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Estimates of the Fundamental Equilibrium Exchange Rate of Kuna

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First draft. Comments welcome.

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Introduction

The real exchange rate is one of the key economic variables, especially for a small open economy. It determines the relative price of domestic and foreign goods and impacts the demand for them and price trends. Economic theory says that an appreciated real exchange rate decreases the demand for domestic goods and increases imports, depresses domestic output growth and generates downward pressures on inflation. Real exchange rate that is below its equilibrium value (setting aside for now how this equilibrium values can be determined) stimulates demand through increased exports, but produces inflationary pressures.

The search for equilibrium exchange rates and the fair value of a currency has long been in a focus of academic and policy related research. Beside the long lasting research on relationship between the major world currencies, the recent entrance of transition countries to the EU and their prospect of adopting the euro has ignited interest in estimating the correct exchange rates for these countries. Getting the rate right has become of paramount importance for these countries, as the exchange rate influences competitiveness, price trends and other key macroeconomic variables.

In that context, while it is still early to prepare for entry of the Kuna to ERM-II it is certainly of more then a purely academic interest to see where the kuna stands today. Given the abundance of equilibrium exchange rates concepts and empirical methods, the assessment of the fundamentally correct value is not a trivial task. The calculation of fundamental equilibrium exchange rate for kuna is a first attempt in that direction, with the intention to expand the research to include other complementary approaches.

Concepts of equilibrium exchange rate

Real exchange rates--definitions

For the purpose of macroeconomic analysis of developed countries, then usual approach is to define the real exchange rate as the nominal exchange rate multiplied by the ratio of foreign to domestic price level:

$$Q = \frac{E \cdot P^*}{P} \qquad or \qquad q = e + p^* - p \quad \text{if expressed in logarithms.} \qquad (1)$$

The real exchange rate is the ration of the foreign prices EP* and domestic prices converted in the same unit of measurement, domestic currency unit (Égert et all, 2004). The usual way of expressing the real exchange rate movements is in indices. The fall in the P*/P ratio indicates faster growth of domestic prices relative to foreign prices, hence appreciation of real exchange rate, provided nominal exchange rate remained stable, or depreciated less then decline of the P*/P ratio. Conversely, the rise of the index denotes depreciation of the real exchange rate.

Foreign prices are usually defined as a weighted index of prices of most important trading partners. Then the real exchange rate is real effective exchange rate. The choice of weights is not straightforward. Trade weights are most usual choice capturing about 70% of trade. IMF's MERM weights allow for third party effects.

The price index used very depending on the aim of the real exchange rate analysis. To the extend the various price indices diverge, the calculation of the real exchange rate can differ.

The relative consumer price index is used in real exchange rate calculation when comparing price levels of final goods bought by consumers in comparing countries. Producer price index would give the real exchange rate suitable for analyzing price competitiveness of goods exported by an economy. For cost competitiveness of an economy, the relative unit labor cost is most suitable.

The ratio of tradable prices to non-tradable prices, or internal real exchange rate is used for assessing the exchange rate within the economy. Hinkel and Montiel, 1999 define the internal real exchange rate as domestic price of exports (imports) relative to the price of domestic i.e. non-traded goods.

RERX = RERM x ITT,

where the RER, the real exchange rate, is domestic price of exports (imports) relative to the price of domestic i.e. nontraded goods. RERX= P_{Xd} / P_{Dd} , internal RER for exports is the ratio of domestic price of exports, P_{Xd} and domestic currency price of imported goods P_{Dd} . RERM= P_{Md} / P_{Dd} , RER for imports is the ratio of domestic price of imports and domestic currency price of imported goods. This makes ITT, or internal terms of trade equal P_{Xd} / P_{Md}

$$\frac{RERX}{RERM} = \frac{\frac{P_{Xd}}{P_{Dd}}}{\frac{P_{Md}}{P_{Dd}}} = \frac{P_{Xd}}{P_{Md}} = ITT$$

However, the above definition is usually used in the context of small developing countries, predominantly trading commodities. This concept does not include nominal exchange rate E, as it is either assumed to be fixed or driven by commodity prices.

