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Mario Holzner

Real Exchange Rate Distortion in Southeast Europe

About

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This study has been developed in the framework of research networks initiated and monitored by wiiw under the premises of the GDN–SEE partnership.

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The GDN–SEE programme is financed by the Global Development Network, the Austrian Ministry of Finance and the Jubiläumsfonds der Oesterreichischen Nationalbank.

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Real Exchange Rate Distortion in Southeast Europe*

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by Mario Holzner (wiiw[♣])

Abstract:
In this paper, first we investigate to which extent the real exchange rate is distorted in the 7 Southeast European countries (SEECs), and compare the findings with other countries in Europe. Second, we shed light into possible determinants and effects of the real exchange rate distortions. Finally, a policy change away from a possibly distorted real exchange rate in the SEECs is being simulated. The results indicate that especially the West Balkan countries have overvalued real exchange rates, while other transition countries' exchange rates are rather undervalued. Some of the main determinants of the real exchange rate distortion are related to the inflow of remittances and FDI, while it was found that nominal exchange rate depreciation and trade openness reduce the real exchange rate distortion. The simulation model shows that a devaluation can have large positive effects on domestic output, exports and trade with self.

Keywords: Real Exchange Rate, Partial Equilibrium Model, Simulation Model, International Trade, Southeast Europe

JEL-classification: D58, E31, F17, F31, O24

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[♣] The Vienna Institute for International Economic Studies, Holzner@wiiw.ac.at

Contents

1. Introduction & research aims

As compared to the Central and East European New EU Member States (NMS) Southeast European Countries (SEECs) run high and partly unsustainable current account deficits. These deficits (in % of GDP) are on average more than double the size of the NMS countries (see Table 1). Three countries (Bosnia and Herzegovina, Bulgaria and Serbia) exhibit even double digit deficit figures as percentages of GDP. This trend is likely to continue in the years to come.

Table 1

Current account

in % of GDP

	2004	2005	2006 forecast	2007 forecast
Czech Republic	-6.0	-2.1	-1.8	-1.7
Hungary	-8.6	-7.4	-7.4	-6.0
Poland	-4.2	-1.4	-1.5	-1.4
Slovak Republic	-3.6	-8.6	-5.7	-5.0
Slovenia	-2.1	-1.1	-1.2	-1.0
NMS-5 1)2)	*-5.2*	*-3.2*	*-2.9*	*-2.5*
Albania	-4.7	-6.7	-6.8	-6.5
Bosnia and Herzegovina	-20.9	-22.5	-20.1	-18.2
Bulgaria	-5.8	-11.8	-14.1	-13.2
Croatia	-5.1	-6.3	-6.5	-6.2
Macedonia	-7.7	-1.4	-3.1	-2.9
Romania	-8.4	-8.7	-9.5	-9.5
Serbia	-12.6	-8.8	-10	-10
Montenegro	-7.8	-8.6	-9.1	-7.9

Notes: NMS: The New EU Member States. - 1) wiiw estimate. –
2) Current account data include flows within the region.
Source: wiiw (July 2006).

Moreover, when examining the single components of the current account (see Table 2) it is striking that the average SEEC has a deficit in the balance of goods as high as about a quarter of its GDP. One major source of finance for these deficits are high remittances inflows from Southeast European emigrants in Western Europe. This can be seen from the highly positive figures in the balance of transfers. To make a point, it could be argued that instead of goods SEECs export their workers to Western Europe. One may argue that continuous migration from Southeast Europe (SEE) to the European Union (EU) is neither in the interest of the EU (given the bad state of its labour markets and social tensions on the issue of migration) nor is it in the interest of SEE (given the enormous brain drain from the region).

Table 2

Components of the current account

in % of GDP

	Balance on goods			Balance on services			Balance on incomes			Balance on transfers		
	2003	**2004**	**2005**	**2003**	**2004**	**2005**	**2003**	**2004**	**2005**	**2003**	**2004**	**2005**
Albania	-22.7	-21.0	-21.7	-1.4	-0.7	-2.1	2.9	2.3	2.1	14.4	14.7	15.5
Bosnia & Herzegovina	-58.4	-53.5	-53.3	4.7	5.4	6.0	7.5	5.3	5.0	23.2	21.9	19.8
Bulgaria	-12.5	-15.1	-20.4	3.0	3.5	3.1	-3.2	1.2	1.2	3.5	4.6	4.3
Croatia	-26.6	-23.7	-24.2	18.8	16.6	17.2	-4.1	-2.2	-3.1	4.7	4.2	3.8
Macedonia	-18.3	-20.7	-18.4	-0.2	-1.0	-0.6	-0.7	-0.7	-1.0	16.0	14.7	18.5
Montenegro	-25.1	-27.1	-30.8	7.8	9.7	11.6	6.9	5.6	7.1	3.2	4.1	3.5
Romania	-7.5	-8.8	-9.8	0.1	-0.4	-0.5	-2.3	-4.2	-2.9	3.9	4.9	4.6
Serbia	-22.6	-29.6	-23.4	1.1	0.8	0.1	-1.1	-1.0	-1.3	12.0	15.0	14.4

Source: wiiw Database incorporating national statistics.

A straightforward explanation for these developments would be that the relative prices of goods produced in SEE are too high – i.e. the Real Exchange Rate (RER) might be overvalued.

It is first the aim of this research to investigate to which extent the real exchange rate is distorted away from a hypothetical free-trade level in the SEECs and to compare the findings with other countries. Second, the determinants and effects (on GDP, growth and poverty) of real exchange rate distortion shall be analysed at a more general and global level. Also, a policy change away from a possibly distorted real exchange rate in SEE shall be simulated using a Partial Equilibrium (PE) model. Finally, we want to discuss possible policy implications and the impact of EU policies on Southeast Europe.

The following chapters will thus provide a brief overview of the existing literature on the equilibrium exchange rate; a description of the chosen methodology and the data employed in the research; a summary of the results and a discussion of effects and causes of real exchange rate distortion as well as a policy change simulation. A chapter on policy implications shall conclude our research.

