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FEER ESTIMATES – THE SLOVENIAN CASE

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Abstract:

We estimate the Fundamental Equilibrium Exchange Rate (FEER) for the Slovenian economy and extrapolate it into the next decade. The FEER is defined as the real exchange rate equilibrating the current account when all the involved macroeconomic variables are in equilibrium, making the FEER simultaneously consistent with the internal and external equilibrium. Several specifications for the structural equations for real exports and imports are estimated and combined with different specifications for equilibrium current account to produce a distribution of plausible FEER estimates. We examine how the FEER estimates depend on the specification of the underlying equilibrium structure and how the latter affects the out-of-the-sample FEER distribution dispersion over time. We find that the mean and the median of the distribution of the FEER estimates are both very close to the current real exchange rate and are expected to remain so in the future.

Key words: Equilibrium real exchange rate, ERM II, central parity

Povzetek:

V prispevku oceniva realni ravnotežni tečaj za slovensko ekonomijo in njegovo projekcijo do konca desetletja. Realni ravnotežni tečaj je definiran kot realni tečaj, ki uravnoteži tekoči račun plačilne bilance, kadar so vse makroekonomske spremenljivke na svojih ravnotežnih ravneh. Tako je ravnotežni tečaj hkrati skladen z notranjim in zunanjim ravnotežjem. Oceniva večje število specifikacij strukturnih enačb za realni izvoz in uvoz, s katerimi v povezavi z različnimi predpostavkami o ravnotežnem tekočem računu pridobiva distribucijo ocen verjetnih ravnotežnih realnih tečajev. Analizirava, kako so ocene ravnotežnega tečaja odvisne od specifikacije ekonomske strukture in kako slednja vpliva na projekcijo distribucije verjetnih ravnotežnih tečajev. Ugotoviva, da sta tako povprečje kot mediana distribucije ocen ravnotežnih tečajev zelo blizu trenutni vrednosti realnega tečaja, to pa je pričakovati tudi v prihodnje.

Ključne besede: Realni ravnotežni tečaj, ERM II, centralna pariteta

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1. INTRODUCTION

The real exchange rate (RER) is recognized in economic theory and policy as one of the key macroeconomic variables, in particular in the case of a small open economy. It determines the relative price of domestic and foreign goods and therefore impacts their demand and price behavior. A RER below its equilibrium value stimulates the demand through increased exports but produces inflationary pressures especially as the aggregate demand reaches its supply potential. An appreciated RER conversely decreases the demand for domestically produced goods, depresses the domestic output growth and generates downward pressures on inflation. This output-inflation trade-off related to the RER is particularly relevant in the perspective of the decision on the central parity at the ERM II entry and the euro adoption later on. A significant departure of the RER implied by the central parity from its equilibrium value may indeed either exacerbate the inflation pressures and demand if the RER is too depreciated or contract the economic activity and prices if the RER is too appreciated. This motivates evaluating how the actual RER compares to its equilibrium and how this relationship may evolve in the future.

The purpose of this paper is to estimate the Fundamental Equilibrium Exchange Rate (FEER) in the case of the Slovenian economy. The basic idea underlying the FEER analysis is that the desired external equilibrium can be achieved by RER adjustment that is simultaneously consistent with the internal equilibrium. We also evaluate how the FEER changes when fundamental macroeconomic variables evolve over time and extrapolate its estimates into the future decade.

The method we apply inspires from the standard IMF method, as for example in MacDonald (2000). The minimal requirements for calculating the FEER are the elasticities of exports and imports to the RER, the long-term sustainable (equilibrium) current account (CA) and the potential GDP and the potential foreign demand. These elements constitute the structure of the underlying long-run economic equilibrium. This enables to compute the RER that is compatible with the existence of fundamental macroeconomic equilibrium, i.e. implying the external equilibrium (equilibrium CA) and consistent with the internal equilibrium (zero output gap). The applied FEER methodology also describes the macroeconomic equilibrium with respect to other fundamental economic variables, which enables to identify how the FEER evolves over time when these variables change. In this sense, the method takes into account the relevant underlying economic structure and should deliver an equilibrium exchange rate that is consistent with ideal or long-run equilibrium economic conditions.

Since at this stage it is difficult or impossible to determine a priori what the true structure underlying economic equilibrium is, we choose to construct and to compare several plausible specifications. Each specification of the economic equilibrium is consistent with one FEER, so that we end up with a distribution of plausible FEER estimates, that can be compared to the actual RER at several points in time. Technically, we start estimating two structural equations describing the behavior of real exports and real imports. These are then multiplied by the export and import prices respectively and subtracted to constitute the CA. When the intervening macroeconomic variables are replaced with their long-run equilibrium values, so that the internal equilibrium is assumed to hold, there is only one RER consistent with the external equilibrium. This RER equilibrates the CA and is defined as the FEER of this particular long-run economic structure. With various structural equation specifications and various long-run equilibrium specifications in the intervening variables we end up with a distribution of various FEER estimates.

We find that the FEER estimates consistent with various plausible underlying equilibrium structures are not very dispersed and the central value of the distribution is very close to the actual RER level. The means and the medians of the FEER estimates distribution currently locate between –0.2 and 0.02 percents deviation from the RER, where the negative value stands for a depreciated and the positive value for an appreciated RER relative to the FEER. Nevertheless, the FEER estimates are sensitive to the specification of the underlying economic structure and the specification of the equilibrium values of the fundamental variables. The principal impacts are the way the terms of trade (TT) intervene in the structural equations, the differential in the impact of import and export demand and the specification of the equilibrium CA. Also, as the out-of-the-sample time horizon increases, the distribution of the FEER estimates becomes more dispersed. While currently 90 percent of the FEER distribution mass locates in the approximate interval between -2 and 1.6 percents deviation from the current RER, this interval spreads from –2 to 4.5 percents deviation from current RER at the end of 2010. The slight tendency towards depreciation is required because of the higher real equilibrium growth in imports in comparison to the real growth in exports deteriorating the CA, *ceteris paribus*. Nonetheless, this effect is small and partly offset by a weakly improving trend in the TT extrapolation, appreciating the FEER. We argue heuristically that, given the plausible future long-run evolution in the TT and the exports and imports demand, the future FEER distribution may be more narrow and should not depart significantly from the current RER.

Some policy implications arise from the evidence that the current and future FEER may be close to the current RER. First, this indicates that the current RER level is not affecting the international competitiveness and/or producing upward or downward pressures on inflation. The results even indicate that the current RER is, if anything, slightly appreciated with respect to the likely current and future FEER. Second, if the RER is found close to the actual and future FEER and if the inflation stabilizes on its long-run equilibrium value, the central parity chosen at the entry into the ERM II should not deviate from the actual value of the nominal exchange rate. And third, if the RER can be assumed close to the FEER, it may be appropriate to avoid an exchange rate policy that would result in a significant RER deviation from its current value. An example of this is an aggressive RER based disinlfation policy, where it is difficult to evaluate how the price or the quantity adjustment would operate to restore the equilibrium.

A review of theoretical foundations and some applications of the FEER is provided for example in Williamson (1994). Dolado and Viñals (1991) present a simple application, based upon a single equation for the CA. Similar methods are applied, often with more than one equation or even complete model structures and amended with additional elements determining the equilibrium CA. Some examples are Church (1998), Costa (1998), Šmidkovà (1998), Beguna (2002), Pattichis, Maratheftis and Zenios (2002). The usefulness of the FEER in the perspective of the euro adoption process, and the feedback effect of this process on the FEER is examined in Csajbók and Kovàcs (2002). Strojan (2001) has previously estimated the FEER for Slovenia. She found in particular that the RER in 2000 was in line with the FEER and that the FEER should remain stable in the future if the behavior of the fundamentals is not altered.

The rest of the paper composes of two sections and a conclusion. Section two presents the estimated model and defines various FEER specifications. The results are outlined in section three. In the conclusion we discuss some implications of the results and provide some directions for further research.

2. THE ESTIMATED MODEL

The estimated model specification consists of two structural equations, one for real exports and one for real imports. Together with the export and import prices they determine the current account. We define the FEER as the RER that implies the equilibrated current account, when all macroeconomic variables are at their long-run equilibrium levels. The FEER therefore corresponds to the simultaneously met internal and external equilibrium.

2. 1. The estimation of behavioral equations for real exports and imports

The two behavioral equations aim at assessing the long-run structural relationships among the intervening variables. They bear the interpretation of the cointegration vectors and therefore enter the model in (log) levels. In this early attempt to estimate the FEER in the case of the Slovenian economy we concentrate to the very simple, but still arguably complete, specification of the model.