Frameworks for RER analysis

PPP and LOOP

By far the most researched, the oldest (firstly synthesized the papers by Cassel in 1916) and the most empirically tested concept of real exchange rate equilibrium is purchasing power parity. It was historically the most natural and intuitive framework to start thinking about real exchange rates movements. While detailed overview of PPP theoretical underpinnings and empirical test is beyond the scope here, it is worth mentioning the main elements of the PPP theory, as some of them appear in other frameworks, albeit implicitly.

The PPP predicts that the nominal exchange rate would equal domestic price level divided by foreign price level, in the long run.

$$E^{PPP} = \frac{P}{P^*} \qquad (1)$$

In the short term, deviation from the PPP equilibrium is possible.

$$Q = \frac{E}{E^{PPP}} \qquad (2)$$

If the ratio Q is higher then 1, then the exchange rate is undervalued, whereas if Q<1, it is overvalued. In the case that Q=1, the exchange rate is fairly valued according to the PPP. If the exchange rate is not at its equilibrium, the Law of One Price will set in motion forces that will return the exchange rate at its equilibrium value, over some period of time. The precondition for this arbitrage to return the exchange rate to its "equilibrium value" are perfect competition, no trade barriers, no capital movements restrictions, homogenous good and consumer preferences home and abroad and that all the goods are tradable.

Clearly such stringent assumptions are violated in reality, and empirical support for this strict form of PPP has been limited. The LOOP itself may not work because of differentiated products, pricing-to-market and transportation costs. Composition of the baskets differ between countries because of different consumer preferences and different production patterns. Non-tradable goods in the basket also cause systematic deviations from the PPP exchange rate. Various extended concepts of PPI relax this initial assumptions, and allow for more realistic scenarios.

Balassa-Samuelson Model

The well known extension of the PPP approach, the one that allows for permanent deviation of the real exchange rate from unity, due to productivity differentials is called BS or HBS

Effect. It is based on the more realistic assumption that there exist both tradable and non-tradable sector in an economy, each with is own level of productivity. Different productivity levels in tradable and non tradable sectors are usually referred to as dual productivity. The LOOP holds for tradable sector only, which means that for this sector prices are given exogenously. Wages are equalized across sectors, and prices in the non-traded sector depend on wages in that sector, rather then on its productivity level.

The HBS model explains the fact that the real exchange rate in transition and developing countries seem undervalued in PPP terms. The productivity growth in the tradable sectors, via wage equalization, leads to price increase in the non-tradable sector. Higher growth of productivity differential in home country relative to foreign country leads to higher increases in the price level, hence appreciation of the home currency. If CPI deflated exchange rate appreciation, CPI being proxy for overall inflation, comes from price increases in non-tradable sectors, it can be fully explained by HBS effect. Since, by assumption, PPP holds for open sector, competitiveness of the open sector will not be harmed by this appreciation. If, by contrast, the PPI based real exchange rate also appreciates (PPI being proxy for tradable prices), the HBS effect can explain only the difference between CPI and PPI deflated exchange rate.

This approach has been used extensively in analysis of real exchange rate movements in developing and transition countries. The assumption of this model has been relaxed in various extended versions of HBS model to capture more fully the transition processes in these countries. First, the LOOP and hence PPP may fail to be present in the open sector, as they require market structure to be perfect competition and no transportation costs (although the PPP can be extended to account for theses costs). Second, an important share of prices in non-traded sector is administered, especially services, as opposed to market based priced in this sector, and their deregulation alone can influence the general level of prices. Also, demand side factors can influence the level of prices in non-traded sector, aside from productivity differential.

Capital Enhanced Equilibrium Exchange Rate (CHEERS)

Capital Enhanced Equilibrium Exchange Rate extends PPP approach with the UIP condition (MacDonald, 2000). The PPP concept is extended in such a way that permanent deviation from the PPP equilibrium may result from non-zero interest rate differential, necessary to finance the capital account.

This approach supplements the uncovered interest rate parity condition

$$e_t = E_t(e_{t+1}) + i_t - i_t^* \qquad (3)$$

Where e_t is nominal exchange rates and i_t are nominal interest rates.