2. Equilibrium real exchange rate theory

This chapter provides a brief synopsis of the theory of the equilibrium real exchange rate, its determination and possible misalignment. The synopsis is based on a recent in-depth overview paper on the issue by Égert (2004). The starting point is the Purchasing Power Parity (PPP) theory. It states that in the very long run the nominal exchange rate (E) is the domestic price level (P) divided by the foreign price level (P*) as shown in equation 1:

$$E^{PPP} = \frac{P}{P*} \tag{1}$$

where E^{PPP} is the long-term nominal exchange rate. However, in the short run the nominal exchange rate might deviate from its PPP level. Thus the real exchange rate (Q) could be described in the following way:

$$Q = \frac{E}{E^{PPP}} \tag{2}$$

If E is higher than E^{PPP} the real exchange rate is undervalued and vice versa. Now there is a number of reasons why the real exchange rate might be deviating from its long run equilibrium and why the PPP concept might be misleading altogether. There are several restrictive assumptions such as the Law of One Price (LOOP) secured by perfectly competitive free international trade and the equal composition of price baskets throughout the world. Moreover and most important, productivity driven differences in the price levels of non-tradable goods in countries at different stages of economic development are influencing the PPP very much. Developing countries experiencing productivity gains in the tradable sector will face a trend appreciation of their equilibrium real exchange rate through an increase in the wages of both the tradable and the non-tradable sector (assuming that wages are created on one single national labour market). This is also known as the Balassa-Samuelson effect (see Balassa 1964 and Samuelson 1964).

Given the above and other restrictions, several approaches try to capture the equilibrium exchange rate in the medium run. Here we shall examine some of them. Williamson (1994) defined the Fundamental Equilibrium Exchange Rate (FEER) to be the real effective exchange rate that secures simultaneously the internal and external balances. The first is achieved at the Non-accelerating Inflation Rate of

Unemployment (NAIRU) and the second at sustainable balance of payments and external debt positions. However, both are difficult to grasp. For the former potential output growth must be estimated while the latter would require a definition of the optimal level of the external debt-to-GDP-ratio. In any case, once the targeted current account position at the potential output path is determined and the elasticity of the Real Effective Exchange Rate with regard to the current account is estimated econometrically it is possible to calculate the exchange rate misalignment.

Another approach is the Natural Rate of Exchange (NATREX) by Stein (1995). This approach distinguishes a medium and a long term equilibrium exchange rate. The medium term rate is defined similarly to the FEER approach. In addition to that a system of interlinked equations also includes the capital stock and the stock of foreign debt. For the medium term the current values are assumed while for the long term steady state levels are calculated. NATREX can be estimated with the help of econometric techniques.

The Behavioural Equilibrium Exchange Rate (BEER) approach developed by MacDonald (1997) and Clark and MacDonald (1998) is based on the so called Uncovered Interest Rate Parity (UIP), which is defined by the following relationship in log terms:

$$q_t = E_t(q_{t+1}) - (r_t - r_t^*) \qquad (3)$$

where q_t is the observed real exchange rate in period t, E_t (q_{t+1}) is the expected value of q in period t+1 and r_t and r_t* are the domestic and foreign real interest rates in t. Practically the real exchange rate can be estimated econometrically by long- and medium-term fundamentals and short-term variables. The misalignment can be calculated by setting the short-term variables to zero.

Besides discussing some other approaches, Égert (2004) also provides for an overview of empirical applications of the theoretical approaches for the Central and East European transition countries. The various results are often rather divergent depending on which models, variables and data were used. This is also what was found in a meta-regression analysis by Égert and Halpern (2005).

3. RERD methodology & data issues

Applying the traditional approaches as described in the chapter above to the countries of Southeast Europe unfortunately appears to be almost impossible. The reasons are the same as in many other fields of economics related to the Balkans. Some of the data does not exist at all or is of very bad quality (such as productivity data due to bad labour statistics) and if it exists the time series are very short. Thus we have to use a fairly simple method that is not too data demanding. This method as well as the data used will be discussed in the following paragraphs.

The present analysis of real exchange rate distortion shall be based on the methodology developed by Dollar (1992). Dollar used the relative price level (RPL) index as a measure for the real exchange rate. RPL can be calculated by dividing each country's price level of consumption in 1996 international USD, taken from the Penn World Table (PWT) Version 6.1 (see Heston, Summers, Aten 2002), by the price level of consumption of the United States of America as the benchmark country (in this part of our research Germany, being one of the most important trading partners for the SEECs, will act as our benchmark country).

However, as discussed in the previous chapter and also proven empirically (see e.g. Holzner 2005), a relatively high domestic price level does not necessarily mean that the real exchange rate is distorted. According to Balassa (1964) the price level of non-tradables can be explained by the level of development in a country. More developed countries should have a higher price level of non-tradables because the productivity advantages of more developed countries tend to be greater in traded goods industries and there is a competitive labour market across sectors assumed.

Following the methodology of Dollar (1992) an effort can be made in order to detect the Real Exchange Rate Distortion index (RERD). RERD is calculated by dividing the actual price level RPL by the predicted price level (PPL). This provides a measure of the extent to which the real exchange rate is distorted away from a hypothetical free-trade level. Thus, this measure is in a more general sense a measure for outward orientation, including the effects of exchange rate policy as well as of trade policy[1], transport costs and other 'distortions'. Estimating the PPL is based on the assumption that there is a systematic relationship between the per capita GDP and the price level. The applied regression equation is:

$$RPL_{it} = a + b_1 rgdpl_{it} + b_2 rgdpl^2{}_{it} + c_t d_t \qquad (4)$$

where the rgdpl variables for the respective countries i and years t represent real GDP per capita in 1996 international dollars, again taken from the Penn World Table Version 6.1 (see Heston, Summers, Aten 2002), and where the d_t's are the year dummies for each year other than the initial year. The quadratic rgdpl² variable is used in order to check for the possibility of nonlinearities. Having obtained from the regression results the PPL for each country and each year allows us to calculate RERD by dividing the actual price level RPL by the predicted price level PPL.

From previous empirical research we know that introducing the RERD variable into a basic growth regression (see Holzner 2005) yields a negative coefficient (more on this issue can be found in the analytical part of this research). This implies that a distorted real exchange rate and inward orientation is negatively related with economic growth in the long run. Additionally, the Real Exchange Rate Variability (RERV), measured as the variation of each country's RERD index around its mean, is significantly negatively related to economic growth after controlling for the standard variables explaining growth. Accordingly countries with an unstable real exchange rate seem to have lower economic growth rates[2].

Unfortunately, the PWT dataset does not include several of the SEECs (Bosnia and Herzegovina as well as Serbia and Montenegro). Moreover for those countries existing in the database recent years are not available. PWT includes data up to the year 2000. Thus it was necessary to extend the PWT using data available from the Eurostat and the wiiw database.

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[1] In this respect e.g. high tariff protection has to be seen as a potential source of real exchange rate distortion.

[2] For a critical discussion of Dollar's RERD and RERV indices as well as his empirical results with regard to their influence on long run growth see Rodriguez and Rodrik (1999). Our own previous research (Holzner 2005) in fact rather confirms Dollar's results. The critical comments concerning the impact of the nominal exchange rate and geography on the indices will be dealt with in more detail in the analytical part of this research.