The explanatory variables for real exports X are the producer price index (PPI) based RER, the imports of eight Slovenian major trade partners and the terms of trade. In real imports M equation, the explanatory variables are the PPI based RER, the real domestic GDP growth multiplied by the openness to trade of the Slovenian economy and the terms of trade (TT). Both equations include a constant term and the residual ε_i, interpreted as the cointegration vector corresponding to the movements of the described relationship around its long-run equilibrium.[2] Recall that since variables are specified in logarithms, the coefficients represent the elasticity of the endogenous variable to the change in the explanatory, i.e. the percentage change in the former to the percentage change in the latter. Formally, the estimated system of equations takes the following form:

$$\ln(\mathrm{X}) = c_{11} + c_{12}\ln(\mathrm{M}^*) + c_{13}\ln(\mathrm{RER}) + c_{14}\ln(\mathrm{TT}) + \varepsilon_1 \quad (1)$$

$$\ln(\mathrm{M}) = c_{21} + c_{22}\ln(\mathrm{Y}) + c_{23}\ln(\mathrm{RER}) + c_{24}\ln(\mathrm{TT}) + \varepsilon_2 \quad (2)$$

To assess the robustness of the estimates, we compute four illustrative specifications for each of the two equations, with different sets of included explanatory variables or constraints on coefficients. The first specification of both equations is the full form presented in (1) and (2). The second specification imposes the exclusion restriction on the TT, i.e. $c_{14} = 0$ and $c_{24} = 0$. The third equation specification includes all the variables in (1) and (2), but imposes the additional restriction on the coefficients c_{12} and c_{22}:

$$c_{12}\,\mathrm{d}\left(\ln\left(\overline{\mathrm{M}^*}\right)\right) = c_{22}\,\mathrm{d}\left(\ln\left(\overline{\mathrm{Y}}\right)\right) \quad (3)$$

where the upper bar indicates the long-run equilibrium trend of the variable. This restriction imposes that the quantity measured exports and imports increase at the same rate, ceteris paribus. This obtains by equalizing the elasticity of real exports to world imports multiplied by the long-run growth in world imports to the elasticity of real imports to domestic demand multiplied by the long-run growth in domestic demand. It implies that, if there is no (long-run or permanent) change in either TT or in the RER, there is no long-run impact on export and import quantities differential, and consequently on the CA (because of the invariant

[2] This interpretation is allowed since the theory suggests that if the intervening variables grow at constant rates in the long-run (or are stationary), the linear combination among the variables arising from the regression equation produces a stationary residual.

TT). This is intuitively interesting to examine since, if this condition is not respected, the RER exchange rate should exhibit a long-run trend to prevent the CA to continuously improve or deteriorate, while in this specification quantities adjust to equilibrate the CA. A RER trend (not offsetting the long-run movements in the TT) is implausible in the long-run, if the market structure is competitive, suggesting an adjustment in quantities implicit in this restriction. The fourth specification also imposes this cross-equation restriction and in addition the exclusion restriction on the TT $c_{14} = c_{24} = 0$.

Other variables may enter the model. Researchers often include the government sector, the (real) interest rates when the national debt service burden is important, etc. We leave to future work the examination of the effects of these additional FEER or long-run equilibrium CA determinants.

The system is estimated by the ordinary least squares (OLS). OLS give the consistent estimates for the cointegrating vectors, which represents the long-run structural equation for exports and imports.[3] The first two specifications can be estimated separately, while the last two are estimated jointly to impose the cross-equation restriction on coefficients.

2. 2. The long-run equilibrium values of exogenous variables

In this attempt to identify the FEER, we need to define the long-run equilibrium of the variables that determine the FEER. To give an idea about the plausible interval for the FEER values, we compute several plausible macroeconomic equilibria, each of these consistent with one FEER. We first discuss the examined long-run equilibrium specification for the CA and then the long-run equilibria for other intervening variables.

To represent the equilibrium CA we propose four plausible specifications, illustrative of different macroeconomic configurations. All equilibrium specifications are represented on *figure 1*, together with the actual CA. The actual CA displays in the beginning of the nineties a substantial surplus, Slovenia being a net exporter even as a former Yugoslav republic. This initial position is also taken into account in some of the proposed long-run equilibrium CA. The initial net surplus progressively decreased, with the collapse of the trade with the former Yugoslavia and the inability to substitute it completely with other markets. The CA in addition significantly deteriorated in 1999 with the anticipation of the VAT introduction.

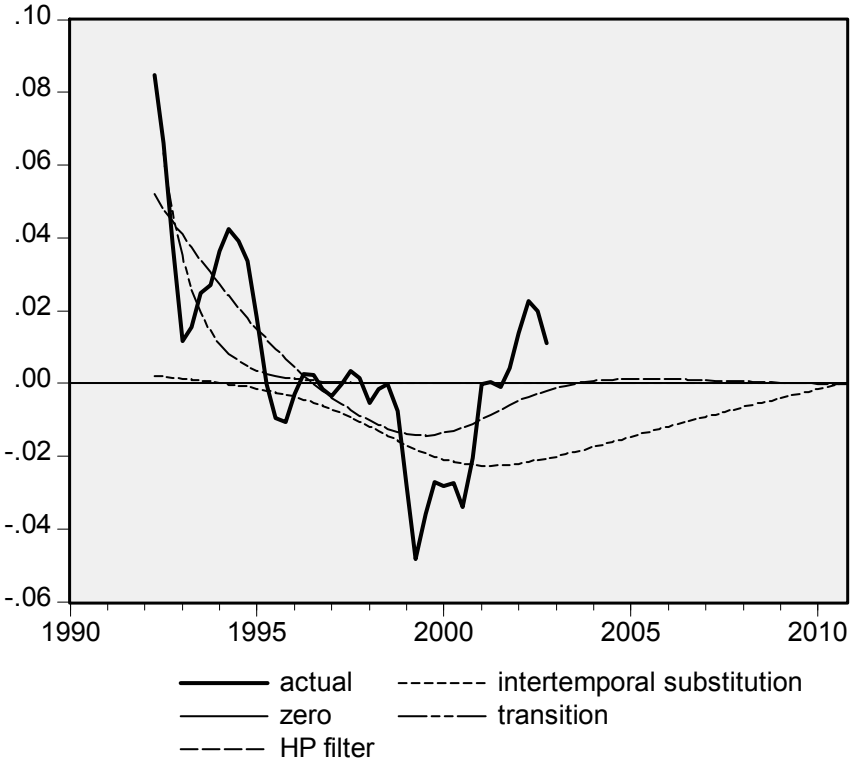
The first obvious candidate is the CA always equal to zero. But the long-run equilibrium is not necessarily zero in a country undergoing a transition and a convergence process towards more developed countries. It may indeed be optimal to borrow at early stages of this process in the view of the intertemporal consumption smoothing or accelerating the convergence process itself. To account for that possibility, the second specification is the HP filter trend of the actual CA, that is the CA series from which the high frequency and

[3] The OLS estimates of the parameters in the cointegration vector are actually "superconsistent", eliminating the endogeneity bias at a rate T rather than √T as usual. A procedure that minimizes the sum of squared residuals should quickly converge to the true parameter as the sample size grows, since alternative parameter values, in the case of the cointegration vector, give rise to an I(1) residual, with infinite variance and a very high sum of squared residuals.

In practice, however, the "superconsistency" doesn't always manifests itself in small samples. In estimating the cointegration vectors, some Monte Carlo studies have suggested that including short-run dynamics elements in the equation specification improves the efficiency of the estimate, as for example in Banerjee et al. (1986). In this first attempt, we do not include any short-run dynamics since there is no *a priori* way to determine its specification. We prefer to circumvent the problem of robustness of the estimates by proposing several specifications of the estimated system.

the business cycle frequency components are removed.[4] The underlying idea is that the component of the series that cannot be altered by business cycle or price movements adequately represents the long-run real equilibrium. The third equilibrium CA, the "intertemporal substitution" is the extreme idea of borrowing at the early stages of the transition so that the CA remains negative for roughly two decades. The maximum equilibrium CA deficit of slightly less than 3% of GDP is progressively attained after roughly ten years of the transition after what it improves towards the equilibrium of zero.[5] The last equilibrium CA specification, "transition" equilibrium, is the CA decreasing towards zero during the transition period up to 1995, and zero afterwards. All these constraints are assumed to be sustainable in the long-run, which is not a strong assumption given the very low Slovenian net debt and the relatively moderate CA deficits we examine.

Figure 1: The CA and its long-run equilibrium specifications



To proxy the long-run equilibrium values of the explanatory variables, we take their loglinear time trend, an alternative trend specification or the trend-component extracted by the Hodrick-Prescott (HP) filter. All explanatory variables and their equilibrium representations are shown in *appendix 2*. For the real variables supposedly increasing at a constant rates on the long-run we use the loglinear trend to represent their long-run equilibrium movements. These variables are the foreign demand for imports, the domestic real GDP and the openness to trade. For the price deflators for imports and exports, that compose the terms of trade, we similarly propose the a trend specification, but together

[4] Since we operate with the quarterly data, we use the standard value of 1600 for the HP filter smoothing parameter.

[5] Technically, it is constructed as the HP trend of the series composed of the max(0, actual CA) until 2000 q4 and a linearly decreasing trend from the 2001 q1 CA actual value towards 0 in 2010 q4 afterwards.

with the HP trend alternative. In the case of the trend, it is assumed that these variables will continue to grow at some rate in the future. The "trend" results from the regression of the TT on a constant and the inverse of the trend in order to capture adequately the in-the-sample long-run dynamics in the TT. In the HP trend case, the in-the-sample long-run movements in these variables are captured more accurately. In addition, in the HP case we assume that the future equilibrium of variables is their current value. Such an assumption is common when the variables are suspected to follow a random walk, the current value of the variable being also best expectation of its future values.

Several specifications of the CA equilibrium and long-run equilibria in other variables are useful to evaluate the sensitivity of the results. This is particularly true in an economic environment where the standard statistical tests are of limited power due to a relatively short data sample. For each of the long-run equilibrium combinations in intervening variables a solution for the FEER can be computed. Next section defines the FEER as the RER simultaneously consistent with the external and internal macroeconomic equilibrium.