The assumption is that the nominal interest rate can be predicted using the relative prices if the PPP holds. The cointegrating relationship is then estimated between exports x, prices p, p*, nominal exchange rate e and nominal interest rates i and i*.

$$x_t = [e, p, p^*, i, i^*] \qquad (4)$$

Focus is on the interaction between the real exchange rate and the capital account items, ignoring any other real determinants. In the strict PPP framework, the non-zero interest rate differential would have only a transitory impact on the real exchange rate, whereas in the CHEERS approach there is the long term persistence the real exchange rate is mirrored in the interest rate differential.

It is a useful concept for the transition economies, where data availability is constrained. As for the time horizon, it is a medium term concept, as it does not impose the stock-flow consistency.

Fundamental Equilibrium Exchange Rate FEER

The FEER approach created by Williamson 1983, 1994 and later developed by Wren-Lewis (1992) is a medium- term concept of equilibrium exchange rate. It is a method of real exchange rate calculation consistent with the internal and external equilibrium. The FEER, by definition equates demand and supply for domestic output. Internal balance is defined by non-accelerating inflation rate of unemployment (NAIRU) i.e. when the economy is at full capacity utilization accompanied by low inflation. The external equilibrium is achieved when the current account is at "sustainable", not necessarily zero, level and that external debt is sustainable.

The slightly normative nature of FEER has given rise to a similar equilibrium concept of the Desired Equilibrium Exchange Rate or DEER. In DEER, the real exchange rate is conditioned on some variables the policy makers deem "optimal" or "desired". The normative elements i.e." desired" policy trajectory versus "sustainable" path of exogenous variables, would be where these two similar concepts depart.

Behavioural Equilibrium Exchange Rate (BEERs)

BEERs aim to use a modeling technique which captures movements in real exchange rates over shorter span of time, not just movements in the medium or long run equilibrium level. BEER is predominantly an empirical concept.

The BEER is usually estimated as a function of real interest differentials, terms of trade, relative price of traded to non-traded goods (as a measure of Balassa-Samuelson effect), and the ratio of government debt. It recognizes that both current and capital account items determine the exchange rate. The same variables will influence the FEER, but in the BEER approach the links are data determined, without imposing any particular functional form based on economic theory.

As with the CHEERs, the starting point is the UIP condition expressed in the real terms, and adjusted for the risk premium (Clark and MacDonald, 1999):

$$q_t = \bar{q}_t + r_t - r_t^* - \lambda_t \qquad (5)$$

The long-term or systematic component of the exchange rate $\bar{q}_t$, depends on:

$$\bar{q}_t = f(nfa_t, tot_t, tnt_t) \qquad (6)$$

In the Clark and MacDonald analysis, they model the US, Germany and Japan, they find two cointegrating vectors, one reflecting the interest rate differential and the other the remaining variables in the system.

BEER models the *behavior* of the exchange rate, without requiring the fundamentals themselves to be at the equilibrium level. Even in the vector of fundamentals Z_t is at the equilibrium level $\hat{Z}_t$ and $Z_t - \hat{Z}_t = 0$, the BEER may not coincide with the FEER because of the factors reflecting transitory components and random errors. Clark and MacDonals 2000 decompose the factors underlying BEER into the permanent and transitory components. As such Permanent Equilibrium Exchange Rate or PEER can be compared with the FEER estimates of exchange rate.

Permanent and Transitory Decomposition of Real Exchange Rates PEERs

The PEER concept decomposes the real exchange rate qt in the permanent and transitory component

$$q_t = q_t^P + q_t^T \qquad (7)$$

The permanent component is the measure of the equilibrium exchange rate. There are various ways of decomposing permanent from transitory components of an economic series, and they have been used in filtering the permanent components of the exchange rate. Beverigde-Nilson univariate and multivariate decomposition has been used in a number of papers (Huizinga 1987, Huizinga 1990, Clarida and Gali 1994). Clark and MacDonald 2000 use permanent component calculated from VAR and interpret that as a measure of permanent equilibrium.

