Empirical analysis of monetary policy: Croatia vs. Slovenia

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EMPIRICAL ANALYSIS OF MONETARY POLICY: CROATIA VS. SLOVENIA

Empirična analiza denarne politike na Hrvaškem in v Sloveniji

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1 Introduction

When Yugoslavia fell apart, what was once a big closed economy became five small open economies. Once the military operations and initial instances of hyperinflation stopped (hyperinflation in Croatia ended in 1994), the succeeding countries started to build their own economies.[1]

The process of transformation from a closed socialist system to an open economy was complex and challenging. Even fifteen years after the fall of communism, some ex-Yugoslavian republics, such as Bosnia or Serbia and Montenegro, have not made much headway in the transition process. Others, like Slovenia, are economically closer to western European countries than to other transition countries. The explanation of these differences presents a challenging task for any economics research paper.

This paper does not look at all of the aspects of the transition process; it only looks at the results of the monetary policies implemented. In effect, the paper is empirically evaluating two different monetary policies implemented, one in Croatia and the other in Slovenia, with a special focus on exports.

But before we look at the specific history, we should look at the big picture. The main economic problems for the newly formed countries can be formulated in the following way:

a) How to transition from the socialist fiscal policy (the government owns everything) to the capitalist fiscal policies of limited (if any) government involvement? This process had to be done, at least in theory, with the minimum of social cost and maximum social benefit.
b) How to formulate a monetary policy and set up a central monetary authority with clearly defined objectives and methods? The main problem with the set-up of the monetary policy was the choice of the optimal monetary policy tool.

This paper does not look into the fiscal policy, privatization, or any other kind of development of the capitalistic free market economies that countries of ex-Yugoslavia have undertaken. Instead, this paper takes a look at two opposing monetary regimes (Slovenia and Croatia) and tries to create, on an empirical level, a study of the real effects of the monetary policy choices.

The fundamental question about monetary policy is the issue of inflation, more specifically the control of inflation. In small open economies with free fluctuation of capital, the control of inflation translates into the control of expectations, as presented in Sargent (1992).

The newly founded countries lived under closed socialistic systems with fixed exchange rates (or exchange rates strictly determined by the National Bank of Yugoslavia). Due to the high inflation in the 1980s and the general instability of the dinar, most people in ex-Yugoslavia preferred to keep their income and savings

[1] The whole process of transition and monetary adjustment is still not over in all countries of ex-Yugoslavia.

Abstract

UDC: 336.74:338.26(497.5:497.4)

This paper tries to explain empirical causation between exports and the real exchange rate. The paper develops a simple model based on the relationship of exports to real interest rate differential, foreign demand for domestic goods, and real exchange rate. The paper then tests the model with empirical data from Croatia and Slovenia. The empirical analysis in the paper finds that there is a very limited relationship between real interest rate differentials, foreign demand and exports. However, there is a strong relationship between exports and the real exchange rate. When empirically tested, the model confirms that the monetary policy of sliding exchange rate in Slovenia was vastly superior to the monetary policy of fixed exchange rate in Croatia.

Key words: real exchange rate, monetary policy, exports

Izvleček

UDK: 336.74:338.26(497.5:497.4)

Članek poskuša pojasniti vzročno odvisnost med izvozom in realnim deviznim tečajem. V članku avtor razvije enostaven ekonomski model, ki temelji na odnosu med izvozom in razliko v obrestnih merah, povpraševanjem iz tujine po domačem blagu in realnim deviznim tečajem. Model je empirično preverjen za Slovenijo in Hrvaško. Empirična analiza kaže, da je odvisnost med razlikami v realnih obrestnih merah, tujim povpraševanjem in izvozom, če sploh obstaja, zelo šibka. Hkrati pa obstaja močna odvisnost med izvozom in realnim deviznim tečajem. Ključna ugotovitev je, da je bila slovenska politika drsečega deviznega tečaja bistveno uspešnejša od politike trdnega deviznega tečaja na Hrvaškem.

Ključne besede: realni tečaj, denarna politika, izvoz

JEL: F41, E42, O24

in foreign currency, mostly Deutsch marks. Unlike other ex-socialist countries which had very limited access to hard currency, Yugoslavia was a special case. There was a constant inflow of hard currency from tourism and from Yugoslavs who worked in Western Europe.

When Yugoslavia fell apart, the main question for both the government and the people was: what to do with the exchange rate?

Soon two opposing schools developed. One school of thought considered it the best to keep the exchange rate fixed. The main argument was that through a stable or fixed exchange rate, the central bank would have an easy mechanism for control of the quantity of money in the economy and, as such, inflation would be contained. In addition, perceptions and expectations of a stable exchange rate would create an expectation of a stable currency with low inflation. This argument was very important in Croatia, where after the war there was a period of hyperinflation, as described in Rohatinski et al (1995).

The second school wanted to constantly depreciate the exchange rate, or implement a "sliding" exchange rate. It was believed that such policies of constant depreciation would weaken the national currency and stimulate exports, an important part of GDP. For a small open economy, a (real) depreciation and growth of exports can be a considerable source of economic growth. From a mathematical stand point, this policy can also be explained as the dynamic programming problem of the real exchange rate as presented in Vidaković (2005b).

In essence, a constant real exchange rate depreciation policy was a mercantile "beggar thy neighbor" type policy, but with one major advantage: there was no concern about counterparty depreciation or a trade war. The countries of the EU, where most of Croatian and Slovenian exports went, would never just depreciate their currencies as a response to Croatian or Slovenian monetary policy, especially with the Maastricht Treaty and the process of building a currency union. On the other hand, the WTO prevents any tariff and customs impositions, but does not stipulate anything about monetary policy.