For the EU25, Bulgaria, Romania, Turkey, Iceland, Norway and Switzerland Eurostat data for 2001-2003 was used to calculate the price level of consumption (PPP/exchange rate) using the PPPs of actual individual consumption as well as the respective exchange rates. For Albania, Bosnia and Herzegovina, Croatia, Macedonia, Serbia and Montenegro, Russia and the Ukraine, wiiw general PPP estimates and exchange rate data was employed. Similarly to the data needed to calculate the additional RPLs, real GDP per capita data from the same sources for the same set of countries was acquired. Using PPP EUR/USD conversion factors in addition to 1996 USD price conversion factors (obtained by applying US CPI data for 2001-2003), growth rates for the respective GDP per capita at PPP data were calculated. With their help, existing year 2000 rgdpl data from the PWT was extended up to the year 2003. For Cyprus, Malta, Bosnia and Herzegovina and Serbia and Montenegro no year 2000 rgdpl data was available. Thus for these four countries the newly calculated year 2000-2003 data was included in the dataset. Overall the PWT dataset was extended by data for 38 countries, which relates to about a quarter of the countries in the original dataset. This enabled us to run a regression as described in equation (4) for about 170 countries for all the years available over the period of 1970-2003.

4. RERD Results

Estimating the regression equation (4) on the extended dataset as described in the chapter above yields the PPL and in turn also the RERD index for each country and year. An index value of above 100 indicates that the real exchange rate is overvalued as compared to the average of the sample as a whole and vice versa. Again it has to be stressed that RERD is in a more general sense a measure for outward orientation, including the effects of the exchange rate as well as trade policy, transport costs and other ‘distortions’.

Table 3 shows the results for the SEE countries between 2000 and 2003. It can be seen that in 2003 three out of the seven countries were overvalued by around 10%, one country had a real exchange rate that was fairly in line with the predicted one and another three countries had an undervalued real exchange rate by some 20%.

Table 3

Real Exchange Rate Distortion (RERD) in SEE

	2000	2001	2002	2003
Albania	103.1	112.0	108.3	107.6
Bosnia & Herzegovina	87.5	100.2	94.7	97.4
Bulgaria	65.4	75.2	76.4	78.1
Croatia	99.8	120.9	116.2	115.9
Macedonia	89.2	87.4	85.1	85.5
Romania	87.6	92.6	85.1	84.2
Serbia & Montenegro	168.9	90.3	101.4	109.0

Source: own calculations.

If we compare this to the RERD indices of the CEE countries (in Table 4) it becomes obvious that some of the SEE countries face strong price competition on shared markets. None of the CEE countries appear to be overvalued. One country has a real exchange rate that is pretty similar to the one that is predicted given its level of development. Two countries appear to be undervalued by about 15% and another two by some 30%.

Table 4

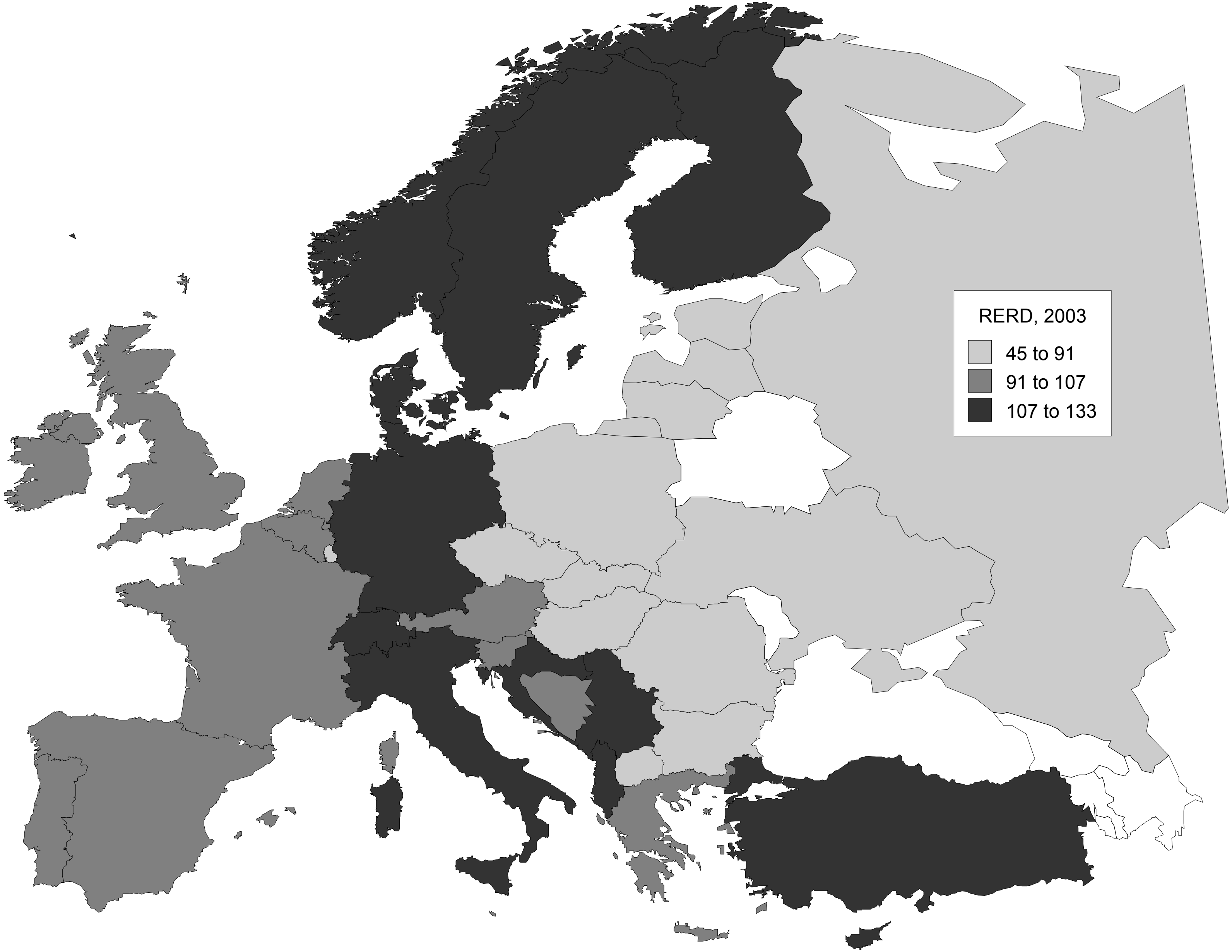
Real Exchange Rate Distortion (RERD) in CEE

	2000	2001	2002	2003
Czech Republic	55.0	65.7	69.3	69.0
Hungary	82.0	76.4	81.3	83.0
Poland	86.8	105.0	97.6	87.1
Slovak Republic	54.4	64.7	61.4	67.3
Slovenia	88.6	93.2	93.2	93.6

Source: own calculations.