The Natural Exchange Rate -NATREX

Another concept closely related to FEERs is that of Natural Real Exchange Rate (Stein 1994, Stein and Paladino 1998). It is defined as the rate that would prevail if speculative and cyclical factors could be removed while unemployment is at its natural rate (stein 1994). On this basis of this definition it is similar to the medium term equilibrium concept such as FEER. In addition the NATREX is also defined as the real exchange rate which is consistent with the portfolio balance, so that domestic real rates equal world interest rates. In the long

run, the capital stock and foreign debt are also endogenous and will be related, along with the real exchange rate, to long run fundamentals.

The value added of the NATREX approach relative to FEER is exactly that it considers the influence of the stock of capital and net foreign debt on the long run exchange rate and it also describes the path of the real exchange rate from medium term to the long term equilibrium.

Exchange rate misalignment at various time horizons

The time horizon over which the equilibrium exchange rate is achieved has an important bearing on the concept of the EER used.

Williamson (1983) defines *market equilibrium exchange rate* as the one which balances supply and demand of the currency in the absence of official interventions. In that context, in countries operating free (or nearly free) floating exchange rate regimes, exchange rate would always be at its *market* equilibrium.

A short term or *current equilibrium exchange rate* (Williamson 1983) is one consistent with the given or *current* fundamentals, abstracting the influence of random effects, such as asset bubbles.

The *medium term equilibrium exchange rate* is defined as the EER consistent with the internal and external equilibrium of an economy. Internal equilibrium is defined as full capacity utilization i.e. when the output gap is zero and unemployment is at its NAIRU. External equilibrium does not necessarily imply zero current account deficit, i.e. equality of saving and investments in the medium term. For external equilibrium to be achieved, a sustainable current account will suffice, sustainable being defined as consistent with the eventual convergence to the stock-flow equilibrium. FEER would be a typical representative of this medium term concept.

The real exchange rate can be expressed in reduced form (Clark and MacDonald, 1997) as:

$$e_t = \beta' Z_t + \theta' T_t + \varepsilon_t \quad (2)$$

where e_t is the real exchange rate, Z is s a vector of economic fundamentals influencing the real exchange rate in the long run, T is a vector of transitory factors (including current and lagged variables as well as dynamic effects from the fundamentals Z), which impact the real exchange rate in the short run and ε_t is a random disturbance and β and θ are vectors of coefficients.

Depending on the time horizon, various measures of real exchange rate misalignment can be defined. A short term equilibrium can be defined:

$$e_t^{ST} = \beta' Z_t + \theta' T_t \quad (3)$$

which is a measure abstracting from the influence of unexpected shocks.

Random disturbance distinguishes short term equilibrium exchange rate from the observed exchange rate. It can be an indication of the existence of a bubble, perhaps caused by misperceptions about fundamentals.

Alternatively, a short term equilibrium can be defined to take account of current level of fundamentals only, abstracting from transitory factors as well:

$$\hat{e}_t^{ST} = \beta' Z_t . \quad (4)$$

Transitory factors describe then dynamic path of the economy from past shocks to both real exchange rate and to the fundamentals, and they essentially provide information on the transmission mechanism.

Medium and long term equilibrium would be consistent with the fundamentals themselves being at their equilibrium level:

$$\hat{e}_t = \beta' \hat{Z}_t . \quad (5)$$

The time horizon of the equilibrium would depend on the fundamentals included.

The misalignment m is the difference between the current exchange rate and the equilibrium exchange rate. The short-term misalignment is the difference between the observed exchange rate and the rate implied by the *current* level of fundamentals.

$$m_t^{ST} = e_t - \hat{e}_t^{ST} = e_t - \hat{\beta}' Z_t \quad (6)$$

The medium term misalignment can be expressed as the difference between fundamentals and their medium (of long) term *equilibrium* values.

$$\begin{aligned} m_t^{LT} &= e_t - \hat{e}_t = e_t - e_t^{ST} + e_t^{ST} - \hat{e}_t \\ &= (e_t - \hat{\beta}' Z_t) + \beta'(Z_t - \hat{Z}_t) \end{aligned} \quad (7)$$

Substituting $e_t = \beta' Z_t + \theta' T_t + \varepsilon_t$

(2) in the misalignment equation:

$$m_t^{LT} = \theta' T_t + \varepsilon_t + \beta'(Z_t - \hat{Z}_t) \quad (8)$$

the medium term misalignment can be expressed as the result of transitory factors, random disturbance and deviation of economic fundamentals from their equilibrium values. If the economic fundamentals are not the their equilibrium level i.e. $\beta'(Z_t - \hat{Z}_t)$ is not zero then the equilibrium real exchange rate would not be the observed rate. For instance, if the firms believe that the observed change in the exchange rate is permanent rather than transitory and change their pricing policy for imports and exports, the measure of medium or long term equilibrium can help identify how an observed change in the real exchange rate is passed through to import or export prices and adding to inflationary pressures.