So from a game theory point of view, it was possible to implement either monetary policy. It was a unique period in time, when two countries had to decide which path to take. The choice was between a path of stability and security (fixed exchange rate); or a path of uncertainty, but with a possible large payoff.[2] Many of these dilemmas were presented in Ribnikar (1999).

The main problem with the exchange rate for both schools was the determination of the transmission of the exchange rate into inflation, meaning: will there be some real depreciation? And is depreciation going to translate into the inflation one-for–one, or will there be an overshooting effect? If overshooting was the case, then the argument for the sliding exchange rate would be void. But today we have an opportunity to empirically see the results of two different policies.

This paper looks at a natural experiment which has occurred in real life. The two "test subjects" are Slovenia and Croatia, two similar countries which have taken two different paths. The most interesting aspect of this paper is not a development of a model in order to artificially test the model's assumptions. Rather, the most interesting aspect of this paper is the explanation of the results of monetary policies in the last 10 years.

One policy was applied in Slovenia, a sliding exchange rate. It was based on a simple rule: depreciate the exchange rate at the same rate as inflation or higher. The exchange rate was depreciated slowly over time. In essence, it was vector targeting of the real exchange rate, as we shall see later. The path of the vector was set in order to achieve two goals:

a) Depreciate the real exchange rate and thus constantly make Slovenian products more competitive in the world market.
b) Prevent large capital inflows in Slovenia and thus decrease foreign debt.

The Croatian strategy was different. After the war in Croatia, there was a period of hyperinflation. At one point, inflation was at 30% per month. Then in 1994 came the stabilization program that ended inflation. In order to keep inflation under control, the HNB (Hrvatska Narodna Banka, Croatian National Bank) decided to keep the exchange rate approximately the same. HNB stated that its purpose was to keep the oscillation of the exchange rate to a minimum, reacting to shocks to the exchange rate. This in effect made the kuna exchange rate a mean reverting series, with oscillations up to 3% from the mean. So the only goal of the monetary policy was the stability of the exchange rate. Monetary policy did not concern itself with exports, imports, foreign debt or any other economic variables, just the stability of the exchange rate.

The model in this paper is based on a simple dynamic programming optimization of export function in a small open economy. Special attention is devoted to the analysis of the real exchange rate and the impact of the real exchange rate on exports. The model is tested empirically, comparing the results of the two monetary policies.

The paper is organized as follows: part two develops the model, part three compares the model and the empirical data with some interesting results, and part four concludes.

2 The model

When the central banks of Slovenia and Croatia were determining their respective policies regarding the exchange rate, the literature on the real exchange rate and open economies was relatively small. Up to that time, the most important research done on open economies was Robert

[2] In essence, we have an Elsberg paradox as presented in Sargent and Hansen (2000) as a choice between known and unknown distribution.

Mundell's (1968) seminal work, and research done by Rudy Dornbush (1988). Furthermore, some computational economics techniques (forward looking rational expectations models[3]) had not been developed at that point in time, and computer power was low.

Today the state of economic theory regarding open economies is unrecognizable from the state of economic theory fifteen years ago. In the last fifteen years, there have been many successful attempts in the creation of a working small open economy model, most notably the efforts of Gali et al (2005), Ball (1999), and Rogoff and Obstfeld (2000, 2002). There have also been huge advances in the development of computational techniques as presented in the works of Ljungqvist and Sargent (2004) and Hansen and Sargent (2006).

After the Asian, Mexican, Russian and Argentinean currency crises, it became apparent that economics as a science does not fully understand the workings of the mechanisms involving the real exchange rate and the transition from fixed exchange rate to flexible exchange rate. Recently the research of Aizenman and Glick (2005) studies the behavior of fixed exchange rates and the transition from a fixed exchange rate to a flexible exchange rate. Aizenman and Glick analyzed the cost of a switch from a fixed regime exchange to a flexible regime exchange rate and came to a stunning conclusion. Out of the 63 instances of currency regime switch, 32 were considered disorderly. However, the duration of the regime plays a considerable role. There were 20 cases where a fixed exchange regime was longer then 200 months. Out of the 20 instances of regime switching, 16 had a negative rate of growth and a fall in real output once the move to the flexible exchange regime was made, 4 had a positive rate of real output, and one instance was neutral. These results offer a powerful empirical argument against a fixed exchange rate regime,[4] especially in the long run. The conclusion of Aizenman and Glick's paper can be summed up as follows: the longer the fixed exchange rate regime, the larger is the cost of switching to the flexible regime.

There are several models that try to portray the behavior of a small open economy. One has been presented in Ball (1999), and many have been presented in the works of Obstfeld and Rogoff. In this paper we will work with a modification of the Mundell-Fleming model explained in Vidakovic (2005a). This paper is in effect the continuation of the theoretical base made in Vidakovic (2005a and 2005b). The main model can be shown as follows:

$$y = c + s + g + (ex - im) \quad (1)$$

$$e = c + I + g + (f - d) \quad (2)$$

$$c = c°(-r,y) + A + c(y,- r, -E/P, W/P);\ A = z + \phi(y, E/P) \quad (3)$$

$$I = i(-r)° + i(CM) - iA*(CM, E/P) = i° + p \quad (4)$$

$$im = c(y) + im° \pm \zeta(CM, E/P) = im° + m \quad (5)$$

$$ex = ex°(E/P) + A*(y*) \pm \zeta\ (CM, E/P) = ex° + x \quad (6)$$

$$g = g° \quad (7)$$

y – GDP
y* – GDP of the rest of the world
e – expenditures
c – consumption
s – savings
g – government expenditures
ex – exports
im – imports
I – investments
r – real interest rates
f – Croatian investment in the rest of the world
d – foreign investment in Croatia
c° – autonomous consumption
A – Croatian demand for imports
W – wages
P – price level
CM – world interest rates
g° – autonomous government expenditures
i° – autonomous investments
ex° – autonomous exports
im° – autonomous imports
A* – foreign demand for Croatian imports