2. 3. The FEER as the long-run equilibrium real exchange rate

The fundamental macroeconomic equilibrium obtains by equilibrating the CA with the above export and import relationships, appropriately deflated, and replacing for the explanatory variables with their long-run equilibrium values. The equilibrium CA is therefore simultaneously consistent with of the internal equilibrium, i.e. zero output gap. We express real exports and imports in value (dollar) terms by multiplying them by their respective price deflators. Subtracting from the value of the exports the value of the imports yields the current account. To work in terms of the CA as the ratio to GDP, the CA value in dollars is divided by the loglinear trend in the domestic GDP in dollars.

$$\begin{aligned} \mathrm{CA}_{\$} &= p_{\$}^{\mathrm{X}}\,\mathrm{X} - p_{\$}^{\mathrm{M}}\,\mathrm{M} \\ \frac{\mathrm{CA}_{\$}}{\overline{\mathrm{Y}_{\$}}} = \mathrm{CA}_{\%\mathrm{Y}} &= \frac{\begin{array}{r} p_{\$}^{\mathrm{X}} \exp\left(c_{11} + c_{12}\ln\left(\mathrm{M}^{*}\right) + c_{13}\ln\left(\mathrm{RER}\right) + c_{14}\ln\left(\mathrm{TT}\right)\right) \\ - p_{\$}^{\mathrm{M}} \exp\left(c_{21} + c_{22}\ln\left(\mathrm{Y}\right) + c_{23}\ln\left(\mathrm{RER}\right) + c_{24}\ln\left(\mathrm{TT}\right)\right) \end{array}}{\overline{\mathrm{Y}_{\$}}} \end{aligned} \tag{4}$$

Where the upper bar again indicates that the variable is included in its long-run equilibrium specification. The long-run equilibrium is defined as the state of the economy where all the intervening macroeconomic variables adopt their long-run equilibrium values. The FEER is therefore the solution for RER in

$$\mathrm{CA}^{*}_{\%\mathrm{Y}} = \frac{\begin{array}{r} \overline{p_{\$}^{\mathrm{X}}} \exp\left(c_{11} + c_{12}\,\overline{\ln\left(\mathrm{M}^{*}\right)} + c_{13}\ln\left(\mathrm{RER}\right) + c_{14}\,\overline{\ln\left(\mathrm{TT}\right)}\right) \\ - \overline{p_{\$}^{\mathrm{M}}} \exp\left(c_{21} + c_{22}\,\overline{\ln\left(\mathrm{Y}\right)} + c_{23}\ln\left(\mathrm{RER}\right) + c_{24}\,\overline{\ln\left(\mathrm{TT}\right)}\right) \end{array}}{\overline{\mathrm{Y}_{\$}}} \tag{5}$$

where $\mathrm{CA}^{*}_{\%\mathrm{Y}}$ corresponds to the equilibrium CA. The simple logic underlying *equation (5)* is that, given the equilibrium in all intervening macroeconomic variables, there is only one RER that is consistent in addition with the $\mathrm{CA}^{*}_{\%\mathrm{Y}}$, the FEER.[6]

[6] The numerical solution to this non-linear one equation-one unknown problem is straightforward. Popular iterative algorithms included in most econometric packages are the Newton-Raphson or Gauss-Seidel methods.

2. 4. Data

The data sample used in the econometric evaluation spans from 1992 q2 to 2003 q2, which gives 41 usable observations. The CA is taken from the Balance of Payments, available in dollar terms. It is divided by the loglinear trend in GDP in dollar terms to obtain the CA in percentage of the GDP. The RER is computed as the ratio of German to domestic PPI, multiplied by the nominal exchange rate to euro (beforehand the EMU, the ECU). Higher values of the RER therefore represent a real depreciation. The PPI is used to avoid Balassa-Samuelson effects that introduce a trend in the standard CPI based RER. Since the PPI is significantly more related to tradable goods, it is probably less subject to these effects. The foreign demand for imports M^* is an index, computed as weighed sum of imports in eight Slovenia's major trading partners, in dollar terms. The weight used for a particular country is its share in Slovenian exports in 1995, the sum of weights being normalized to one. The domestic demand Y is the Slovenian real GDP from the National accounts. Real exports X and imports M are taken from the National Accounts and interpolated for the period where not available quarterly. The export prices $p_{\$}^{X}$ and the import prices $p_{\$}^{M}$ obtain as implicit deflators of the exports and imports in dollars to real exports and imports from the National Accounts. The ratio of the export prices to the import prices is defined as the TT. All series are filtered to remove the seasonal and high frequency irregular components.

3. RESULTS

In this section we discuss the obtained results. First we examine the estimates for real exports equation specifications, and proceed by analyzing the estimates for real imports. We then present the FEER estimates consistent with various configurations of the underlying macroeconomic equilibria. We discuss the in-the-sample fit of the FEER estimates and compare their distribution with the current RER value at the current some future dates.

3. 1. Estimates of the equation for real exports

The coefficients estimates of the four equation specifications for real exports are represented in *table 1*. Since we are not interested in the equation fit, but in identifying a long-run equilibrium relationship among the intervening variables, only the tests for the stationarity of the residual are provided as criteria to evaluate the equation quality. There is indeed no *a priori* reason to prefer a specification producing the smaller (sum of squared) residual (cointegration vector), since the latter is interpreted as the cyclical deviations from the long-run equilibrium, as is a standard interpretation for the cointegration vector in macroeconometrics. The deviations from the equilibrium can be large or small, but must be stationary. We test for the stationarity with the two standard unit-root tests, the Augmented Dickey-Fuller and the Phillips-Perron tests.[7]

The coefficients on real imports of main trading partners M^* and the RER intervening in the cointegration vector are in all specifications of the right sign and of the plausible order of magnitude. The elasticity of real exports X to real imports of main trading partners M^* is close to 1, between 0.904 and 0.990 given the equation specification. The long-run elasticity to the RER is as expected positive, higher RER standing for real depreciation of the domestic currency. The range of the coefficients over various specifications is fairly

[7] Stock and Watson (1988) is a useful overview on cointegration analysis and the interpretation of cointegration vectors.

narrow, between 0.361 and 0.521, and all are significantly different from zero at 1% confidence level and 5% confidence level in specification 4. That means that, if the currency permanently depreciates by 1% (i.e. increase the RER by 1%) real exports increase, *ceteris paribus*, by roughly between 0.35 and 0.55%.

Table 1: Specifications of the equations for real exports

Specification	Coefficients of the explanatory variables				Stationarity of the residual	
	constant	ln(M*)	ln(RER)	ln(TT)	ADF[1]	Phillips-Perron[1]
1	6.657***	0.939***	0.361***	-	-2.9418***	-2.2243**
2	6.143***	0.919***	0.493***	0.229	-2.7653***	-1.8009*
3	5.589***	0.957***	0.516**	0.133	-2.7915***	-1.9000*
4	5.677***	0.990***	0.521**	-	-2.7139***	-1.9711**

*** represents a 1%, ** 5% and * 10% level of significance.
[1] Using MacKinnon critical values for rejection of hypothesis of a unit root.

The impact of the TT is positive, but is not significantly different from 0 at a usual 5% confidence level. It is unclear in what direction real exports should react when the TT increase, that is when the price of exports rises (relative to the price of imports), in particular for a price taker country as is Slovenia. On the one hand, if the export prices increase because of the higher demand for the exported goods one expects a positive relationship between X and TT. On the other hand, if the price increase is due to other than demand factors, a higher price should decrease the real demand for these goods, thus implying a negative relationship between X and TT. There seems to be some evidence, in the case of Slovenia, that the former effect dominates over the latter.[8]

The ADF tests for stationarity of the cointegration vector all reject the hypothesis of a unit root at a highest confidence level. The Phillips-Perron test also provides evidence in favor of a stationarity of the cointegration vector, but a lower significance level. It rejects the unit root hypothesis twice at a 5% confidence level and at 10% in the remaining two equation specifications.[9] The results are nevertheless satisfactory, given the relatively short data range. The cointegration vectors are presented in *appendix 1*. It is often useful to check visually the cointegration vectors to get an idea whether they really represent the cyclical deviations (the movements at a business cycle frequency) around some long-run equilibrium. Given the standard view that the business cycle frequency lays between 6 and 32 quarters,[10] the cointegration vectors may be (subjectively) accepted as a fairly good representation of the business cycle movements around the long-run equilibrium.

3. 2. Estimates of the equation for real imports

Table 2 displays the coefficients and the tests for stationarity of the four specifications for real imports. The graphical representations of the corresponding cointegration vectors are again shown in *appendix 1*.

[8] Given this explanation it is not clear whether to include the TT or the export prices $p_{\$}^{X}$ in real exports equations. In this first attempt we preferred the TT as a relative price of exports and imports, but amending the equation with $p_{\$}^{X}$ may be worth examining in the future.

[9] All unit root tests are performed on levels of the residuals, without trend or constant terms, and with one lagged difference.

[10] See, for example, Baxter and King (1999).

Table 2: Specifications of the equations for real imports

Specification	Coefficients of the explanatory variables				Stationarity of the residual	
	constant	ln(Y)[2]	ln(RER)	ln(TT)	ADF[1]	Phillips-Perron[1]
1	-0.759	1.531***	-1.556***	-	-2.8657***	-4.2677***
2	-1.617	1.454***	-1.146***	open./2[3]	-2.9466***	-4.3996***
3	-0.829	1.416***	-1.206***	open./2[3]	-2.9290***	-4.5097***
4	0.584	1.466***	-1.656***	-	-2.9100***	-4.4471***
2 unconstr.	-3.224**	1.319***	-0.402	1.744***	-4.6850***	-4.0551***

*** represents a 1%, ** 5% and * 10% level of significance.
[1] Using MacKinnon critical values for rejection of hypothesis of a unit root.
[2] Domestic output times the openness.
[3] Contrained to openness/2.