Map 1 gives us a broader picture of the year 2003 results across Europe. Interestingly enough most of the West Balkan countries are part of a group of overvalued countries along an axis including the Scandinavian countries, the countries in the centre of Europe all the way to the Southern Mediterranean countries. The East Balkan countries though are part of a group of undervalued countries which is almost solely made up of transition countries. Countries in Western Europe do not seem to have real exchange rates distorted.

Map1



One reason for the difference between the West Balkan countries and the transition countries might be that most of the West Balkan countries share a common ex-Yugoslav history of a relatively high initial (pre-transition) price level. At the same time most of the other transition countries had before transition a very low price level. Given the wars in the wake of the break-up of former Yugoslavia, the GDP drop in the 1990s was much bigger in the West Balkans than in the other transition countries. Wages did not adjust to the lower productivity levels. As a consequence these countries have a too high price level given their stage of development. In the case of Albania it was probably not the war but rather a massive emigration at the beginning of transition causing a permanent strong inflow of remittances to Albania. This could be one way of explaining the difference between the transition countries.

By coincidence a similar map as Map 1 in this paper was produced in a recent research done on tax evasion in consumption by Christie and Holzner (2005). By contrast the countries were split in three groups according to the level of the Concealed Consumption Share (CCS) in percent of total consumption of taxable goods and services. The picture is almost perfectly inverted. The countries in the East of Europe have high levels of tax evasion of Value Added and Excise Taxes, while the countries of the central axis exhibit low levels. Again, the West of Europe is at an intermediate level. This would hint at the fact that tax evasion of consumption taxes lower the domestic price level and as a consequence decrease the real exchange rate.

However, the reasons determining the calculated RERD indices are certainly manifold and we shall try in the following analytical part of this research to investigate some of them in more detail, trying to explain the RERD index by a set of explanatory variables.

5. The effects of RERD

Before we go on analysing the determinants of real exchange rate distortion we would like to briefly replicate some of the results acquired from our previous research in Holzner (2005) where we want to look at the relationship between the real exchange rate distortion and GDP. This is in order to demonstrate the negative impact that a real exchange rate distortion has upon economic growth and GDP. We also want to have a quick look at the impact of real exchange rate distortion on poverty.

For this purpose we want firstly to conduct a cross country analysis, which is based on a growth model similar to the Solow growth model with Cobb-Douglas[3] production including human capital (see Romer 1996). In this framework output is characterised as follows:

$$Y = K^{\alpha} H^{\beta} [AL]^{1-\alpha-\beta}, \quad \alpha>0, \beta>0, \alpha+\beta< 1, \qquad (5)$$

where Y denotes output, K physical capital, H human capital, A the effectiveness of labour and L labour. Defining k = K/AL, h = H/AL, and y = Y/AL, and using equation (5) yields:

$$y = k^{\alpha} h^{\beta}. \qquad (6)$$

Taking logs of equation (6) results in:

$$\ln y = \alpha \ln k + \beta \ln h. \qquad (7)$$

However, considering the dynamics of output under the conditional convergence theory and the needs for the empirical application of the researched relationship in a cross country analysis setting based on the standard literature by Barro (1991), Levine and Renelt (1992), Barro and Sala-i-Martin (1995) and Sachs and Warner (1995) leads to the following equation:

[3] The author would like to note that he does not necessarily believe the aggregate Cobb-Douglas production function to be an especially good model for explaining economic output and growth. On the contrary, growth models in the tradition of Keynes (1936), Harrod (1939), Domar (1946) and Kaldor (1961) might be explaining reality much better. For a critical discussion of the aggregate neoclassical production function in general and the Cobb-Douglas production function in particular see e.g. Zambelli (2004) and Shaikh (1974) respectively. However, its practical applicability for econometrics has made the Cobb-Douglas production function a conventional starting point of growth analysis. Allegedly, in 1927 Paul Douglas asked a professor of mathematics, Charles Cobb, to devise a formula that could be used to measure the comparative effect of each of two factors of production upon the total product to satisfy a linear log-log relationship in his input and output data (see Douglas, 1967).

$y_T/y_0 = F[y_0, k, h],$ (8)

where the growth of output per effective labour unit y_T/y_0 is a function F of the initial output per effective labour unit y_0, k and h. Using the interpretation of Mo (2001), which is based on Schumpeter (1912, 1939), the described relationship reflects two main classes of influence on the evolution of an economy in the long run. One is the growth component, which is due to changes in the factor availability of capital and labour (i.e. variables K and AL). The other is the development component of social and technological changes driving total factor productivity (i.e. variables Y_0 and H)[4].

As we aim at analysing the relationship between the real exchange rate distortion and growth, the basic growth function as described in equation (8) shall be augmented by the variable rerd. This yields the following equation:

$y_T/y_0 = F[y_0, k, h, rerd].$ (9)

Using (9), a testable equation in logarithmic form can be defined as:

$\ln(y_T/y_0) = \alpha \ln y_0 + \beta \ln k + \gamma \ln h + \delta \ln rerd.$ (10)

The estimated cross-country regression[5] equation is the following:

$\ln G7000/30_i = a + b_1 {*} \ln Y70_i + b_2 {*} \ln I7000_i + b_3 {*} \ln S7000_i + b_4 {*} \ln RERD7000_i.$ (11)

The variable lnG7000/30 is the average annual growth of the natural logs of real GDP per capita between the years 1970 and 2000 taken from PWT 6.1. This variable is used as a proxy of the growth of y. lnY70 is the natural log of real GDP per capita in the initial year 1970 taken from the same source. lnI7000 is the natural log of the investment share of the real GDP per capita, averaged over the period of 1970 to 2000. This variable is the proxy variable for k and stems also from the PWT 6.1

[4] The reason why, beside the human capital stock H, the initial output level Y_0 is also defined as a development component is that under the conditional convergence theory initially poorer countries have the possibility to grow faster as they can learn, imitate and apply technological achievements of the leading countries in a relatively short period of time.

[5] The cross country regression was estimated with the help of Microsoft Office XP Professional Excel 2002 software.

database. lnS7000 is the natural log of the gross secondary school enrolment ratio, averaged over the period of 1970 to 2000. It was taken from the WDI 2003 database. The variable lnS7000 can be used as a proxy for h. lnRERD7000 is our preferred real exchange rate distortion index.

Please note, that this sample has been chosen out of a data pool of 208 countries and territories of the world on the basis of data availability of all five employed variables. In order not to diminish the sample further, those three variables that were calculated as averages (lnI7000, lnS7000, lnRERD7000) do not necessarily represent an average of the whole period of 31 years. Rather, they represent an average of years due to data availability.