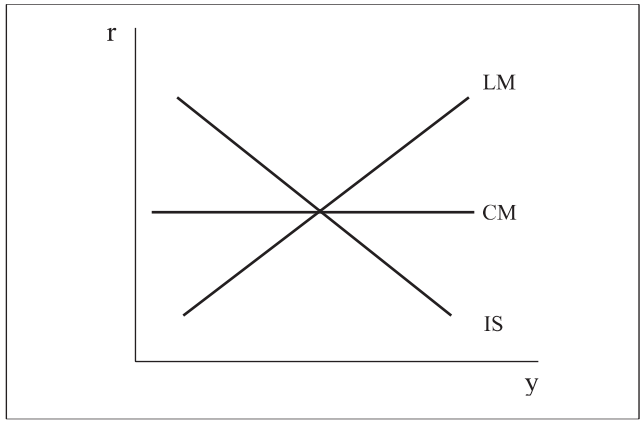
From the above equations, we can get the IS curve for a small open economy:

$$y = c°(-r,y) + c(y,-r, -E/P, W/P) + i°(-r) + g° + \\ + im° + ex° + [A + p + m + x] \quad (8)$$

For the LM curve, we will use a standard Keynesian LM function:

$$r = \frac{hy - x - l\pi}{l} \quad (9)$$

Once we graph the two equations, we will get a static Keynesian small open economy model:



This model, in effect, is the Mundell-Fleming version of the IS-LM closed economy model. It is a standard Keynesian *static* macroeconomic model. It is assumed that the labor market clears and that all changes are instantaneous. The

[3] Here the author is mostly considering the rational expectations model presented in Sargent and Hansen (2006)

[4] Naturally this argument does not hold if a country has a fixed exchange rate in order to enter a currency union.

expectations do not enter into the model and time variant processes do not play any role, so there are no lag operators.

Obviously this kind of model is not an appropriate or modern tool in today's economic theory. Today we have mathematical tools to develop more dynamic models, so we shall work with an updated version of the model.

The theoretical background from Vidaković (2005b) tries to create an optimization of the export function. The basis for this optimization is the mathematics of dynamic programming. The central focus of Vidaković (2005b) is on the functions:

$$\text{im} = \text{c(y)} + \text{im}^{\circ} \pm \zeta(\text{CM, E/P}) = \text{im}^{\circ} + \text{m} \quad (10)$$

$$\text{ex} = \text{ex}^{\circ}(\text{E/P}) + \text{A}^{*}(\text{y}^{*}) \pm \zeta(\text{CM, E/P}) = \text{ex}^{\circ} + \text{x} \quad (11)$$

These two functions represent the static functions for exports and imports in a small open economy. Previous work has theoretically transformed these functions from static to dynamic forms. This transformation has ushered in a model able to give optimal dynamic account of the export function for a small open economy.

2.1 Dynamic model of exports.

In order to develop the model, we will have to make some assumptions about the model. The first assumption will be that there are n households in economy. Although the number of households is large, there is one representative agent that resembles the rest of the households. The main problem the household faces is how to maximize utility over an infinite period of time. Utility comes from consumption:

$$\max \int_0^{\infty} \beta^{-t} \left(\frac{c^{1-\theta}}{1-\theta} \right)^{\frac{\theta}{1-\theta}} dt \quad (12)$$

Subject to:

$$c_t = w_t - sw_t + \tau_t \sum_0^{t-1} (1+r_i)^{t-1-i} sw_i$$

$0 < \beta < 1$

where w is the wage the household receives, s is constant savings rate, and τ is the portion of savings households decide to liquidate in period t, $0 \le \tau \le 1$. This number is stochastic for every time period. Function 12 gives us the optimization problem for the household given its consumption. But since we are dealing with a small open economy it is necessary to define consumption.

The household has the opportunity to consume two kinds of goods, domestic goods and foreign goods. Equation 13 defines such total consumption:

$$c_h = (1-\vartheta)c_d + \vartheta c_f \quad (13)$$

Where ϑ represents the fraction of goods consumed, totaling 1; subscript d represents the domestic goods and subscript f represents the foreign goods; and c is the vector of goods consumed.

If we take the utility function as:

$$u(c_h) = \left(\frac{c^{1-\theta}}{1-\theta} \right)^{\frac{\theta}{1-\theta}} \quad (14)$$

Combining equations 13 and 14 we get:

$$u(c_h) = \left(\frac{\left((1-\vartheta)c_d + \vartheta c_f\right)^{1-\theta}}{1-\theta} \right)^{\frac{\theta}{1-\theta}} \quad (15)$$

The cost of consumption can be defined as follows:

$$\max P = \sum_0^m \rho_i c_{i,d} + \sum_0^n (\rho_i c_{i,f} * \psi) \quad (16)$$

Subject to $c_t = w_t - sw_t + \tau_t \sum_0^{t-1} (1+r_i)^{t-1-i} sw_i$, so c=P for every time period.

The price (P) spent on goods is the sum total of prices paid for domestic goods plus prices paid for foreign goods; ψ in period t represents the exchange rate; and ρ is the price of the i^{th} good.

2.2 Factors that have an impact on exports

In order to better understand the optimization of the export process, we have to define and investigate what factors have an impact on exports.