Conversely to the case of real exports, the impact of the inclusion of the TT in the equation is puzzling. If the coefficient on the TT is free, it leads to two fairly different sets of real imports specifications, that excluding and that including the TT. In the first case real imports are highly and positively reactive to a real appreciation (a fall in RER). The result is plainly consistent with the theory and the coefficient on ln(RER) respects a 1% statistical significance level. In the second case, as can be seen in the unconstrained specification 2, the TT exert a large and positive impact on real imports, and the RER impacts becomes barely significant. From the theory we do expect a positive impact of the TT, since an improvement in the TT increases the nation's wealth and allows, for example, to increase imports.[11] But the very high elasticity of real imports to the TT, c_{24}, is questionable. This elasticity is estimated to be larger than 1.7, and therefore more than offsets the small increase in real exports (c_{14}) and the direct TT price effect on the CA. Since the imports would increase in value by more than exports the CA deteriorates following an improvement in the TT, which calls for the need of depreciating the currency to restore the equilibrium. Therefore the FEER would depreciate in that specifications, if the TT improve. Note also that an appreciating RER still increases real imports, but this effect is barely significant. We prefer to reject this possibility. Nevertheless, we want to examine the impact of an inclusion of the TT into the equation since we suspect, given the results of the unconstrained regression, that this impact might be relevant. Therefore, a good candidate for the elasticity of real imports to the TT is the half (long-run trend in the) openness to the international trade. This choice is motivated because, given the definition of the CA in *equation (4)* and recalling the TT are defined as the ratio of the export prices to the import prices, openess/2 represents the total direct improvement of the CA in percents when the TT improve by one percent (at the margin and if the CA is close to equilibrium). The high effect on imports due to the TT improvement, interpreted as the wealth effect, thus strongly offsets the above direct price effect on the CA, but still insufficiently to generate a CA deficit.[12] We shall carefully analyze how this assumption impacts the FEER later on.

[11] For more on the related theory, see for example Obstfeld and Rogoff (1996), chapter 4.

[12] Several additional arguments support this way to proceed, in this early attempt to estimate the FEER, and suggest that further investigation is needed in the future. First, the large coefficient on the ln(TT) may be related to the short-to-medium-term impact rather than the long-run one. If economic agents indeed expect the improvement of the TT to be temporary, i.e. not a long-run, they may found optimal substitute the future relatively more expensive imports for current, relatively cheaper imports. This may substantially increase current imports in the short-to-medium-run producing a high estimated coefficient on the ln(TT). These intertemporal substitution effects might therefore prevent to identify the true long-run effect, at least in the proposed specifications of the equation for M.

Second, a strong negative correlation between ln(TT) and ln(RER) of -0.6036 might generate overfitting in the estimation of the equation. We do not think this is a case here because, in practice, overfitting produces large and highly significant coefficients in both variables. Here only the coefficient on ln(TT) is highly

The constraint on the TT coefficient produces the estimates in the specifications 2 and 3 in *table 2*. The coefficient on the RER now appears more stable across all proposed specifications, varying between -1.14 and -1.65, but it remains lower in the case the TT enter the equation.

The elasticity on real domestic demand Y is statistically very significant and seemingly high. It is larger than one, ranging form roughly 1.41 to 1.55, given the equation specification. The reason for this is, we believe, that the average price level of the GDP, which includes non-tradable goods (services subject to Balassa-Samuelson effects[13]), increases relatively to the price of imports, mostly industrial goods and raw materials. For each percentage point of growth in real GDP, more than one percentage point of real imports is needed to match in value.

The tests for stationarity of the cointegration vectors unanimously reject the unit root hypothesis at the highest level of significance. This holds for both the ADF and the Phillips-Perron test. On the graphs of the *appendix 1*, one can see that the departures from the equilibrium are somewhat larger than in the case of exports. Even though the stationarity of the cointegration vector is well established, the volatility of real imports around the equilibrium seems larger than that of real exports.

3. 3. The FEER estimates

In this section the likely range for the Slovenian FEER is evaluated and how it may evolve over time. Each combination of the long-run equilibrium conditions and the specification of the underlying economic structure is consistent with a different FEER. The combinations we select to illustrate the possibilities for the FEER are the following. The equation specifications are combined into six underlying economic structures, (1, 1), (2 ,2), (1 ,2), (2 ,1), (3 ,3), (4, 4), where the first index indicated the specification for exports and the second the specification for imports. To each of the six structural specifications are successively associated the four equilibrium CA specifications. Finally, we distinguish between the two long-run descriptions of the TT and the corresponding import and export prices: the non-linear extrapolated trend an the HP filter trend, stabilized at the current value out-of-sample. Recall from section 2. 2 that the other intervening variables are assumed to have only one possible long-run equilibrium path.

The 48 resulting combinations specifying the long-run equilibrium are displayed in *table 3*, together with the corresponding FEER at various dates. The second and the third column of *table 3* show the structural equation specification used for respectively X and M. The fourth column shows the related CA specification: "0" for the zero equilibrium CA, "hp" for the HP filter trend, "int-sub" for the intertemporal substitution CA specification and "transit" for the transition CA specification. The TT specification is shown in the sixth column and the implied FEER values for interesting dates in columns seven to eleven.

The values for the FEERs are given in percentage deviation form the current (last available RER) observation, the second quarter 2003. A positive (negative) number states that the FEER is larger (lower) than the RER, that is the current RER is appreciated

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significant. Note also that the large significance of the ln(TT) coefficient doesn't come from a possible spurious regression problem, since it is hardly imaginable (and easy to show) that ln(TT) and ln(M) share common trend.

Third, future work must examine whether there is no omitted variable problem in this equation, what may strongly boost the coefficient on ln(TT) if the omitted variable is correlated with the TT and M.

[13] The CPI gains roughly 2 percentage points over the PPI on a yearly basis and in the long-run. See for example Kozamernik (2003).

(depreciated) respectively to the equilibrium. The dates chosen for the FEER representation are illustrative in the view of the possible Slovenian scenario for the adoption of the euro. The 2003 q2 column represents the current situation. The column 2005 q1 and 2008 q1 respectively represent a possible the entry into the ERM II and the EMU. The column 2010 q4 is indicative of what can be expected if the entry into ERM II or EMU is postponed.

We observe that the FEER estimates are dependent upon the specification of the underlying equilibrium structure. In addition they are both positive and negative, indicating that there is no unanimous way to conclude that the currency is depreciated or appreciated with respect to the equilibrium. Finally, we observe that the deviations from the current FEER slightly increase over time, in both directions. The resulting FEER indeed continues to (moderately) appreciate if it is currently appreciated respectively to the RER and conversely if it is currently depreciated. In the rest of this section we intend to interpret these results, but before we provide an additional criterion in an attempt to distinguish the more likely structures from the less likely.

The weights listed in the sixth column of *table 3* propose a ranking to differentiate between more and less likely long-run equilibrium structures. The weights base upon the ability of the implied FEER to qualify as good representation of the long-run equilibrium of the actual RER. Therefore we want to put a higher weight on the long-run equilibrium structures that imply a higher probability that the implied RER movements are stationary around the implied FEER.[14] Of course, this is an *ad hoc* indicator and is to be used with some care. The idea of stationarity is again used because one expects (following in that the prediction of the theory) that the actual RER converges to its FEER in the long-run. A higher weight corresponds to a higher probability that the deviations of the in-the-sample RER from the particular FEER are stationary, in turn indicating a higher probability that the FEER is the true long-run equilibrium and its underlying long-run economic structure the true one.

We start by examining how the FEER estimates compare with the actual FEER in-the sample. On *figure 2a and 2b* some FEER estimates are compared to the actual RER. We represent the FEER estimates for each possible underlying economic structure, but with the long-run equilibrium specification "transit" for the CA. *Figure 2a* displays a "hp" specification, while *figure 2b* shows the "trend" specification for the TT. These specifications are chosen because they always display a high weight, indicating a high probability that they are close to the true one.

The in-the-sample fit of all specifications is fairly good. Since both variables are represented in logarithmic scale, (hundred times) the difference of two variables is their percentage deviation. There are no large deviations, say more than ten percent, during the whole in-the-sample period and for all estimates. The FEER estimates seem to successfully mimic the long-run trend in the RER. The initial fall in the FEERs is due to the progressive fall in the "transit" equilibrium CA specification, requiring *ceteris paribus* a real appreciation of the currency. At the last available date, all FEER estimates are rather close

[14] Technically, the indicator is constructed as follows: $\text{ceiling}\left(\text{ADF test stat} / 1\%\ \text{critical value}\right)^2$. ADF test stats results from the unit root test in the difference between the RER and the particular FEER. The 1% critical value is the MacKinnon critical value for the rejection of hypothesis of a unit root. Taking the square increases the dispersion of the indicator, giving even more weight to the structures implying highly stationary differences between FEER and REER. The ceiling function rounds up the indicator to the closest integer. We prefer an integer measure of weight, since that enables later on to easily construct a weighed distribution of the FEERs, by including each FEER as additional observation a number of times equal to its weight.