In the terms of the modeling approaches described previously, PPP, Balassa-Samuelson and NATREX are log-term concepts, as they require a long time span to converge to equilibrium. On the shorter end, there are purely statistical approaches (SVAR), BEER and CHEER as they are constructed in such a way that they are able to capture and forecast short term

exchange rate movements. Between these two, there are remaining frameworks, FEER, DEER and PEER, as they refer to modeling the medium term equilibrium.

Model

It is difficult to obtain satisfactory specifications of the import and export equations. There were many structural shifts during the last decade (WTO membership, credit rating, CEFTA, euro-changeover, VAT, tariffs changes) that influence the dynamics of trade.

For a start the specifications suggested in the literature were tried,

X-M=f (Y, M*, RER) **(8)**

as they are arguably complete, yet parsimonious specifications, where is Y domestic GDP exchange rate, M* foreign demand for imports, RER is real effective exchange rate, and X-M is the goods and service balance.

Firstly the exports (X) and imports (M) equations are estimated, with α_{i3} being elasticities of exports and imports to changes in RER,

$$X = \alpha_{10} \times M^{*\alpha_{12}} \times RER^{\alpha_{13}} \times e_1 \qquad (9)$$

$$M = \alpha_{20} \times Y^{\alpha_{22}} \times RER^{\alpha_{23}} \times e_2 \qquad (10)$$

or in the log form,

$$\ln X = \alpha_{11} + \alpha_{12} \ln M^{*} + \alpha_{13} \ln RER + \varepsilon_1 \qquad (11)$$

The same is with the imports equation.

As the trade balance is the difference between the exports and imports, the FEER is the solution for RER in

$$\frac{CA}{\overline{Y}} = CA^{*} = \frac{e^{\left[\alpha_{11}+\alpha_{12}\ln(\overline{M^{*}})+\alpha_{13}\ln(\overline{RER})\right]} - e^{\left[\alpha_{21}+\alpha_{22}\ln(\overline{Y})+\alpha_{23}\ln(\overline{RER})\right]}}{\overline{Y}} \qquad (12)$$

where in the place of M* and Y variable, the long term trend of a variable is placed, $\overline{M}^{*} and \quad \overline{Y}$, while the coefficients are from the estimated trade equations. For purpose of further FEER calculation, long term values of explanatory (exogenous) values are needed. HP filter as a proxy for long term values is suggested in literature. CA* is the long-run equilibrium value, or sustainable value of the current account. Rather arbitrarily, for the first pass, the sustainable value of the current account was set at the 4,5%.

Additional requirement in the FEER calculation is the fact that the equations have been estimated in the dlog form, hence the functions have to be firstly integrated then antilogged. As the variables entering in the import and export equations are not stationary, they were differenced first. Although there are examples in the literature to estimates such series in the levels, i.e. applying cointegration techniques (Genorio and Kozamernik 2001), the short span of the data (10 years of quarterly data) and structural shifts present especially in the first half of the sample, decided against anything but the most robust estimation techniques. Hence the dlog estimation form, even if it adds additional complication for the solving for the RER.