According the Mundell-Fleming model presented at the beginning of the paper, the most important factors affecting exports in a small open economy are:

1. Real exchange rate.
2. Capital mobility, caused by the real interest rate differential.
3. The economic condition of the country where most of the exports go.

The reasons for naming each of these variables should be obvious. The real exchange rate presents the true value of the goods; capital mobility (real interest rate) will serve as an equalizer for the marginal productivity of capital; and the economic condition of the country that is importing the goods from a small open economy represents the demand factor for export products.

The author's main interest is the analysis of the time vector for each of the three variables presented. Some assumptions are in order. The first one is the assumption of rational expectations as presented in Muth (1961) and Lucas (1972). The second assumption is the assumption of time optimization consistent with the set-up of a dynamic programming problem as presented in Stokey and Lucas (1989) and Adda and Cooper (2003). The third assumption is the assumption of perfect substitution between domestic and foreign goods. This assumption states that a representative household is indifferent between the domestic and foreign good as long as the *real* price is the same. In case the domestic currency is undergoing a real appreciation over time, consumers will start to substitute for the cheaper

foreign goods. This changes the relative values of the distribution of weight between domestic and foreign goods.

The reader should notice here that there is no mention of the nominal exchange rate. This is a very important aspect of this paper. In essence the author of this paper is arguing that under the above assumptions the nominal exchange rate is irrelevant.

Extrapolating from the argument of Lucas (1972), we see that any kind of announced exchange rate movements will not have any kind of real effect on the customer's preferences. The nominal exchange rate in this paper is considered only in relation to the real exchange rate. The effect of changes in nominal exchange rate is understood to be neutral in the model. However, this assumption of neutrality of the nominal exchange rate is tested in the appendix.

Capital mobility is an important factor for the standard of a small open economy. Better real return on capital invested can mean movement of jobs from one country to the next one, thus increasing employment and overall standard of living in the economy.

With perfect capital mobility, as presented in the model, capital will move to countries where it can obtain a greater real interest rate return. The movement of capital in essence is the capital account balance. In case a country has large and persistent trade deficits, it will be necessary to finance those deficits. For a country to do that, it has to allow a counter balance in the capital account to offset the current account deficit. This can only be done by selling goods or by selling labor. For the scenarios of trade deficits in the case of Croatia, see Vidaković (2005a).

The third factor is the demand for export goods, or we can say the current economic state of the country where the exports go. The rationale for this is simple: if we are exporting in a country with high economic growth, even if the percentage of the market held by the exporting country stays the same, economic growth will cause imports to increase in nominal quantities, although the percentage in the market might stay the same. This is the exogenous variable in the model.

2.3 Real exchange index

The following part of this paper develops an index of the real exchange rate and runs simple OLS regressions in order to establish which of the above noted variables have an impact on the exports and to what extent. The purpose of the OLS regression is not to be used as a forecasting mechanism, but to confirm or deny causation and connection between the variables. There will also be a separate test for the nominal exchange rate.

First we have to create an index of the real exchange rate for Croatia and Slovenia. The notation for the data used and the process of index creation are in the data appendix at the end of the paper.

The main purpose of the index is to show in a simple and straightforward manner the movement of the real exchange though time.

The index of the real exchange in the model is:

$$\Phi_t = \Lambda \prod_0^t \frac{1}{\left(e_t^{ex} - e_t^{im}\right) + 1} \tag{17}$$

Λ – constant, the beginning value of index 1994 = 100.
e^{ex} – price change in Croatia or Slovenia (percentage change or inflation), plus exchange rate appreciation, minus the exchange rate depreciation in the period.
e^{im} – world inflation, in this case inflation in the EU.

The index created here is very simple. If the index is going down, this means that the prices in the domestic country are increasing more then the prices in the rest of the world. This means that the real exchange rate is appreciating. Domestic goods are more expensive, foreign goods are cheaper, and the substitution effect takes place. On the other hand, if the index is going up, the prices in the rest of the world are increasing faster then the prices in the domestic country, the real exchange rate is depreciating, and households will start to substitute foreign goods for domestic goods.

According to the basic theory, the decrease in this index should have a negative effect on exports in a small open economy.

3 Empirical testing

Before we start the regression analysis, let us look at the nominal exchange rate for a ten-year period for Croatia and Slovenia. The exchange rate used is the exchange rate of the HRK vs. the euro and the tolar vs. the euro in the period 01/95-01/05.

As seen in the graph, it is clear that the kuna exchange rate has been in a very narrow range from the period of mid-1998 until today. The mean for the whole period is 7.28, with a standard deviation of 0.33. The minimum in the series is 6.61 and the maximum is 7.73. The lower bound is 0.67 kuna away from the mean of about 9%. The upper bound is 0.45 kuna away from the mean of 6%, essentially indicating an upward resistance.