Table 5

Growth and Real Exchange Rate Distortion

Estimations:	A1
	Dependent variable
Independent variables	lnG7000/30
Constant	4.915
	(2.485)**
lnY70	-0.985
	(-4.952)***
lnI7000	1.342
	(4.078)***
lnS7000	1.335
	(4.537)***
lnRERD7000	-0.865
	(-2.329)**
R^2	0.503
Adjusted R^2	0.481
Number of observations	96

Note. Values of the *t* statistics are in parentheses.
The superscripts *,**, and *** following the t statistics represent a 10, 5, and 1% significant level, respectively.

Introducing the RERD variable into the basic growth regression (see estimation A1 in Table 5) yields a negative coefficient significant at the 5% level. This implies that a distorted real exchange rate is negatively related with economic growth in the long run.

In order to counter check this result we also performed a panel data analysis on levels. Our starting point to investigate the long run impact of the real exchange rate distortion on economic growth in a panel data Cobb-Douglas production function setting (based on the methodology of Canning and Bennathan, 2000) is a common world-wide production function given by

$$y_{it} = a_i + b_t + f(k_{it}, h_{it}, rerd_{it}) + \varepsilon_{it}, \qquad (12)$$

where y is the log output per capita of country i in time period t, a is a country specific level of total factor productivity, and b is a time dummy capturing world-wide changes in total factor productivity while k, h and rerd represent the log of per capita inputs of physical capital, human capital and the real exchange rate distortion index respectively. The term ε stands for the random error.

In this section we allow the production function f to be Cobb-Douglas, so that, in logs, we have

$$f(k_{it}, h_{it}, rerd_{it}) = \alpha k_{it} + \beta h_{it} + \gamma rerd_{it}. \qquad (13)$$

With regard to estimating this production function Canning (1999) emphasises that possible reverse causality might be a major problem, where capital inputs may determine output, but output may also have a feedback into capital accumulation. Canning notes that the output and capital variables might be non-stationary[6]. As a consequence, the production function may represent a long-run cointegrating relationship[7]. For this case Canning suggests to use the panel data cointegration methods of Kao and Chiang (1997), which allow each country to have its own short-

[6] A stationary process is such that the mean, variances and covariances of the error term do not change over time. The opposite holds true for a non-stationary process.
[7] In case there exists a particular (linear) relationship between two non-stationary series Y_t and X_t, these two series are said to be cointegrated.

run dynamic interactions and feedbacks[8]. This should give consistent estimates of the parameters of the production function that are robust to reverse causality. Thus, while the same production function is assumed to hold worldwide, the short run effects of the relationship between investment and income are allowed to vary across countries.

Therefore we shall try to estimate[9] the following equation

$$y_{it} = a_i + b_t + \alpha k_{it} + \beta h_{it} + \gamma rerd_{it} + \sum_{s=-m}^{m} \Phi_{is}\, \Delta k_{it+s} + \sum_{s=-m}^{m} \varphi_{is}\, \Delta h_{it+s} + \sum_{s=-m}^{m} \theta_{is}\, \Delta rerd_{it+s} + \varepsilon_{it}, \quad (14)$$

where equation 12 (using 13) was augmented by the short run dynamic effects of lags and leads of the capital stock growth rates (indexed by s), in addition to the current growth rate (i.e., s = 0).

For the levels of output per capita y_{it} we use the natural logs of real GDP per capita between 1970 and 2000 from PWT 6.1. In following closely Canning (1999), we construct a physical capital stock k_{it} (in natural logs), for the years of the period 1970-2000, using a perpetual inventory method and data from PWT 6.1. Assuming a capital-output ratio of three in a base year (for our purpose this is 1960) we update each year's capital stock by adding investment and subtracting as depreciation 7% of the existing capital stock. The human capital stock h_{it} is being proxied by the natural logs of the gross secondary school enrolment ratio from 1970 to 2000 from the WDI 2003 database. The variable rerd is our preferred real exchange rate distortion indicator.

Estimation B1, in Table 6, controls for the influence of RERD on output per capita in our traditional growth explaining panel analysis model. The result is the expected one. A distorted real exchange rate has a negative impact on output. The estimated coefficient of -0.14 is significant at the 1% level.

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[8] It is argued by Canning (1999) that simple ordinary least squares in levels (assuming stationarity although the series are in fact non-stationary) may lead to a tendency to find statistically significant coefficient estimates when in fact there is no relationship. On the other hand, simply taking first differences of all the variables, to eliminate non-stationarity, results in an estimation that relates short-run capital accumulation to short- run changes in output and may thus fail to capture the long-run relationship in levels that is at the heart of the production function.

[9] All the panel data regressions in this research were calculated with the help of Intercooled Stata 8.0 for Windows software.

Table 6

Output and Real Exchange Rate Distortion	
Estimations:	B1
Specification:	Fixed Effects Time Dummies
Short-run dynamics:	2 lags, 1 lead
	Dependent variable
Independent variables	y
Constant	2.485 (14.68)***
k	0.706 (49.57)***
h	-0.022 (-1.61)
rerd	-0.137 (-13.59)***
R^2 within	0.710
R^2 between	0.958
R^2 overall	0.954
Countries	107
Average T	17.6
Number of observations	1878

Note. Absolute values of the *t* statistics are in parentheses. The superscripts *,**, and *** following the *t* statistics represent a 10, 5, and 1% significant level, respectively.

Finally we also want to look at the impact of real exchange rate distortion on poverty. The theory suggests (see e.g. Klugman, 2002 or Min, 2002) that the real exchange rate can affect the poor in two ways. First, it influences a country’s external competitiveness and, thus, its growth rate (as it was shown above). Second, a devaluation the real exchange rate can have a direct impact on the poor. The idea is that the income of the poor is rather tied to the production and export of tradables, this would in turn increase their income while the cost of their main consumption item of nontradables would remain unchanged. Ceteris paribus, this would have a beneficial distributive impact on the poor.

In order to test this we want to estimate a simplistic poverty model, where poverty is explained by real GDP per capita at Purchasing Power Parities (y) and our real exchange rate distortion variable (rerd). As a poverty indicator (pov) we have been choosing the WDI 2005 variable poverty headcount ratio at USD 1 a day at PPP in % of the total population. The variable is defined as the percentage of the population living on less than $1.08 a day at 1993 international prices. The data is in logs. The estimated equation is the following:

$$pov_{it} = a + \alpha y_{it} + \beta rerd_{it} + \varepsilon_{it}, \tag{15}$$

Testing the model with regard to the underlying assumptions of panel data analysis for heteroskedasticity and autocorrelation has yielded the following results. To test for autocorrelation of panel data the Wooldridge test was used[10]. The null-hypothesis of no first-order autocorrelation had to be rejected, thus we observe autocorrelation of the errors across various points in time. With regard to heteroskedasticity we employed a likelihood-ratio test[11]. Again, the null-hypothesis of homoskedasticity had to be rejected. Thus the model's variables error term has a non-constant variance (i.e. is heteroskedastic). The consequence is that the standard errors are biased and thus the significance tests on the parameters are incorrect.