Table 3: FEER specifications estimates – deviations from the current RER value

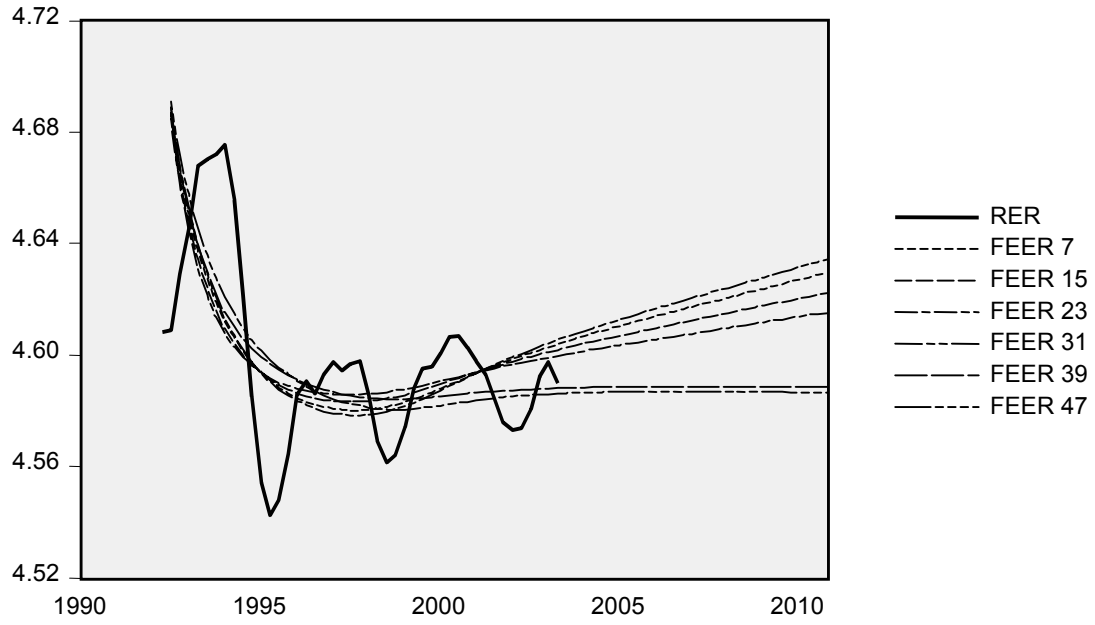
FEER	X	M	CA	TT	weight	2003 q2	2005 q1	2008 q1	2010 q4
1	1	1	0	hp	5	0.01378	0.02038	0.03045	0.03949
2	1	1	0	linear	5	0.00117	0.00488	0.01220	0.01959
3	1	1	hp	hp	5	0.01321	0.02130	0.03082	0.03930
4	1	1	hp	linear	5	0.00064	0.00577	0.01255	0.01940
5	1	1	int-sub	hp	4	-0.00244	0.00866	0.02548	0.03961
6	1	1	int-sub	linear	4	-0.01421	-0.00644	0.00732	0.01971
7	1	1	transit	hp	6	0.01378	0.02038	0.03045	0.03949
8	1	1	transit	linear	6	0.00118	0.00488	0.01220	0.01959
9	2	2	0	hp	4	0.01170	0.01691	0.02498	0.03226
10	2	2	0	linear	5	0.00303	0.00634	0.01273	0.01909
11	2	2	hp	hp	5	0.01104	0.01800	0.02541	0.03202
12	2	2	hp	linear	5	0.00241	0.00739	0.01314	0.01886
13	2	2	int-sub	hp	3	-0.00741	0.00308	0.01910	0.03240
14	2	2	int-sub	linear	3	-0.01499	-0.00692	0.00700	0.01923
15	2	2	transit	hp	6	0.01170	0.01691	0.02498	0.03226
16	2	2	transit	linear	6	0.00303	0.00634	0.01273	0.01909
17	1	2	0	hp	4	0.00955	0.01347	0.01963	0.02519
18	1	2	0	linear	4	0.00367	0.00635	0.01144	0.01646
19	1	2	hp	hp	5	0.00883	0.01465	0.02009	0.02493
20	1	2	hp	linear	5	0.00299	0.00748	0.01189	0.01622
21	1	2	int-sub	hp	3	-0.01108	-0.00144	0.01329	0.02534
22	1	2	int-sub	linear	3	-0.01585	-0.00801	0.00524	0.01661
23	1	2	transit	hp	6	0.00955	0.01347	0.01963	0.02519
24	1	2	transit	linear	6	0.00367	0.00635	0.01144	0.01646
25	2	1	0	hp	5	0.01524	0.02270	0.03407	0.04427
26	2	1	0	linear	5	0.00082	0.00496	0.01318	0.02150
27	2	1	hp	hp	5	0.01471	0.02357	0.03441	0.04408
28	2	1	hp	linear	5	0.00031	0.00580	0.01352	0.02132
29	2	1	int-sub	hp	4	-0.00002	0.01166	0.02937	0.04438
30	2	1	int-sub	linear	4	-0.01362	-0.00566	0.00860	0.02161
31	2	1	transit	hp	6	0.01524	0.02270	0.03407	0.04427
32	2	1	transit	linear	6	0.00082	0.00496	0.01318	0.02150
33	3	3	0	hp	5	-0.00193	-0.00145	-0.00131	-0.00128
34	3	3	0	linear	5	-0.00885	-0.00988	-0.01106	-0.01173
35	3	3	hp	hp	4	-0.00255	-0.00043	-0.00091	-0.00150
36	3	3	hp	linear	4	-0.00944	-0.00891	-0.01068	-0.01195
37	3	3	int-sub	hp	3	-0.01977	-0.01433	-0.00677	-0.00115
38	3	3	int-sub	linear	3	-0.02571	-0.02225	-0.01638	-0.01161
39	3	3	transit	hp	6	-0.00193	-0.00145	-0.00131	-0.00128
40	3	3	transit	linear	6	-0.00885	-0.00988	-0.01106	-0.01173
41	4	4	0	hp	5	-0.00388	-0.00324	-0.00323	-0.00339
42	4	4	0	linear	5	-0.01496	-0.01686	-0.01927	-0.02088
43	4	4	hp	hp	4	-0.00437	-0.00244	-0.00292	-0.00356
44	4	4	hp	linear	4	-0.01542	-0.01608	-0.01897	-0.02105
45	4	4	int-sub	hp	3	-0.01799	-0.01339	-0.00751	-0.00329
46	4	4	int-sub	linear	3	-0.02835	-0.02667	-0.02348	-0.02078
47	4	4	transit	hp	6	-0.00388	-0.00324	-0.00323	-0.00339
48	4	4	transit	linear	5	-0.01496	-0.01686	-0.01927	-0.02088
					Average:	-0.0019	0.0026	0.0091	0.0150
					Weighted average:	-0.0004	0.0038	0.0101	0.0158
					Median*:	-0.0011	0.0033	0.0103	0.0173
					Weighted median*:	0.0002	0.0042	0.0114	0.0186
					Lower bound of the 90% mass interval*:	-0.0230	-0.0212	-0.0213	-0.0221
					Weighted upper bound of the 90% mass interval*:	-0.0197	-0.0187	-0.0191	-0.0202
					Upper bound of the 90% mass inverval*:	0.0165	0.0240	0.0352	0.0469
					Weighted lower bound of the 90% mass interval*:	0.0159	0.0233	0.0346	0.0454

* Computed respectively to the correspondent kernel density.

to the actual RER. This suggests that the current RER is fairly close to the FEER. Nevertheless, in-the-sample the FEERs evolve somewhat differently, given the specification of the underlying economic equilibrium, in particular after 2000. Note also that, given the definition of the weights and the fact that they turn out to be all larger than one, all percentage differences between the FEER estimates and the actual RER are stationary at the highest conventional statistical confidence level. In this perspective, no FEER or its underlying economic structure can be rejected as the true one.

Out-of-the-sample, however, the FEER estimates get somewhat more dispersed as the time horizon increases. To understand this evolution we must examine how the FEER is dependent upon the specification of the underlying economic structure.

Figure 2 a: Examples of FEER estimates

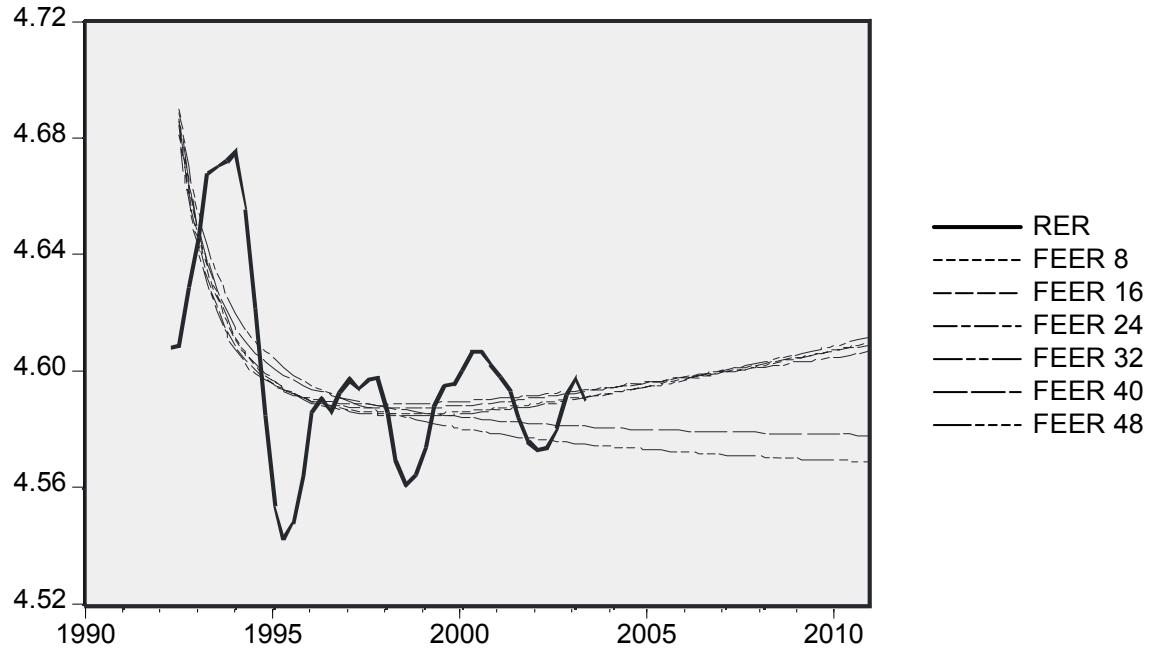


PPI based RER in logarithmic scale

Three elements are relevant determinants of the long-run equilibrium trend in the FEER estimates. The first element are the TT. The impact of the TT can best be observed on *table 3* by examining the underlying economic structures (3, 3) and (4, 4) and the TT specification "trend" where the out-of-the-sample TT (slightly) appreciate. In these cases, there is no long-run impact on the CA, and therefore on the FEER, from the demand for exports, M^*, and the demand for imports, Y, whose effects are constrained to exactly cancel out given the constraint (3). That allows to isolate the effect of the TT. In the absence of the TT from the equations, i.e. in the economic structures (4, 4), there is no effect, *ceteris paribus* (!), on quantities from a variation in the TT. The CA is nevertheless impacted by the direct price effect originating from the TT variation. To offset that effect, the RER must appreciate, implying the decreasing trend in the FEER in case of an improvement in the TT. The opposite reaction takes place in case of a deterioration in the equilibrium TT. When the TT are included in the equation specification, the FEER tends to display a significant less appreciating trend, i.e. the estimated FEER decreases less. This effect is due to the elasticity of real imports to the TT, c_{24}. This elasticity in part offsets the small increase in real exports (c_{14}) and the direct TT effect on the CA. Another way to asses the impact of the TT on the FEER is to compare the *figures 2a and 2b*. On *figure 2b*,

the underlying economic equilibria are subject to more TT improvement and therefore the FEER estimates are appreciated respectively to their counterparts on *figure 2a*.