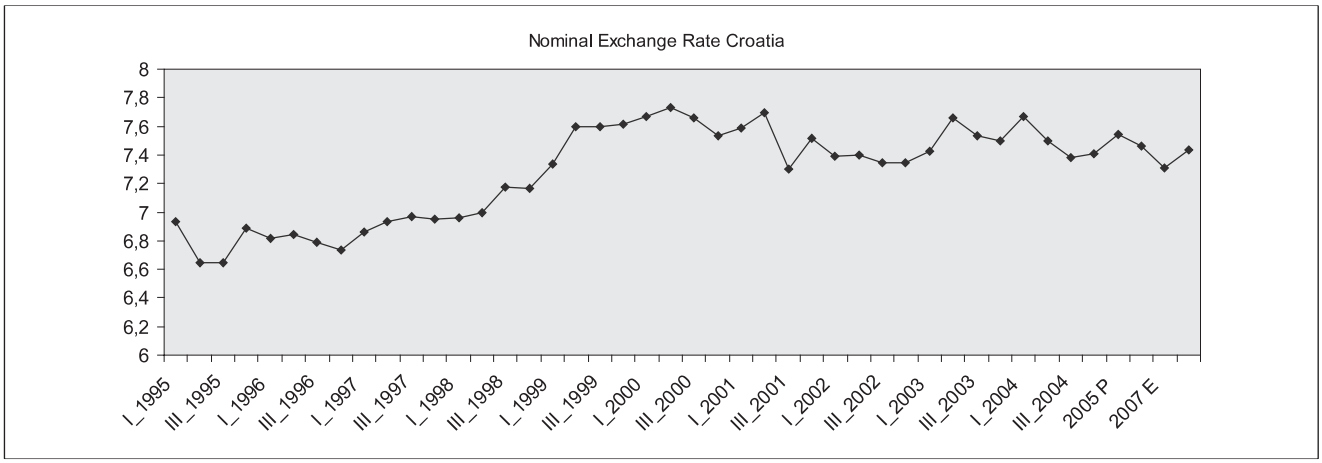
The graph shows that since the beginning of 1999 the kuna has been heavily controlled. The exchange rate is not fixed, but it has been kept in a very narrow band. Now given the theory of the model, such an economic behavior should be negative for the exports in Croatia if there exists a considerable price differential between Croatia and the country that imports Croatian goods.

The same analysis can be done with the tolar. The mean of the series is 201.783. The highest point is 239.99 and the minimum of the series is 150.78. It should be noted that the minimum value occurs at the beginning of the series, and the highest value occurs towards the end of the series.

It can be clearly seen that there is a persistent nominal depreciation of the exchange rate of the tolar vs. the euro.

The first observation from these two graphs should be the way the graphs look. The kuna is a straight line, while the tolar is almost a linear function with a steady slope. The slope

Graph 1: *Nominal exchange rate, Croatia*



Source: Author's calculations

ends and levels off once Slovenia entered the EU and had to stabilize the exchange rate in order to prepare for the EMU.

Let us now look at the real exchange index. The real exchange rate for Croatia is:

As the graphs show, there has been a double appreciation. Over time both countries have experienced downward movement in the real exchange rate. Similar results can be found in Flere (2004) and Coricelli and Jazbec (2004).

Here are the actual values for the index according to the author's calculations from Equation 17:

Table 1: *Real exchange rate index*

year	Index Slovenia	Index Croatia
1994/1	100	100
1995/1	103.612536	112.24437
1996/1	102.7783623	112.06656
1997/1	100.5169348	108.37648
1998/1	94.9051328	103.67039
1999/1	95.84666741	95.55924
2000/1	97.21661765	88.468245
2001/1	94.28389935	85.392597
2002/1	92.58304952	86.405689
2003/1	90.85235005	86.743685
2004/1	89.90019597	84.337115

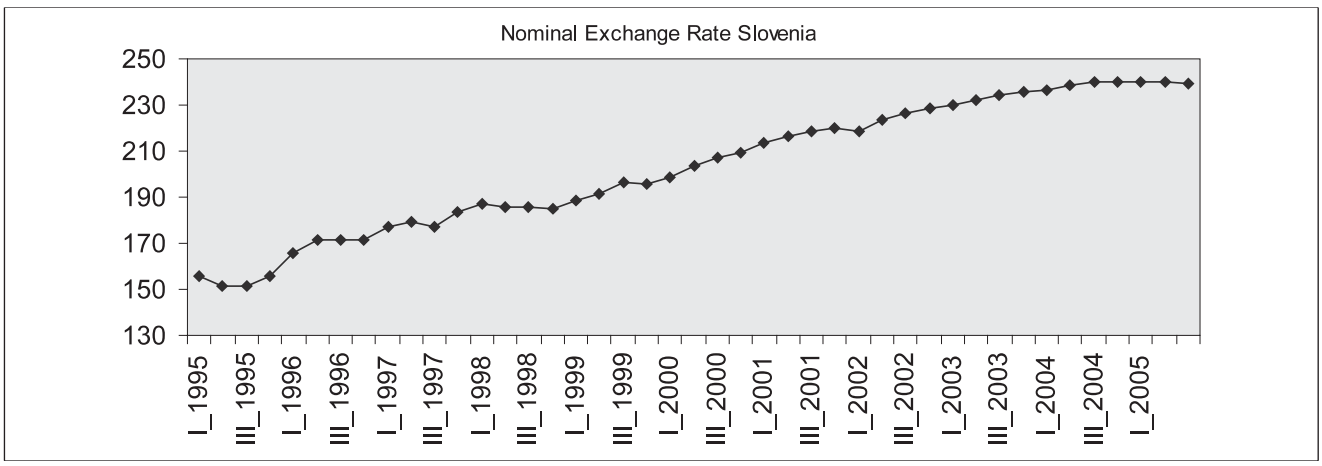
Source: Author's calculation

The Slovenian rate fell by 14%, and the Croatian rate fell by 25% from their peaks in 1995. Now given the fact that the index starts with 1994=100, there are several things that have to be said before we analyze the index.