The estimates of X and M are (partly) in dlog form:

$$d\ln X = \alpha_{11} + \alpha_{12} d\ln M^{*} + \alpha_{13}\ln RER + \upsilon_1 \qquad (13)$$

the equation $\frac{CA}{\overline{Y}} = CA^{*} = \frac{e^{\left[\alpha_{11}+\alpha_{12}\ln(\overline{M^{*}})+\alpha_{13}\ln(\overline{RER})\right]} - e^{\left[\alpha_{21}+\alpha_{22}\ln(\overline{Y})+\alpha_{23}\ln(\overline{RER})\right]}}{\overline{Y}}$ (12) should be rewritten because $e^{c_{11}+c_{12}d\ln M^{*}+c_{13}\ln RER} = e^{d\ln X} \neq e^{\ln X}$

The dlog equation is integrated iteratively and solved in terms of initial values and log values of the variables.

$$\ln X_t = \ln X_0 + \alpha_{11} t + \alpha_{12}(\ln M_t^{*} - \ln M_0^{*}) + \alpha_{13}\sum_{i=1}^{n}\ln RER + \sum_{i=1}^{n}\nu_{1t} \qquad (14)$$

$$\ln M_t = \ln M_0 + \alpha_{21} t + \alpha_{22}(\ln Y_t - \ln Y_0) + \alpha_{23} \sum_{i=1}^{n} \ln RER + \sum_{i=1}^{n} \nu_{2t} \qquad (15)$$

The equation $\frac{CA}{\overline{Y}} = CA^* = \frac{e^{\left[\alpha_{11}+\alpha_{12}\ln(\overline{M^*})+\alpha_{13}\ln(\overline{RER})\right]} - e^{\left[\alpha_{21}+\alpha_{22}\ln(\overline{Y})+\alpha_{23}\ln(\overline{RER})\right]}}{\overline{Y}}$

(12) is now:

$$CA^* = \frac{e^{\left[\ln X_0+\alpha_{11}t+\alpha_{12}(\ln \overline{M}_t^* - \ln \overline{M}_0^*)+\alpha_{13}\sum_{i=1}^{n}\ln RER\right]} - e^{\left[\ln M_0+\alpha_{21}t+\alpha_{22}(\ln \overline{Y}_t - \ln \overline{Y}_0)+\alpha_{23}\sum_{i=1}^{n}\ln RER\right]}}{\overline{Y}} \qquad (16)$$

The solution is obtained as the cumulative series of lnRER $\sum_{i=1}^{n} \ln RER$ from which the RER series is then recovered, which then represent the FEER

Driver and Wren-Lewis (1999) show that it is often difficult to produce well defined estimates of trade equations, the underlying trade elasticities, which are central to FEER. This is because the estimated trade elasticities often turn out to be effectively zero.

For the exercise of FEER calculation, "we are not interested in the equation fit, but identifying a long-run equilibrium relationship among variables" (Genorio and Kozamernik, 2004). Put differently, it is necessary to obtain the elasticity of the current account to domestic and foreign output and to the real effective exchange rate, rather then focusing on the precise modeling of trade.

Data

The data sample is from 1994 q2 to 2004 q4, after adjustment for the loss of initial observations due to lagged and differenced variables the results are obtained for the span of 1995 q1 to 2004 q4. Croatian exports and imports of goods and services are from the GDP statistics (source: CBS), at constants prices. For all variables 1997=100. Index of real effective exchange rate is quarterly data, eop, PPI deflated (source: CNB). The foreign

demand is proxied by EU25 imports of goods and services (source: Eurostat), constant prices and exchange rates. EU25 accounted for 65% of Croatian exports in 2004.

Figure 1: Destination of exports

in % of total exports

	2004	cum 2004
TOTAL	**100**	
eu15	**51**	
eu25	**65**	**65**
of which		
-Austria	**9**	
-Italy	**23**	
-Germany	**11**	
-Slovenia	**7**	
Bosnia and Herzegovina	**14**	**79**
YU;Srbija and Montenegro od 02.03.	**4**	**83**
Russia	**1**	**84**
SAD	**3**	**87**

Results

The estimated coefficients are as follows:

Dependent Variable: DLOG(X)

Variable	Coefficient	t-Statistic	Prob.
C**	-5.251365	-2.181759	0.0354
LOG(RER)**	1.104226	2.124240	0.0402
DLOG(M*(-1))***	3.443672	5.009847	0.0000
DLOG(M)***	4.579862	12.15990	0.0000

R-squared	0.809640	F-statistic	53.87378
Adjusted R-squared	0.794611	Prob(F-statistic)	0.000000
S.E. of regression	0.166968	Sum squared resid	1.059375

Dependent Variable: DLOG(M)