Nevertheless, it is possible to estimate panel corrected standard errors. The parameters are estimated by Ordinary Least Squares (OLS) or Prais-Winsten regression (depending on the options specified). When computing the standard errors and the variance-covariance estimates, the disturbances are, by default, assumed to be heteroskedastic and contemporaneously correlated across panels (each country being one panel data set). Thus we re-estimated the model assuming heteroskedasticity and first-order autocorrelation. Table 7 presents the results of the estimation of equation 15, using world wide data for the period 1970-2000.

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[10] This test was obtained from Drukker (2003) who has written the respective 'xtserial' STATA ado file. The test is based on Wooldridge (2002).

[11] The test was performed with the STATA 'xttest3' ado file written by Baum (2000). The author would like to express his gratitude for the help and instructions provided by Kit Baum from the Boston College Department of Economics.

Table 7

Poverty and RERD

Estimation:	C1
	Dependent variable
Independent variables	pov
Constant	11.360
	(16.2)***
y	-1.223
	(-25.9)***
rerd	0.167
	(1.31)
R^2	0.629
Number of observations	338
Number of groups	94

Note. Z statistics are in parentheses. The superscripts *,**, and *** following the z statistics represent a 10, 5, and 1% significant level, respectively.

The result of estimation C1 is that the coefficient of rerd is positive but only significant at the 20% level. This suggests that real exchange rate distortion increases poverty rather than not. Moreover the previous analysis showed that rerd is negatively correlated with real GDP per capita (y). Given that a higher y is associated with a lower level of poverty we can dare to claim that real exchange rate depreciation is a pro-poor policy.

6. The determinants of RERD

The empirical literature on the determinants of the real exchange rate and its misalignment is vast. As can be seen from Égert (2004) and Égert and Halpern (2005) only for transition countries a lot of research has been performed. Égert and Halpern (2005) conduct a meta analysis on that issue and look at the most common explanatory variables for the real exchange rate: productivity, net foreign assets and openness. Also, many studies look at the determinants of real exchange rate for developing countries in general. Thus, e.g. Drine and Rault (2005) try to explain the real exchange rate with the help of: the terms of trade, the trade policy, foreign direct investments, public spending, domestic investment and GDP per capita. A host of country papers try also to include more specific explanatory variables relevant for many countries in development. For instance Hyder and Mahboob (2005) include in their real exchange rate equation for Pakistan *inter alia* also remittances as an independent variable.

In this analytical part of our research the RERD index will be used as the dependent variable (rerd)[12]. Explanatory variables such as for instance nominal exchange rate policy will be tested. Moreover we shall also control for the effects of high remittances as well as high tourism exports, which both might have a negative influence on the real exchange rate, if the mechanism is similar to what is predicted by the 'Dutch Disease' theory in the case of high natural resources exports (see e.g. Corden and Neary 1982 and Corden 1984). This could help us to detect some relevant policy issues which could be applied to reduce real exchange rate distortions.

As we aim for explaining the general determinants of the RERD throughout the world using as many observations as possible we want to use here the RERD index calculated relative to the United States of America as the world's main trading partner using our 1970-2000 database from Holzner (2005) as a starting point. This is also because all of our world-wide raw data is denominated in USD and we want to perform as few as possible transformations.

Thus, we shall test for the following variables (their acronyms are put in brackets) as suggested by the literature, our own intuition and data availability (the expected sign of the coefficient is put in brackets – note that a '+' goes together with more real exchange rate distortion with an increase in the respective variable and *vice versa*):

a) Net Foreign Assets (nfa), (-);
b) Trade openness (open), (-);
c) Transport and communication quality (transcom), (-);
d) Nominal exchange rate depreciation (lcuusd), (-);
e) Remittances and compensation (remitcomp), (+);

[12] All our variables used in the analytical part are in log form.

f) Tourism (travel), (+);

g) Aid (aid), (+);

h) Foreign Direct Investment (fdi), (+);

i) International Financial Organisations' disbursements (nff), (+);

j) Natural resources exports (fuel), (+);

k) Government consumption (gov), (+);

l) Investment (gfcf), (+);

m) Real interest rate differential (rird), (+).

With the exception of the rerd and the travel variable all the above variables were taken from the World Development Indicators (WDI) 2005. Data on rerd stems from the Penn World Tables 6.1 and data on travel from the IMF's Balance of Payments and National Accounts databases. All variables were calculated as natural logs in order to simplify the interpretation. A proxy for productivity which is used in most of the literature, such as GDP per capita, was not included as this information is already contained in the rerd indicator.

The group of (partly overlapping) chosen explanatory variables splits into two sub-divisions – those that are expected to be linked to less real exchange rate distortion (-) and to more (+). In the first group we have Net Foreign Assets. The nfa variable is defined as the sum of foreign assets held by monetary authorities and deposit money banks, less their foreign liabilities. The values are defined as shares in GDP plus the value of 1[13]. As more capital flows into the country foreign liabilities increase and nfa falls. Thus increasing nfa is expected to be related with less rerd.

Moreover we have the trade openness indicator open which should act as a proxy for trade policy. This variable is the sum of exports and imports of goods and services measured as a share of gross domestic product. More trade openness is expected to

[13] This transformation of the indicator was necessary as there are also negative values for which a natural log can not be calculated. The exact way of calculating was to take the log of the absolute value plus 1 and multiply it with the original sign. This is based on the methodology explained in Levy-Yeyati, Panizza, Stein (2003).

be connected with less trade barriers and thus a less distorted real exchange rate. The transport and communication quality indicator was chosen as a crude proxy for 'geographical proximity' within the world wide transport and communication networks. The variable transcom are the telephone mainlines per 1000 people for the entire country. These are telephone lines connecting a customer's equipment to the public switched telephone network. Unfortunately no better indicator was to be found for such a big set of countries and years. The expectation is that transcom is strongly correlated with such variables as for instance the share of paved roads. More transcom is thought of decreasing rerd.

Finally, nominal exchange rate depreciation is assumed too to reduce rerd. The lcuusd variable is defined as the official exchange rate which refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar). lcuusd is put as the share of the current with regard to the previous period's official exchange rate. Thus values above 1 describe depreciation and *vice versa*.