1. Slovenian policy has been constant. Monetary policy has attempted to prevent a drop in the real exchange rate. On average in the last ten years, the index depreciated less then 1% each year.
2. The initial jump for Croatia in 1995 can be interpreted as an after effect of the hyperinflation period more than the effect of a radical shift in monetary policy.
3. We can see two distinct shocks in the index in 1998 when the tolar and kuna dramatically appreciated.
4. There was a switch in policy in Croatia. From 1994 to 1996 the index is about even, but from 1997 the index appreciates dramatically until 2002, when it stabilizes.
5. In the same time span (1995-2004), the index in Slovenia dropped by 13.44 points. In Croatia in the same time period, the index dropped by 27.91 points, more than twice the move in Slovenia.

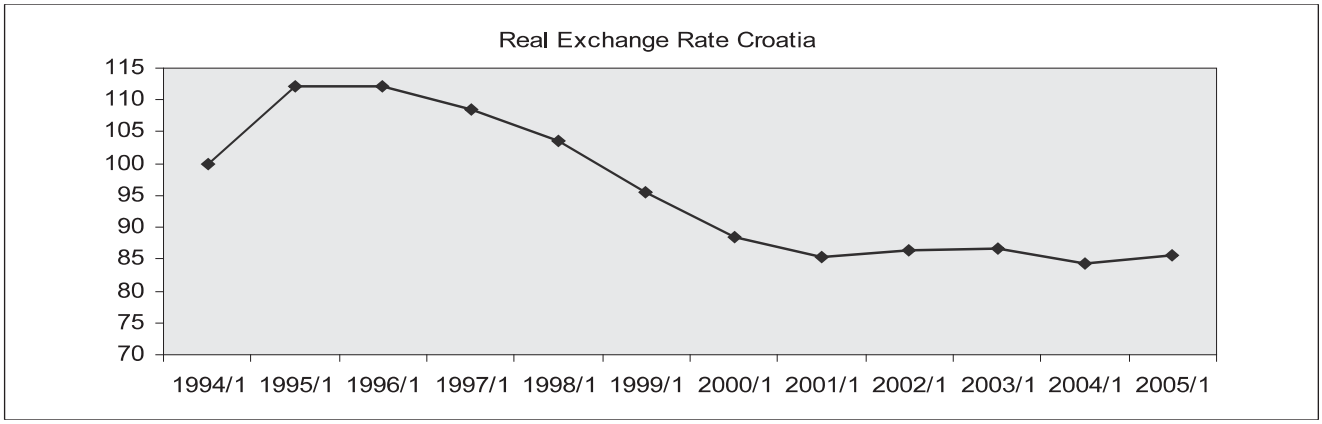
From this data we can conclude that the shock of the real exchange rate on exports should be much more adverse on Croatian exports then on Slovenian exports in the same

Graph 2: *Nominal exchange rate, Slovenia*



Source: Author's calculations

Graph 3: *Real exchange rate, Croatia*



Source: Author's calculations

time period, under the assumption that real exchange rate has an effect on exports. This assumption still has to be proven empirically.

Going back to Equation 15, we see utility is based on consumption, and from equation 16 we see that if domestic goods are becoming cheaper, households will substitute foreign goods for domestic goods. From the results in the real exchange rate movement, we can conclude the substitution effect in Croatia should be much more adverse to domestic production than in Slovenia.

3.1 Regressions

Now we will run regressions on several variables to see the overall impact of real exchange rate, interest rate differential, and foreign demand for exports. We will be dealing with the basic one step ordinary least squares regression of the form:

$$ex = \alpha + \beta_1\gamma + \beta_2\delta + \beta_3\varepsilon$$

γ – log value A*
δ – log value ξ
ε – log value Φ

The purpose of this regression is not to be able to predict the future movement of the real exchange rate or to serve as a model. Much better and more accurate results for prediction can be obtained using VAR methods as in Echebaum and Christiano (2005) or a recently developed FAVAR procedure as proposed by Bernanke et al (2005). Rather OLS regressions here are being used to be able to determine with statistical significance which of the variables have an impact on exports and which variables do not have impact on exports. The three main variables that we are focusing on are: real exchange rate (as presented in the index above), interest rate differential, and growth in the country where Croatia and Slovenia export, in this case growth in the EU.

The regression results here are for Croatia. The regression results for Slovenia are in the appendix.

The most striking result of regression was the fact that the interest rate differential and growth in the EU were not statistically significant.

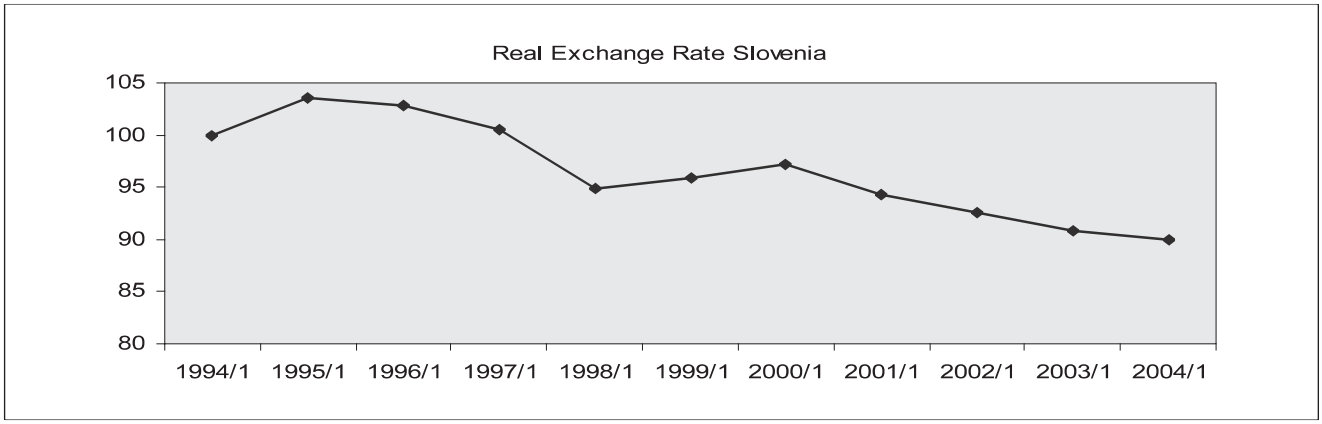
$$ex = 10.37 - 5.72\gamma - 4.188\delta + 0.536\varepsilon$$

(13.32) (-0.52) (-1.01) (3.59)

The t-statistic values are in brackets.

