to the monetary policy and banking sector reaction to the crisis in the 1980s.

The findings above for the crisis period support econometric estimates for the 2000s, which are mainly based on a precrisis sample (see the discussion above and Table 7). Thus, as the discussion suggests, the moderate and slow pass-through from the exchange rate to wages of the 2000s (Table 7) held during the 2008–9 crisis. This is also confirmed by a crude estimate of the corresponding coefficient for pass-through to wages obtained as the ratio of the wage increase in 2009 to the currency depreciation during the currency crash (22.6). The estimate for the whole economy is $3.5/22.6 = 0.15$, while for the private sector it is $6.5/22.6 = 0.29$, both of which are broadly in line with the coefficients reported in Table 7 for the period from 12 to 18 months.

Moreover, the cointegration estimate of exchange rate pass-through into price level (0.24), which is also dominantly based on the precrisis sample (see Table 2), is likewise vindicated by developments during the 2008–9 crisis. The stability analysis (see Figures 2–4) thus suggests that pass-through coefficients, as well as the whole price (cointegration) relation, have not exhibited a structural break during the crisis period. This is consistent with the discussion above showing that significant depreciation (22.6 percent) has not sparked high inflation (only 6.6

percent over 2009). Thus a crude estimate of the pass-through coefficient after the currency crash for 2009 is 6.6/22.6 = 0.29, which is very close to the cointegration estimate of 0.24 as well as to cumulative estimates over one year: 0.28 and 0.26 (see Table 3).

Conclusions

This paper demonstrates that the two completely different inflation outcomes of the currency crises in Serbia in the 1980s and in 2008–9, namely high and low inflation, respectively, can be explained by two distinct economic policy stances that can be traced back to different institutional environments. Specifically, it has been found that differences in policy responses and the functioning of the labor market can explain the two contradictory inflation outcomes. Namely, the second-round effects of currency depreciation on inflation in Serbia are found to be significant in the aftermath of the crash in the 1980s, while they are practically nonexistent in the recent episode. Thus, while the cointegration estimates of the coefficient of pass-through from the exchange rate to the price level are similar in both episodes, the cumulative estimate, which captures second-round effects, is much higher for the 1980s episode. It has been shown that these strong second-round effects come from the large, swift pass-through of currency depreciation to money growth and wage increases, as demonstrated by the estimates of the corresponding cumulative pass-through coefficients. Accordingly, the findings indicate the presence of an accommodative monetary policy and wage indexation in the Serbian currency crash in the 1980s and their absence in the aftermath of the 2008–9 crash. These results are consistent with the predictions of an open economic model (see Edwards 2006).

These findings are also consistent with those for a set of emerging European economies, namely, the Czech Republic, Hungary, Poland, and Slovenia, where the link between the size of the exchange rate pass-through and the nature of macroeconomic policy has also been discovered (Brezigar-Masten and Masten 2009; Coricelli et al. 2006). For example, it has been shown that Hungary and Slovenia, while pursuing accommodative monetary policy targeting the real exchange rate, exhibit complete exchange rate pass-through, whereas the Czech Republic has a nonaccommodative monetary policy and consequent low pass-through (Poland is somewhere in between).

The complementary finding of this paper that the magnitude of pass-through decreases with inflation in Serbia over time (i.e., the 2000s versus the 1980s) agrees with cross-country results obtained for a set of new EU member states indicating a positive relationship between the degree of exchange rate pass-through and inflation (Maria-Dolores 2009). Thus, Taylor's (2000) hypothesis also has been vindicated for other emerging economies where the observed decline in pass-through (Choudhri and Hakura 2006; Frankel et al. 2005) has been related to a decrease in long-run inflation (Bank for International Settlements 2002).

Notes

1. Note that variables in Figure 1 are given at a monthly frequency.

2. The last panel of Figure 1 depicts logarithm of real exchange rate, hence the difference between the two approximate values at the beginning of 1982 and the end of 1984 gives: 1.5 – 0.8 = 0.7, that is, 70 percent real depreciation.

3. See Johansen (1996) and Juselius (2006); see also Petrović and Mladenović (2000: 504, table 4).

4. The hypothesis is confirmed: $\chi^2(1) = 0.24(0.62)$ in the cointegration subsystem of three variables (prices, wages, and exchange rate), with the exchange rate being weakly exogenous. This implies that the exchange rate changes feed fully into wages, which we found to be the case (see Table 5). We thank an anonymous referee for stressing the relevance of the coefficient on the wage rate for determining overall exchange rate pass-through.

5. Thus the pass-through over j months is calculated as p_{t+j}/e_{t+j}, where p_{t+j} and e_{t+j} are the impulse responses of the price level and the exchange rate, respectively, to the initial exchange rate shock.

6. Large capital inflows in emerging Europe are documented and analyzed in Abiad et al. (2009), Berglof et al. (2009), and Bruegel (2010). See Foundation for the Advancement in Economics (FREN) (2007–11).

7. However, Slovenia and Hungary tried to prevent currency appreciation by implicitly targeting the real exchange rate, which led to accommodative monetary policy. See Brezigar-Masten and Masten 2009; Coricelli et al. 2006.

8. It might be that currency depreciation spills over into inflation only above a certain threshold value. Evidence for Croatia (Tica and Posedel 2009) lends some support to this conjecture: a point estimate of threshold monthly depreciation is found to be 5.91 percent, albeit with a high, 95 percent confidence interval running from 2.7 percent to 21.8 percent. Average monthly depreciation in the episodes above are somewhat below the 5.91 percent threshold value (except in Poland).

9. For a recent review of the Yugoslav system and the related labor-management theory see Estrin and Uvalic (2008). See also Estrin (1991).

10. Thus in hindsight, Bergson's early perception that "market socialism has been materializing . . . as successor not to capitalism but to central planning under socialism" (1967: 571) proves to be correct.

11. Interestingly, a similar pattern emerged early in Russia's transition: after the 1987 enterprise reform, wages rose sharply and firms started to rely more heavily on direct central bank credits (see Sachs 1995). In addition, a correlation was found between wage growth and lagged credit growth to the enterprise sector in Russia (see Wolf 1993), supporting the aforementioned stylized facts.

12. Large inflows of capital in the 1970s are shown by the very strong increase in Yugoslavia's external debt: from USD 2 billion in 1970 to USD 18 billion in 1980 (Estrin and Uvalic 2008: 667).

13. Hence the endogeneity of the money supply that Tyson (1980) detected even before the crisis of the 1980s.

14. Data sources for this discussion are: Statistical Office of the Republic of Serbia (http://webrzs.stat.gov.rs), National Bank of Serbia (www.nbs.rs), and FREN (2008–9; www.fren.org.rs/qm/).

15. The Labor Force Survey (http://webrzs.stat.gov.rs/WebSite/Public/PageView.aspx?pKey=27/) is conducted twice a year, in April and October.

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