Figure 2 b: Examples of FEER estimates



PPI based RER in logarithmic scale

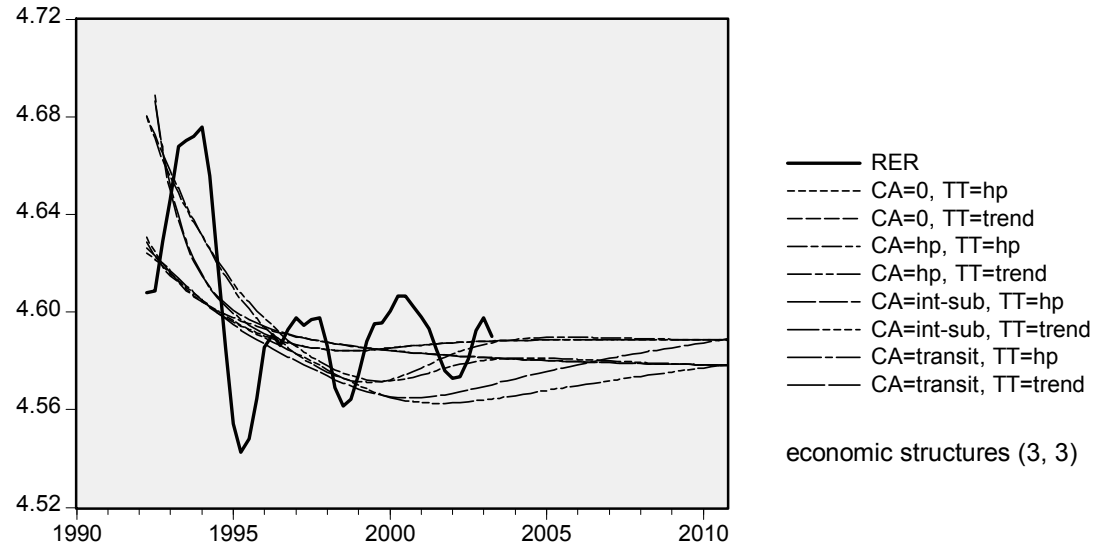
The described effect appears to be quantitatively relatively small because we foresee in the extrapolations only moderate variations in the TT. For larger changes in the TT equilibrium trend, a substantially larger effect on the FEER is generated, in particular in the case where the TT are excluded from the structural equations. The elasticity of the FEER to the TT is estimated to -0.464 in the case of excluded TT and -0.227 in the case of included TT. The second effect is smaller because of the direct effect of the TT on the quantities M and X that in part equilibrates the CA.[15]

The second determinant of the equilibrium trend in the FEER is the differential in the quantity effect CA of the demand for exports, M^*, and the demand for imports, Y. This can be seen when the TT remain (nearly) unchanged, as in the "hp" out-of-the-sample extrapolation for TT. The only effect operating on the CA and the FEER is then due to the effects on quantities. In *table 3* it can be seen that the FEER increases over time in all specifications but the economic structures (3, 3) and (4, 4), where the two effects on the CA form M^* and Y exactly offset. This is due to the demand for imports (Y times the elasticity of M to Y) tends to increasing faster than the demand for exports (M* times the elasticity of X to M*), i.e. the right-hand-side in (3) is larger than the left-hand-side. The FEER must continuously depreciate to maintain the equilibrium the CA. When (3) holds, as in economic structures (3, 3) and (4, 4) the two effects exactly offset and there is no

[15] This obtains simply by dividing the percentage change in the FEER by the percentage change in the TT trend between two moments of time and for the same equilibrium CA, say CA=0. Structures (3, 3) and (4, 4) ensure that there is no simultaneous effect due to export and import demand on the CA.

long-run impact on the CA form M^* and Y. This is best seen in the out-of-the-sample interval on *figure 2a* where as already noted the TT are stable and all but the FEERs 39 and 47 trend upward.

Figure 2 c: Examples of FEER estimates

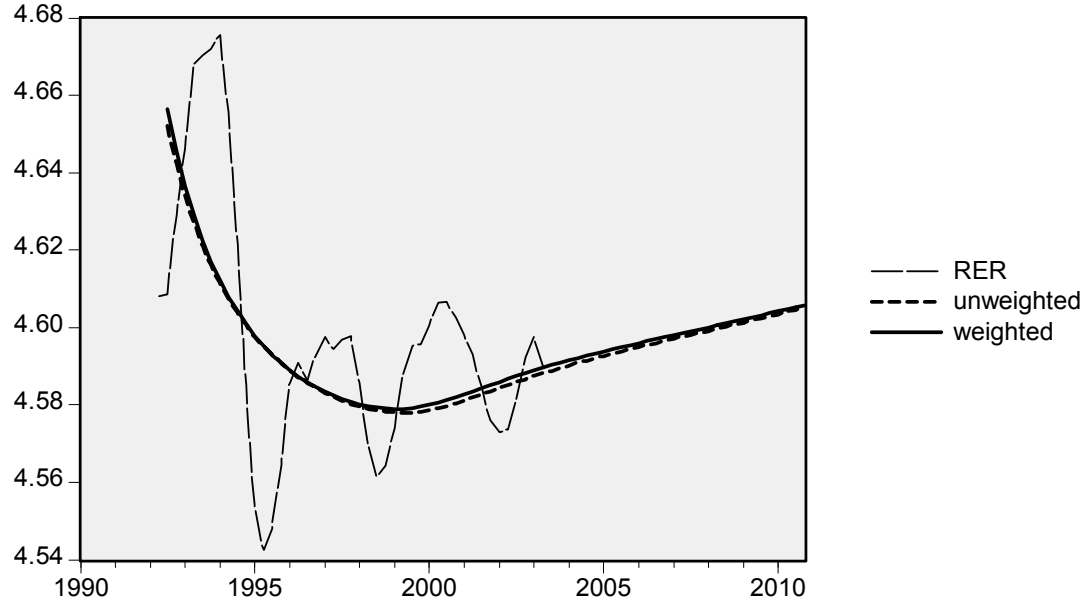


PPI based RER in logarithmic scale

The third FEER determinant is of course the equilibrium CA specification. How this effect impacts the FEER is shown on *figure 2c*. All CA specifications are represented for the economic structure (3, 3) and both specifications for the TT. The lower (more negative) is the equilibrium CA, the more RER appreciation is required to maintain the equilibrium. That in turn implies a decrease in the FEER. The most striking example is that of the "intertemporal substitution" equilibrium CA. It most of the time departs importantly from the observed RER. Note that, since we expect a price adjustment to operate in the direction of the FEER, we argue that this specification is less plausible. It is also more formally demonstrated by the lower weight on the FEERs resulting from the "int-sub" specification. We take that as evidence that a CA of zero, or close to zero, is the most sensible way to specify the current and future equilibrium CA in the Slovenian economy, given the observed behavior of the involved macroeconomic variables.

The unweighted and the weighted mean of the FEER estimates are shown on *figure 2d*. The weighted and the unweighted estimates means are almost identical. They seem to capture quite satisfactorily the in-the-sample (imaginary) long-run equilibrium movement in the RER. This is expected, since the true FEER should not systematically depart from the observed RER because of the adjustment in prices such a discrepancy between the RER and its equilibrium would produce. In the first period, the FEER mean series indicate an appreciation in the equilibrium RER, generates by the improvement in the TT and a fall in the equilibrium CA specifications. In the second half of the sample and in the out-of-the-sample extrapolation these effects stabilize and the dominating effect appears to be the higher impact of the import demand on real imports growth in comparison to the impact of the export demand to the real exports growth. A FEER consistent with this desequilibrium in the growth of exports and imports is slowly depreciating over time.

Figure 2 d: RER and the mean values of the FEER estimates



PPI based RER in logarithmic scale

Figures 2a, 2b, 2c and 2d only represent a selection of the FEER estimates or their mean values, but it is also useful to examine the whole distribution of FEER estimates. On *figure 3* we present two representations of the distribution of the FEER estimates at four different dates listed in *table 3*. For each of the four dates, we provide on the kernel density estimate of the FEERs resulting from the various underlying long-run equilibrium specifications.[16] The graphs on the left on *figure 3* show the unweighted FEER distribution (all FEER observations have the weight one) and on the right the weighted distribution of the FEER estimates. In that second case all FEER observations enter the distribution as "weight" observations of the same type. Although these representations are somewhat *ad hoc*, since the selection of the specifications is necessarily subjective as well as the weight criterion used, they provide a good illustration of the possible FEER dispersion currently and at interesting dates in the future.