As we can see, neither interest rate differential nor growth is significant. The only statistically significant element of the equation is the real exchange rate index. From this the conclusion follows that in order to increase exports, a country should depreciate the real exchange rate.

Graph 4: *Real exchange rate, Slovenia*



Source: Author's calculations

There is also a possible problem with the small sample size, but since the time period considered is small, the 40 observations are the only observations possible.

From this regression we can move to the single factor regression, and regressing only the values of exports on the index of real exchange rate we get:

$$ex = 10.1625 + 0.5514\varepsilon$$

(13.84) (3.79)

Again the real exchange rate index is extremely significant and confirms the assumptions of the model.

In fact it is very significant and R square is at 26%, a relatively high R square for only a one variable regression. Also keep in mind that these are log values, so a positive sign in front of â makes sense. As the index goes up by 1 percent, the exports will go up by 0.55 percent.

The results for Slovenia are very similar to those obtained for Croatia and are shown in the appendix with the rest of the results.

3.2 Discussion

The testing of data rejects the theoretical implications in Vidakovic (2005b). Vidakovic (2005b) states that there should be three main variables for the stimulation of exports; however, empirical testing rejects that hypothesis and leaves us with only one variable: real exchange rate.

The only realistic policy for a small open economy is to keep depreciating the real exchange rate. Through real depreciation of the exchange rate, a small open economy in essence forces households to substitute domestic for foreign goods.

But there are two problems with this logic:

1. The first problem is the fact that the real exchange rate cannot be constantly depreciated. The reason for this is the autonomous imports. We are dealing with a small open economy and there are some imports that a small open economy needs in order to function properly, and there are some goods where the substitution effect is impossible. The autonomous imports are part of eEquation 5.
2. The second reason is the nature of the problem. It is not possible to set a goal for the depreciation of the real exchange rate forever. Such constant depreciation of real exchange rate in a linear or on an exponential (by constant percentage) basis seems highly implausible in the real world.

But there is a solution to the problem. A small open economy cannot constantly depreciate its currency ad infinitum, but a small open economy can optimize the real depreciation/appreciation, which we have empirically seen in the case of Slovenia. The real exchange index is appreciating, but through proper monetary policy the real depreciation has been slowed and put under control. On the other hand, in the case of Croatia we are seeing a lack of defined monetary policy. There is only preservation of the status quo: a fixed exchange rate no matter what the cost. In Croatia's case, the real exchange rate has been left to drift widely, and due to the considerable interest rate differential, this has caused massive foreign debt and a huge current account deficit.

3.3 Solution

As we can see from the regressions, the most important factor for growth in imports is the real exchange rate. So in order for an economy to have growth in exports, it is necessary to optimize the real exchange rate.

However, the real exchange rate is not just a variable that can be easily changed. If we look at equation 17, we see that prices in the exporting country are beyond our control. In essence, controlling the real exchange rate is a stochastic dynamic programming problem. Such a problem can be represented in the value equation 18.

$$V(ex) = \max u(c) + \beta E_{ex'|ex} V(ex') \tag{18}$$

Empirically, if we look at the exchange rate indices for Croatia and Slovenia, we see that the real exchange index for Slovenia is a solution to Equation 18.[5] Although the index is not moving in the desired direction (the index is appreciating instead of depreciating), we see that the index is smooth with very small volatility. Croatia's real exchange, on the other hand, is wild and volatile.

3.4 Results

This is an empirically oriented research paper and now we shall look at the empirical results of the monetary policy chosen. Looking at the model, the main prediction is that due to oscillations in the real exchange rate, a substitution effect will take place. If the real exchange rate is appreciating, domestic goods will increase in price and force rational households to substitute domestic for foreign goods. This substitution effect will cause large persistent trade deficits and in case there is are no alternate domestic means to finance the deficit, the country will have a large increase in foreign debt.

From the data we have seen on real exchange rate, the model tells us that Slovenia should have a small trade deficit and small foreign debt. On the other hand, Croatia, according to the model, should have a large trade deficit and large foreign debt. Now we shall look at the data and see if the model's predictions are correct.

In the last ten years, Croatia has undergone a persistent trade deficit and foreign debt has exploded, as can be seen from the data below. During the same time period, Slovenia has had a stable balance of payment and relatively benign foreign debt.

Thus, the model is absolutely correct in its predictions about the effect of the real exchange rate on the trade balance and foreign debt.

As we see, the empirical data has shown the wrong orientation of Croatian monetary policy and the correct

[5] By solution, the author here means smoothness of the curve and small standard deviation of the index, not the mathematical properties of the dynamic programming value equation solution.