Variable	Coefficient	t-Statistic	Prob.
C	0.466114	0.299066	0.7665
DLOG(Y)***	1.092772	4.117664	0.0002
LOG(RER)	-0.098456	-0.292423	0.7715

R-squared	0.304470	F-statistic	8.536183
Adjusted R-squared	0.268802	Prob(F-statistic)	0.000842
S.E. of regression	0.108511	Sum squared resid	0.459208

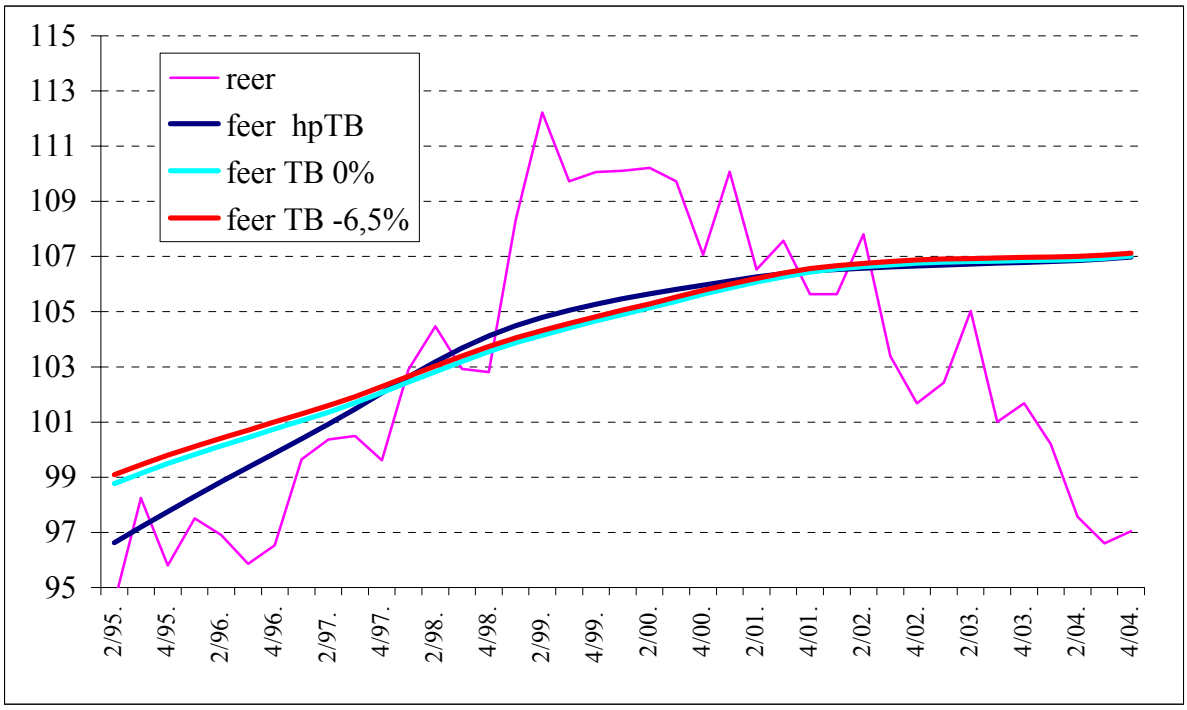
On the estimated equations:
The sign on RER is expected, + in exports equations as increase in the index means depreciation and minus sign, which denotes appreciation in imports equations. However, RER is weakly connected with either imports or exports, although somewhat better in the exports equations. That could weaken the whole FEER exercise, as small coefficients would require a huge adjustment in RER to move the trade balance to a desired level.
The income variables in both equations are much stronger that the price variables, especially for imports. This has been confirmed in previous studies of Croatian trade (Mervar, 2003), where "income elasticites dominates over the price elasticities" (on both import and exports).

Various other variables that were tried, were:
-terms of trade (ratio of exports to imports prices). TOT are sometimes included in trade equations, but in Croatian case did not prove significant. Mervar 2003 uses IRET as a proxy for terms of trade, whereas Genorio and Kozamernik 2004 include both TOT and IREET in the trade equations for Slovenia.
-DOLEUR, or dolar/eur ratio tries to capture the influence on the changes in US dolar/eur on trade, again with little success. Mervar 2003 includes it in the trade specifications. As all variables are in constant 1997 prices, the 1997 dollar / eur ratio (avg 1997 was 1,12 as opposed to 1,36 in 2004) was "frozen" in all series, which was the rational for trying to include in as explicit expression, but it did not prove significant.