The second sub-group of variables are those which are expected to increase the real exchange distortion, starting with workers' remittances and compensation of employees (remitcomp). This variable is defined as current transfers by migrant workers and wages and salaries earned by non-resident workers. Data are shares in GDP. The travel variable for tourism is the share of travel income in % of GDP as taken from the Balance of payments. The rationale of using this variable stems from a theoretical model by Copeland (1991) and was employed in our previous work (Holzner 2005). The idea is that tourism revenues would work in a similar manner as receipts from natural resources' exports in the Dutch Disease model – the 'Croatian Disease', thus causing a real exchange rate appreciation.

Similar to the above two variables it could be assumed that foreign currency inflows from aid could trigger a real exchange rate appreciation. The aid variable includes both official development assistance (ODA) and official aid. Ratios in GNI are computed using values in U.S. dollars converted at official exchange rates. Also the coefficient for the Foreign Direct Investments variable fdi is expected to be positive and it represents Net Foreign Direct Investment inflows, which is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. The indicator is calculated similarly to the nfa variable as a ratio to GDP plus 1[14].

Another indicator of this sort is the International Financial Organisations' disbursements nff variable. The indicator was calculated as the sum of the IMF's, IBRD's, IDA's and RDB's net financial flows, which are disbursements of loans and credits less repayments of principal, divided by the country's GDP plus the value of 1[15]. Needless to say that we also included an indicator for natural resources exports which is at the very heart of the Dutch Disease theory. As a proxy we took the variable fuel which is the share of fuel exports in % of merchandise exports. Fuels comprise SITC section 3 (mineral fuels).

The next two variables assumed by the theory to increase real exchange rate distortion are national accounts expenditure side indicators. First, government consumption gov, which is defined as general government final consumption expenditure and includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. It is calculated as share of GDP. Second comes the investment variable gfcf, which is defined as gross fixed capital formation and includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. It is also calculated as a share of GDP.

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[14] Again, this transformation of the indicator was necessary as there are also negative values for which a natural log can not be calculated. The exact way of calculating was to take the log of the absolute value plus 1 and multiply it with the original sign. This is based on the methodology explained in Levy-Yeyati, Panizza, Stein (2003).

[15] See previous footnote.

Finally, the real interest rate differential (rird) variable is also assumed to have an increasing impact on the real exchange rate distortion. It was calculated as the difference of the national real interest rate and the US level in the respective year plus 1[16]. Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.

Having demonstrated the negative impact of real exchange rate distortion on growth and output in the long run as well as its poverty increasing potential we can move on to the core of our analysis, the determinants of the real exchange rate distortion. Therefore we shall have our rerd variable as the dependent and our set of possible explanatory variables as the independent variables in a panel data analysis framework.

In such cases the question arises whether to perform the estimates from general to specific (deduction) or from specific to general (induction) as we do not have a clearly defined theoretical model to test. The weakness of the deductive method is the issue of the correctness of the initial assumptions while the weakness of the inductive method is the issue of the correctness of the final results. Thus neither deduction nor induction leads to the truth in which case we shall try to use both – the one being a check on the other (see Chiang and Wainwright 2005). This is what we have done. In the first case we have put all the explanatory variables in the regression and stepwise kicked out the most insignificant. In the second case we did the opposite and introduced the variables one by one, choosing the most significant to remain in the regression. Where two variables had the same level of significance we have been choosing the one with the highest R^2 in the model and we have been choosing the model with the highest R^2 and as many significant explanatory variables as possible.

Testing the models with regard to the underlying assumptions of panel data analysis for heteroskedasticity and autocorrelation has yielded the same results as in the case of the poverty model above. Therefore we, again, estimated panel corrected standard

[16] See previous footnotes for the exact calculation.

errors. We re-estimated stepwise the models assuming heteroskedasticity and first-order autocorrelation.

Table 8

Determinants of RERD

Estimation:	D1
	Dependent variable
Independent variables	rerd
Constant	5.406
	(44.24)***
lcuusd	-0.154
	(-8.17)***
open	-0.200
	(-7.99)***
fdi	0.222
	(2.53)**
gov	0.053
	(1.78)*
remitcomp	0.015
	(2.11)**
aid	-0.026
	(-3.84)***
gfcf	-0.061
	(-2.27)**
nff	-0.021
	(-2.80)***
R^2	0.9152
Number of observations	1643
Number of groups	112

Note. Z statistics are in parentheses. The superscripts *,**, and *** following the z statistics represent a 10, 5, and 1% significant level, respectively.

Table 8 shows our preferred model which was achieved by going from specific to general. The reasoning behind the choice was that this model had a higher R^2 as compared to the model going from general to specific. The results of estimation D1 show the following. The first two variables are those where a negative coefficient was expected. As anticipated, the lcuusd variable, indicating nominal exchange rate depreciation has a negative coefficient. This means that nominal exchange rate depreciation reduces the real exchange rate distortion in the long run (recalling that our sample includes world wide data for the period 1970-2000). The common interpretation is that a depreciation of the nominal exchange rate by 1% would lead (*ceteris paribus*) to a reduction of the real exchange rate by 0.15%, or for that matter a depreciation of the nominal exchange rate by 10% would lead to a reduction of the real exchange rate by 1.5%. Using the estimates from the growth regression A1 this would result (again *ceteris paribus*) in an increased long-run GDP per capita growth rate of more than 1 percentage point, which is not a trivial factor. Similarly, trade openness (open), which is assumed to be closely (inversely) related to the level of trade barriers, has a negative coefficient.

All the remaining variables are from the sub-sample of variables which were assumed to have a positive coefficient and thus be increasing real exchange rate distortion. However, three of them have in fact a negative coefficient. These are the indicators for the International Financial Organisations' disbursements (nff), aid and gross fixed capital formation (gfcf). FDI, remittances and government consumption display the expected positive coefficient. One explanation might be that the former three are connected with increased imports which could potentially lower the price level in the countries affected, while the latter foreign currency inflows involve more consumption of domestic non-tradables which would increase the domestic price level and as a consequence also increase the real exchange rate distortion. The same would be true for government consumption. In the case of the result for the International Financial Organisations' (IFOs) disbursements (nff) coefficient it might also be an explanation that under the Bretton Woods System nominal exchange rate devaluations after a crises often went together with IFO's disbursements, e.g. under the IMF stand by agreements. This could be another explanation why nff inflows are related to reduced real exchange rate distortions.