Table 2: *Economic Indicators, Slovenia*

Slovenia[6]	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Exports of goods and services	-	1.264.856	1.586.863	1.798.212	1.874.305	2.167.682	2.540.812	2.930.001	3.155.864	3.652.367
Imports of goods and services	-	1.304.230	1.616.064	1.859.755	2.040.601	2.230.383	2.616.276	2.913.648	3.186.507	3.681.409
Surplus with the rest of the world	-	-39.374	-29.200	-61.543	-166.296	-62.701	-75.464	16.353	-30.642	-29.043
deficit as % of GDP	-2	-1	-1	-1	-4	-3	-1	1	0,00	-1

Source: Slovenian Central Bank

Table 3: *Economic Indicators, Croatia*

Croatia[7]	1996	1997.	1998.	1999.	2000.	2001.	2002.	2003.	2004.
current account deficit as % of GDP	-4,8	-12,3	-6,8	-7	-2,5	-3,7	-8,7	-7,3	-5,2
foreign debt	4.284	6.761	9.173	10.101	12.109	13.458	15.055	19.811	22.781
foreign debt as % of GDP[8]	27	38	47,6	54,1	60,6	60,7	62,2	77,6	82,5

Source: Croatian Central Bank

orientation of Slovenian monetary policy. The wrong choice of monetary policy has caused Croatia to have a large debt and persistently inept economy; on the other hand, such economic doom has been averted in the case of Slovenia.

4 Conclusion

The purpose of this paper was to look at the development of the monetary policies in two countries: Slovenia and Croatia. Instead of just a comparative analysis of the economies, the paper tests a model based on the dynamic optimization of the real exchange rate. Once the model was developed, the empirical analysis brings two points to light. Foreign demand for domestic goods and the real interest rate differential do not play a major role in the level of exports for a small open economy. Thus, the two variables predicted to be important by the model are dismissed. The only variable left to be statistically important for the level of exports in a small open economy is the real exchange rate. Simple OLS regression confirms that there is a strong statistical relationship between exports and real exchange rate as the model originally predicted.

After statistical tests, the empirical data is analyzed and empirical data fully confirms the model. A strong real currency with the tendency for appreciation will cause a large trade imbalance and persistent growth of foreign debt. As we see in the data for Croatia, a constantly appreciating currency in real terms has caused a large and ever increasing trade deficit and exponential growth of foreign debt.

If we look at the research paper as an empirical study, it is not very hard to conclude which policy turned out to be correct and what the cost (benefit) was of the policy chosen.

Appendix

Here are the results for some computations run and mentioned in the text.

We see when we run regression with the Slovenian data that only the real exchange index is significant. What is strange is the fact that the real exchange index has a negative number. This implies that a fall in the real exchange index (real appreciation) will cause exports to go up; economically,

Table 4: *Regression results for Slovenia*

Regression Statistics	
R Square	0.85
Adjusted R Square	0.84
Standard Error	0.10
Observations	42.00

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3.00	2.00	0.67	71.22	1.17E-15
Residual	38.00	0.36	0.01		
Total	41.00	2.36			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	17.39	0.72	24.16	0.00	15.93
EU GDP growth	0.03	0.04	0.57	0.57	-0.06
Interest rate dif.	-0.01	0.01	-1.23	0.23	-0.03
Real exchange index	-2.16	0.17	-12.73	0.00	-2.50

Source: Author's calculations

6 In millions of tolars, constant prices.

7 In millions of euros

8 As of January 2006, foreign debt is 25.5 billion euros, around 87% of GDP.

Table 4: *Regression results for Slovenia*

R Square	0.84				
Adjusted R Square	0.84				
Standard Error	0.04				
Observations	42.00				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.00	0.36	0.36	212.96	0.00
Residual	40.00	0.07	0.00		
Total	41.00	0.43			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	7.46	0.21	35.12	0.00	7.03
log index	-0.39	0.03	-14.59	0.00	-0.44

Source: Author's calculations

Table 5: *Regression results for Slovenia*

R Square	0.91				
Adjusted R Square	0.91				
Standard Error	8.48				
Observations	42				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	28451.59	28451.59	395.81	2.36E-22
Residual	40	2875.24	71.88		
Total	41	31326.83			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	94.39	5.65	16.69	1.27E-19	82.96
Nominal exchange rate	0.038	0.00	19.89	2.36E-22	0.034

Source: Author's calculations

this does not make any sense. This can be explained in two ways:

1. Statistically the regression is correct. In the time period tested, the index is falling and exports are rising, so the regression coefficient should be negative.
2. The nominal value of the exchange rate is important, although in the paper we have assumed households only care about the real value of variables, not just nominal values.

Running a one variable regression, we again obtain a negative coefficient on the long index, but this time the coefficient is much smaller (-0.39 versus -2.16 from the previous regression). Also in this regression the t-statistic is much larger.

The next regression is the regression of nominal value of exports on the nominal value of the exchange rate. As we can see, regression is statistically significant and the values of the t statistic are extremely large in the case of Slovenia, but in the case of Croatia we do not get this result.

In the case of Croatia, the same regression is not valid, the t statistic is small, and the nominal exchange rate is insignificant even at the 10% level test. The p value is 13%. So we can conclude that the nominal exchange rate and exports are not correlated. This is an extremely powerful conclusion that completely supports the main argument of the paper: only the real exchange rate matters.

What these two regressions tell us is that Slovenian exports are growing not because the exchange rate is falling, but because the real exchange rate is being controlled through depreciation. On the other hand, in Croatia there is no exchange rate movement due to any factor, so the relationship between the exchange rate and exports is not statistically significant.

Table 6: *Regression results for Croatia*

R Square	0.05				
Adjusted R Square	0.03				
Standard Error	0.32				
Observations	43				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,.24	0.24	2.39	0.13
Residual	41	4.21	0.10		
Total	42	4.46			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	7.01	0.19	37.00	3.98E-33	6.63
Nominal exchange rate	6.58E-07	4.26E-07	1.54	0.13	-2.02E-07

Source: Author's calculations

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