Currently, the 90% of the estimated (weighted) FEER distribution lays within a range of roughly –2 and 1.6% of deviation form the current RER. The sign of the descriptive statistics of the current FEER estimates distribution, shown *in table 3*, also appears to be inconclusive. On one hand, the unweighted average of the 2003 q2 FEER estimates distribution is negative, suggesting a depreciated RER respectively to the FEER by 0.2%. The median indicates a RER depreciated by only 0.1%. Given the weighted average criterion, favoring more probable underlying economic long-run equilibrium structures, the RER is depreciated by only 0.04%. The weighted median is on the other hand positive and indicates a too appreciated RER. These differences are quantitatively negligible. Also, given the small dispersion of the 2003 q2 FEER estimates distributions, we conclude it is unlikely that the current RER is distant form the current FEER. Also, given the inconclusive

[16] The kernel density estimator produces a smoother representation of the variable's distribution than the histogram, and in addition continuous and not sensitive to the choice of origin. Smoothing is done by putting less weight on the observations more distant from the point being estimated. Smoothing obtains by increasing the bandwidth around the estimated point where the weights determined by the kernel function on the surrounding observations are positive. We use the Epanechnikov kernel (k=e) and the Silverman's option for the bandwidth (b) determination. The details and the exact functional specification can be found for example in Silverman (1986).

sign of the descriptive statistics of these distributions, we argue that there is no indication of whether the current RER is too depreciated or too depreciated.

At a more distant horizon, the FEER distribution becomes slightly more dispersed. This results from the dependence of the FEER upon its underlying economic equilibrium specification. As we have shown, in the case of "trend" TT, the TT tends to appreciate over time making the FEERs decrease, especially when the TT are excluded from the equations. Similarly, for economic specifications others than (3, 3) and (4, 4) the FEER trendly depreciates since the imported quantities increase faster than the exported quantities, *ceteris paribus*. These effects become larger at longer horizons increasing the dispersion of the FEER estimates distribution. Between 2003 and 2010 the 90% mass interval of the estimated (weighted) FEER distribution lengthens from 3.6 to 6.8, expressed in percentage deviation from the current FEER in both directions.

The descriptive statistics of the FEER estimates distributions listed in *table 3*, as well as distribution representations on *figure 3*, show a slight tendency towards depreciation in the FEER estimates in the out-of-the-sample extrapolation. This indicates that the quantity effect of the differential in the exports and imports demand, depreciating the FEER, dominates the TT improvement effect that requires an appreciation in the FEER. Overall, the projections foresee a depreciation in the PPI based RER of the order of magnitude between 1.5 and 2% until the end of 2010, i.e. between 0.2 and 0.3% on average per year. Note that this is quantitatively small with respect to the Balassa-Samuelson effects that are expected to generate a CPI based RER appreciation of between 1 and 1.5% on average per year.[17]

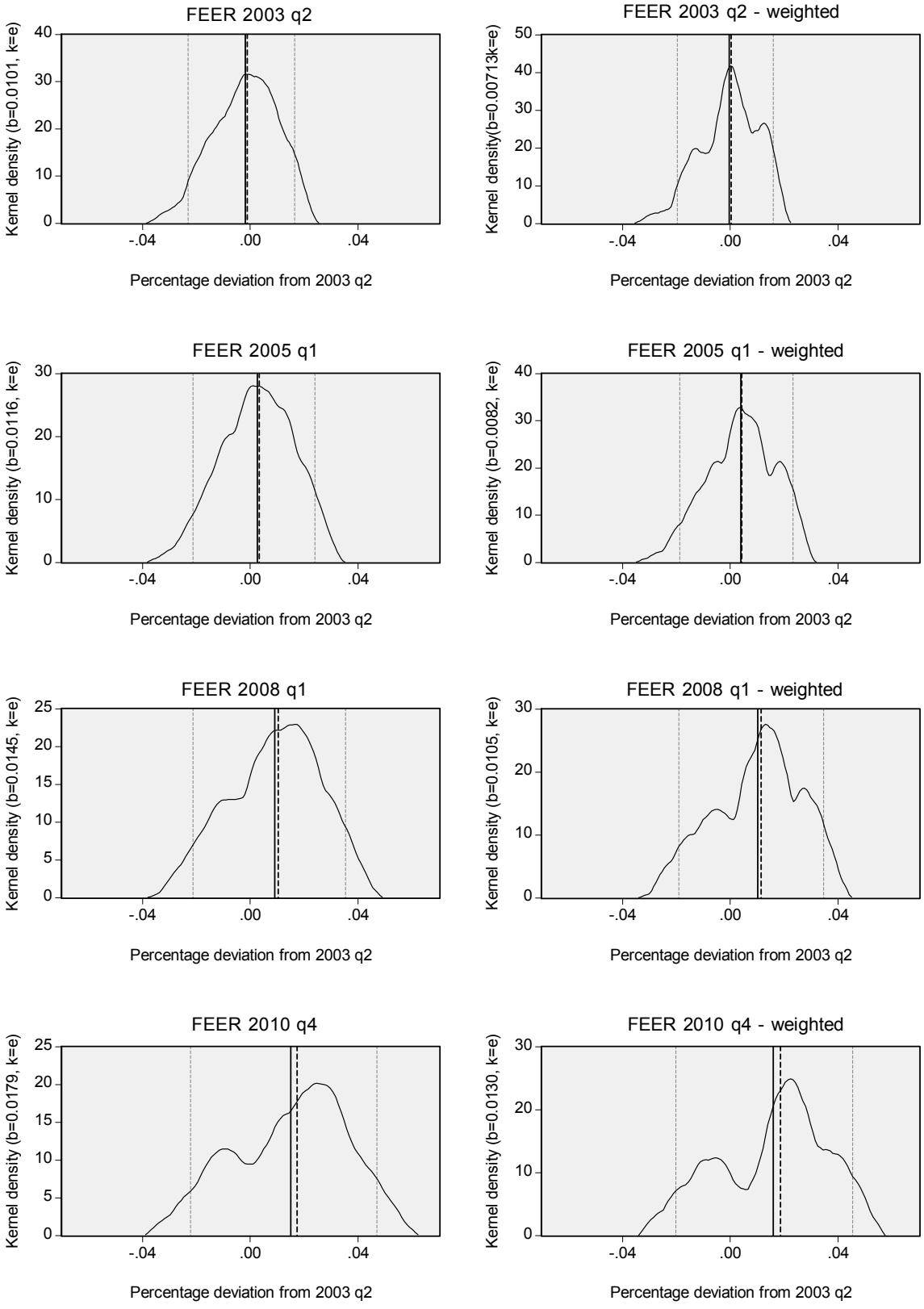
We end this section by a heuristic discussion on what may be a plausible future evolution of the FEER. To evaluate what may be a plausible evolution for the FEER, we must determine what is the plausible future evolution for the TT and for the foreign demand for exports M^* and the domestic demand for imports Y.

There is no reason, *a priori*, that the terms of trade will continue to improve in the future as compared to the average during the sample period. In particular, if the in-the-sample situation may be biased because of the transition. Prior to 1995, in particular, the TT improvement is mainly due to the reallocation from ex-Yugoslav markets towards the Western Europe, where the overall price level was (and remains) substantially higher. Such reallocation increased export prices more than import prices, since imports contain more goods subject to world prices (oil, raw materials) than exports which are more market related. Inspecting the TT in *appendix 2* gives the impression that the TT are fairly stable after 1995. The stable "hp" extrapolation in the future therefore appears much more plausible than the "trend" extrapolation that continuously improves the TT.

Similarly, it is difficult to expect a substantial long-run disequilibrium, resulting from the differentiated quantity effect on CA of the foreign demand for exports M^* and the domestic demand for imports Y. As already argued, the related coefficients in both equations are close, when the constraint (3) holds and when it does not. That implicates that the quantity effects can be expected to be sufficiently close so that no disequilibrium arises in the future, what would call for a sizeable FEER adjustment. In addition, if a long-run disequilibrium arises, there may be other margins of adjustment in this case, for example an adjustment in imported quantities.

[17] See Kozamernik (2003). This Balassa-Samuelson effect estimate is consistent with the current growth pattern. Remember that both studies assume that the PPI is not subject to the Balassa-Samuelson effect since it is (mostly) related to the tradable goods.

Figure 3: FEER estimates and deviations from the RER value 2003



In the likely perspective for the future evolution of the above CA determinants, the most plausible FEER distribution in the future may be very similar to the 2003 q2 FEER distribution. If the TT remain stable and the quantity effects of the foreign demand for exports and the domestic demand for imports cancel each other out, the FEER distribution should not get more dispersed in the future and should actually look rather similar to the current distribution. Implicitly, in this discussion, we suggest that the in-the-sample weights may not be adequate out-of-the sample and we favor much more the long-run economic equilibrium structures that imply a stable FEERs. If this is the case, the FEER in the future is expected to be distributed very closely to its current estimated distribution, i.e. centered close to the current RER and 90% of the distribution mass falling within a range between -2 and 1.6 percentage points deviation from the current RER. We conclude from this discussion that the actual current RER is quite close to the current and the future FEER, given the available information today.