7. Policy simulation

The final part of our research is devoted to the simulation of a policy change in the case of a distorted real exchange rate. We employed the global simulation model

(GSIM) for the analysis of global, regional, and unilateral trade policy changes by Francois and Hall (2003)[17]. The model is a multiregion, imperfect substitutes model of world trade employing a partial equilibrium approach. Though it is not a fully-fledged general equilibrium model it has still some useful advantages because it allows for a relatively rapid and transparent analysis of a wide range of commercial policy issues with a minimum of data and computational requirements. Having the limitations of the partial equilibrium approach in mind, useful insights can be drawn with regard to relatively complex, multi-country trade policy changes. The results of the GSIM allow the assessment of importer and exporter effects related to tariff revenues, exporter (producer) surplus, and importer (consumer) surplus, changes in trade, output and prices. The model requires the input of a bilateral trade matrix at world prices, an initial matrix of bilateral import tariffs in ad valorem form, a final matrix of bilateral import tariffs in ad valorem form, export supply elasticities, aggregate import demand elasticities and elasticities of substitution. Using additional data, domestic production effects can also be fitted into the framework. For a more detailed description of the model see Francois and Hall (2003). The model has been used in our previous research on the costs of protection in Southeast Europe (see Holzner 2004[18]).

Assuming that each measure of economic policy can be substituted by another one with regard to its effects we shall feed the GSIM instead of tariff rates with the RERD indices of those three SEE countries where an overvaluation was estimated in 2003. These countries are Albania, Croatia and Serbia and Montenegro with a real exchange rate overvalued by about 8%, 16% and 9% respectively. Three models, one for each of the mentioned countries, were estimated separately in order to estimate the effects of a devaluation of the real exchange rate to the predicted level with regard to the stage of economic development.

2003 Balance of Payments total trade data as well as the GDP data were taken from the wiiw database. The models consist of two regions – the respective country

[17] The GSIM model can be downloaded, implemented in an Excel spreadsheet, from Joseph Francois' Homepage at: http://www.intereconomics.com/handbook/Models/Index.htm

[18] This and other studies conducted within the project 'Measuring the Costs of Protection in Southeast Europe' financed by the Jubiläumsfonds of the Oesterreichische Nationalbank can be found at: http://www.wiiw.ac.at/balkan/costofprotection.html

analysed and the ‘Rest of the World’ (ROW). An estimate of the ROW GDP was taken from the ECB. In the initial state we assume zero ‘tariffs’ for imports of the respective SEE country from the ROW and the RERD overvaluation percentage as a ROW ‘tariff’ with regard to imports from the respective SEE country. In the final state we assume that, after a real exchange rate devaluation to the extent of the estimated RERD overvaluation percentage, the SEE country’s exports to the ROW don’t face anymore ‘tariffs’, while on the contrary, the SEE country’s imports from the ROW become more costly and thus face a ‘tariff’ in the order of the RERD overvaluation percentage. Finally the elasticities were set. The export supply elasticity (1.5), aggregate import demand elasticity (-1.25) and the elasticity of substitution (5) were adopted from Francois and Hall (2003). However, in the case of the ROW an ‘infinite’ export supply elasticity (9999999) was assumed. This flattens out the supply curve and is in line with a small vs. very large country assumption. For the respective SEE country it was assumed that the elasticity of substitution is at 7.5, indicating that citizens of the West Balkan countries prefer to a lesser extent local products to foreign as compared with the ROW. This is based on anecdotal evidence and the fact that the West Balkan countries are in many respects rather heterogeneous countries with parts of the population having very tight relationship with neighbouring countries and/or the EU. These are certainly very simplified assumptions. However, due to scarce data it would be almost impossible to estimate ‘true’ elasticities. It could be thought of employing average elasticities as e.g. described in 22 industry studies by Messerlin (2001). There, especially the elasticities of substitution seem to be in general much lower than 5. However, in the literature an elasticity of substitution of 5 is used quite often (see also Fujita, Krugman and Venables 2000).

Disregarding the estimated welfare effects as calculated by the model we want to focus on the estimated changes in output and trade. The estimated results of the GSIM modelling can be observed in Table 9. A devaluation of the real exchange rate to its predicted level yields significant general output increases.

The magnitude of the output increases is similar to the former level of RERD. This increase of output is due to a substantial estimated double digit surge of exports to the ROW as well as a rise in trade with self (i.e. import substitution) after imports became more costly and diminished as a consequence. Assuming the GSIM results to be accurate it could be expected that a realignment to a balanced real exchange rate might have also very positive effects on employment.

Table 9

GSIM estimates of a real exchange rate devaluation

	Albania	Croatia	Serbia & M.
RER depreciation	7.6%	15.9%	9.0%
Change in output	5.4%	15.1%	6.6%
Change in exports	22.8%	37.6%	26.5%
Change in imports	-27.1%	-37.4%	-31.1%
Change in trade with self	6.5%	16.7%	8.0%

Source: own calculations.

The empirical findings of economically positive results of policies reducing real exchange rate overvaluation in SEE could help to change both domestic as well as EU policies on SEE and to improve their impact. These policy issues will be discussed in the following, last part of our research.

8. Policy consequences & the impact of EU policies on SEE

Given the acquired results from above we can conclude our research with some policy implications focusing at the impact of EU policies on Southeast Europe.

The countries of Southeast Europe are currently experiencing a vast inflow of foreign currency notably via the channels of remittances and/or FDI. Our analysis has shown that these two items are among the determinants of the real exchange rate distortion that is observable especially in the Western Balkans.

At the same time most of these countries perform a fixed or even nominally appreciating exchange rate regime *vis a vis* the Euro as their anchor currency. This is not necessarily voluntarily. In fact the EU has here in a first step only an indirect influence as in the stage of negotiating the Stabilisation and Association Agreements (SAAs) with the countries of SEE the EU has outsourced its influence on SEE's nominal exchange rate policy to the International Financial Organisations. These have set ‘stability-oriented’ exchange rate policies as conditionalities. Without these conditionalities SEE countries can’t participate in the European and world wide integration processes, which are most vital for those countries. In a second step via the SAAs the EU influences SEE countries’ real exchange rate policy – but only via (free) trade policy. Finally, only in a third step in case the SEE countries become members of the EU, the EU influences directly their nominal exchange rate policy via the introduction of the common currency.

Our research suggests with the help of a simulation of a policy change that the reduction of the real exchange rate distortion would have substantially positive effects on both exports and total output of the respective countries. One way to do this would be a nominal exchange rate devaluation. However, we do not suggest neither a radical over-night devaluation nor a gradual approach. Non of the two options follows automatically but depends on the concrete situation.

The EU could thus reconsider its (indirect) pre accession influence on the SEE countries’ nominal exchange rate policy and actively promote a real exchange rate targeting. This could not only increase the SEE countries’ export and output potential but could also ease their migrants’ flows to the countries of the EU through a reduction of unemployment and an improvement of the social conditions.

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