-FDI is often included as a very important explanatory variable for exports (Šmidkova et al, 2002). In Croatian case, the FDI flows were mostly directed in services, and have little relevance for export performance, unlike Hungary or Slovakia, that were included in Šmidkova paper.

Also, separate specifications for goods exports and services exports were tried and the combining those to get the trade balance, but the loss of degrees of freedom was not justified with the significantly improved fit.

Figure 2: Actual index of real exchange rate, and various FEER index



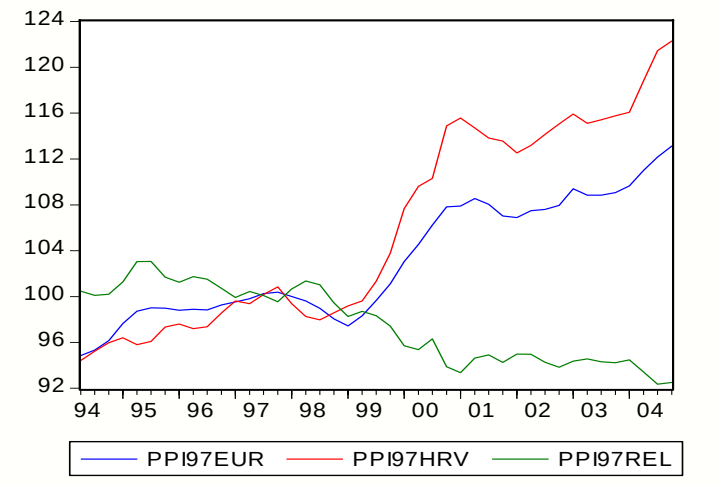
The movement of the REER is characterized by depreciation from 1998 to 1999 due to nominal depreciation of kuna vs. euro (banking crises and loss of confidence in the banking sector and hence in domestic currency). From 2000 onwards, the nominal exchange rate kuna/euro is stable, but the weakening of the dollar contributes to the real appreciation of the exchange rate. The weight of currencies in the REER are as follows:

	ECU/EUR	USD	GBP	CHF	SIT
WEIGHTS	70,6	27,2	1,0	1,0	0,2

Also, the differential in price growth, (faster growth of PPI[1] in Croatia then abroad) with the nominal stability of contributes to the appreciation:

[1] There are methodological difficulties with the way the CBS compiles the PPI. As opposed to the CPI which has recently been revised to be in line with the European HICP, PPI is collected on a very small sample, mainly

Figure 3: PPI for Croatia, EU25, and relative PPI (decrease means the faster price growth at home)



The calculate FEER would suggest that the REER depreciated below[2] its "fundamental" value during the 1998-1999 nominal depreciation, slowly appreciating afterwards. It is worth noting that the kuna/dollar component of REER, which is the main element behind the real appreciation after 2002, is not targeted by monetary policy, as opposed to the nominal kuna/euro exchange rate, whose movements prompt monetary policy reactions (see chapter on Foreign Exchange Regime).

Different specifications of " the equilibrium" trade balance were tried, but due to weak coefficients between the RER and trade balance, the FEERs do not differ significantly. Three target balance specifications were tried: TB of -7% of GDP, TB of 0% of GDP and HP filtered trade balance (actually hpfiltered trade balance divided by hpfiltered GDP). It is worth mentioning that in Croatian current account, strong positive transfers, and (still) weak but negative income, constitute about 2% of GDP, hence improve the TB by a significant amount. A trade balance of about -6,5% would equal current account deficit of some -4,5%. Whether

on big companies that have strong pricing power dur to large market shares. For a complete discussion on Croatian price indexes see:

[2] Note that an increase on the graph represents depreciation and a decrease appreciation.

such ratios would continue, in the light of fact that FDI inflows tend to reverse the income items on the current account after some years, is questionable. If not, this would impact the assessment of the sustainable current account deficit.

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