4. CONCLUSIONS

In conclusion we summarize the main results, discuss some of their implications for the economic policy and propose some guidance for further research. The distributions of the FEER estimates, at the current moment and in the future, are centered very close to the current RER. The means and the medians of the current FEER estimates distributions, both the unweighted and the weighted with respect to the plausibility of the underlying long-run equilibrium specification, are located between -0.2 and 0.02 percent deviation from the actual RER. Given the inconclusive sign of these descriptive statistics, there is no indication that the current RER is appreciated or depreciated in comparison to the FEER. The 90% mass interval of the FEER estimates distribution lays between -2 and 1.6 percent deviation from the current RER.
The FEER estimates are somewhat sensitive to differences in the specification of the underlying economic structure and the specification of the equilibrium values of the fundamental variables. The most obvious is, of course, the impact of the equilibrium CA on the FEER. The lower (more negative) is the equilibrium CA defining the external equilibrium, the more RER appreciation is required to maintain the equilibrium, what in turn implies a decreased FEER.

Another relevant determinant of the FEER estimate is the evolution of TT. When the TT are excluded from the equations, the only impact, *ceteris paribus*, is the direct price effect improving the CA. It requires a real appreciation of the currency to return to the equilibrium so that the FEER must fall. The inclusion of the TT in the equations produces above all a positive effect on the imported quantities due to the wealth effect favorable to the domestic economy. This effect in part offsets the price effect improvement of the CA. Therefore, if the TT are included in the behavioral equations, the impact on the FEER is roughly halved in comparison to the situation where TT are excluded from the equation. The estimated elasticity of the FEER to the TT decreases from -0.464 to -0.227.

The last relevant determinant of the differences across the FEER estimates results from the differences in the quantity impact from exports and imports demand. Due to this effect, the FEER estimates are foreseen to depreciate over time. The demand for imports (Y times the elasticity of M to Y) indeed tends to increase faster than the demand for exports (M* times the elasticity of X to M*), producing a disequilibrium in the CA, *ceteris paribus*. The FEER must therefore continuously depreciate to maintain the equilibrium CA. In economic structures where the two effects are constrained to exactly offset, there is no long-run impact on the CA form the exports and imports demand factors.

As the out-of the sample time horizon increases, the distribution of the FEER estimates becomes somewhat more dispersed and tends to moderately depreciate. The FEER determinants described above (with the exception of the equilibrium CA) amplify in various directions, depending on the underlying equilibrium specifications so that the FEER departs over time from the central point of the distribution. While currently 90 percent of the FEER (weighted) distribution mass locates in the interval between roughly -2 and 1.6 percents deviation from the RER, this interval is evaluated at the end of 2010 to spread from -2 to 4.5 percents deviation from current RER. We note that the estimated FEER distribution tends to depreciate, the quantity effect of the export and import demand dominating the effect of slight improvement in the TT. We argue, however, that given the plausible future long-run evolution in the TT and the exports and imports demand, the future FEER distribution should not depart significantly from the current RER.

The evidence that the current and future FEER may be close to the current RER bears some policy implications. First, since in Slovenia the RER is shown to be close to the FEER, there is no evidence that the current RER level is improving or harming the international competitiveness or produces pressures on inflation. The results indicate that the current RER is neutral or, if anything, slightly appreciated with respect to the likely future FEER trend. Second, if the RER is found close to the actual and future FEER *and if the inflation stabilizes around its long-run equilibrium value*, the nominal central parity should not deviate much from the actual value of the nominal exchange rate. A deviation in the parity from the actual nominal exchange rate value would either generate unnecessary inflationary pressures and higher demand for domestic goods if too depreciated, or decrease the competitiveness, worsen the external balance and depress the economic activity if too appreciated respective to the equilibrium. And finally, if the RER can be assumed close to the FEER, one may want to avoid an exchange rate policy that would result in a significant RER deviation from its current value. This is particularly true for the aggressive RER based disinflation policies, where it is difficult to evaluate how the price adjustment would operate to restore the equilibrium. The external equilibrium may deteriorate for a substantial period of time as there may be quantity instead of price adjustment. Such a policy may be especially inappropriate in the view of the entry into the ERM II, where the nominal exchange rate must be stabilized around a central parity. In that case, if the central parity is chosen close to the actual nominal exchange rate, such a policy may lead to a too appreciated RER and may move the economy away from the macroeconomic equilibria. That in turn questions the sustainability of the achieved disinflation.

The work can be expanded in many directions to provide additional insight in the FEER determinants and check the robustness of the obtained results. The first extension of the analysis may be to work at a more disaggregated level. In constructing the model for exports and imports, one could distinguish between goods and services. A useful distinction might also be between investment goods, consumption goods and raw materials. Another informative way to disaggregate the analysis is to consider several regional markets for exports. The exchange rate elasticity or the growth potential may be very different in the case of EU, ex-Yugoslavia, CEFTA or Russia.

Another direction of extending the analysis is to decompose the effects intervening in the TT variations. The different effects useful to consider in the case of a small open economy, a price taker on international markets, are the variations in the oil price or the raw materials prices, the movements in the euro-dollar exchange rate, the foreign market price level, etc. A better assessment of the TT determinants is especially useful for the prediction of the future values for the TT.

Finally, an additional check for the robustness of coefficients, and therefore of results, is to examine additional specifications of the model. In addition, the cointegrated vectors could be estimated inside dynamic equations, but the specification choice and the restrained number of degrees of freedom might limit the power of such analysis. One important contribution of estimating the dynamic equations would be to identify the adjustment path of the involved macroeconomic variables towards the equilibrium, when the system is perturbed. For the optimal policy design it is indeed crucial to evaluate to what extent the short-to-medium-run macroeconomic adjustment operates through quantities or through prices.

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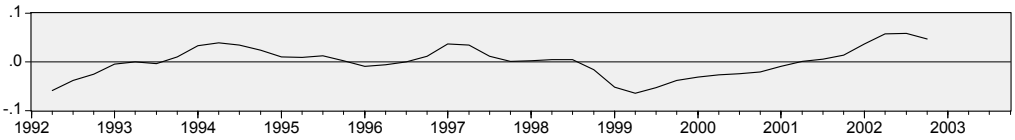
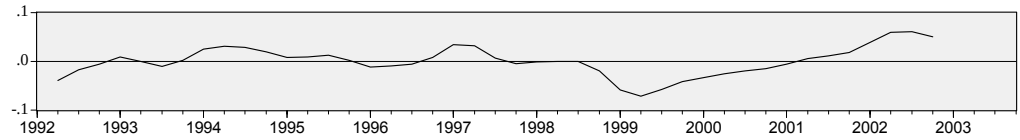
Appendix 1: Representations of cointegration vectors

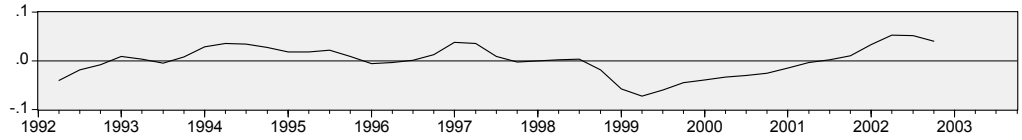
Specifications for real exports



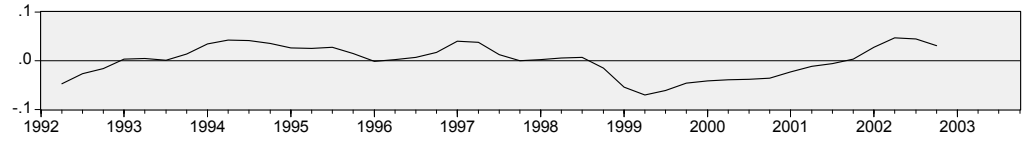
— Real exports specification 1



— Real exports specification 2

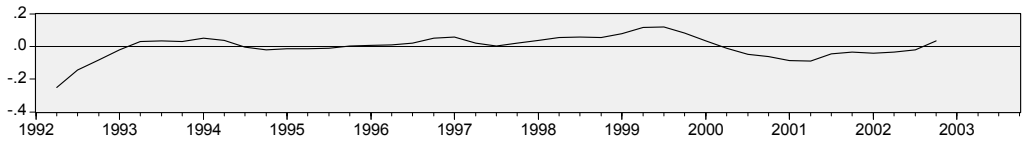


— Real exports specification 3

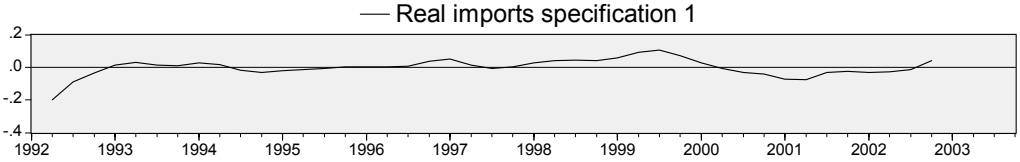


— Real exports specification 4

Specifications for real imports



— Real imports specification 1



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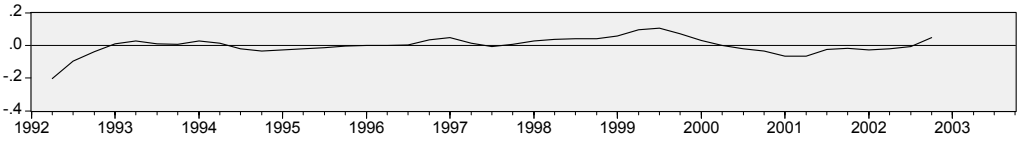
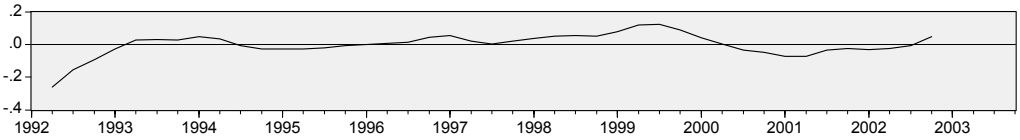


— Real imports specification 3



— Real imports specification 4

Appendix 2: Representations of the long-run equilibrium paths in exogenous variables