Imre Vámos
Óbuda University
Department of Finance, Hungary
E-mail: vamosz@vipmail.hu

EXCHANGE RATE AND PUBLIC DEBT IN CENTRAL EUROPE

Abstract

In the present paper – following a preceding investigation in 2012 – I investigate the way the most important macroeconomic and economic policy factors have influenced the equilibrium exchange rate of the Central and South Eastern European currencies in the last decade. I am endeavouring to compare the price fluctuations of foreign exchange markets in the eurozone and 15 emerging economies. I take advantage of the concept and methodology of fundamental and behavioural exchange rates theory. I examine in a panel regression framework how productivity, interest rate differentials and monetary variables affect nominal and real exchange rates and then compare the result with individual countries' analysis based on the methodological guidance offered by ECB (2004). Empirical tests suggest that higher than average public debt largely influences the market value judgement of currencies and explain long run tendencies. I also point out that emerging markets' data raise a lot of methodological problems.
Keywords: nominal and real exchange rates, public debt

1. INTRODUCTION

The goal of the paper is to reveal the long-run relationship between nominal and real exchange rates and macroeconomic fundamentals in a panel of 15 Central and South (Eastern) European countries with close economic ties to the eurozone for the years following the introduction of the common European currency.

When estimating long-run relationship between exchange rates and macroeconomic fundamentals the general problem regarded as starting point is why PPP based real exchange rate deviates from one or a constant, what factors make the long run exchange rate follow different path than that marked by the purchasing power parity condition proposed by Cassel. Even in the original conception it was acknowledged that presuming that the law of one price holds, one needs to take account of – among others – the presence of transaction costs and temporary interest deviations. In the short run a reason for the exchange rate fluctuating around an equilibrium path can be the temporary difference between (real) interest rates of the two currencies based on the interest parity condition. Between a more and a less developed country such interest differential also appears in the long run which is manifested in the CHEER (capital enhanced equilibrium exchange rate) approach which combines purchasing power parity relations with uncovered interest parity, in which the difference in interest rates existing between the two countries is not interpreted as a simple short-term effect but as a persistent phenomenon. Furthermore, the PPP based exchange estimation is often – especially in the case of comparing the currency price of a less developed country to a more developed one – supplemented by the Balassa-Samuelson effect. This effect can better detect the productivity growth differentials prevailing between the two countries which accounts for the dissimilar price level development of the tradable and non-tradable (tertiary) sector goods and therefore explains long-run trends of real exchange rates. Égert-Halpern et al. (2005) question the Balassa-Samuelson effect whether it really exerts strong influence on the relative growth rate of the price level of two countries. The fact that tradable sector products might include non-tradable market-determined and regulated market components makes the question even more complicated. They conclude, nevertheless, that the dual (tradable and non-tradable) productivity differential – similarly to terms of trade and public consumption with less explanatory power – always has a positive impact on the real exchange rate in the studies focusing on exchange rate movements in the CEECs.

Most of the relating literature examines how real exchange rate behaves in equilibrium. The internal-external equilibrium conceptions – including fundamental equilibrium exchange theories (FEER) – were developed to define an exchange level (which can be interpreted mostly from a normative point of view), in that internal balance is underpinned by full employment and an output level at low inflation, whereas external balance is ensured by net savings and the corresponding current account identity under the given internal conditions

(Bouveret, 2010). The behavioral equilibrium exchange rate theory (BEER) – see Clark and MacDonald (1998) for instance – tries to explain the formation of real effective exchange rates determined by economic fundamentals and does not necessarily provide any economic equilibrium condition such as external balance or full employment. Behavioural equilibrium exchange rates, nevertheless, often have well-established results which can be used for explaining the deviation of exchange rates from their historically given equilibrium path, and therewith for a valid judgement on the explanation of the overratedness or underratedness of currencies. PEER (permanent equilibrium exchange rate) theories separate persistent long-run and medium-run effects (defining currency fluctuations along a business cycle) to interpret equilibrium exchange rates (Bęza-Bojanowska, 2009). After calculating medium-run and long-run effects, exchange rate misalignment is then decomposed into the effects of transitory factors and random walk disturbances and the impact of the deviation of economic fundamentals from their long-run their sustainable values. While the models designed following internal-external equilibrium conditions or any economic relation among fundamentals usually lack a consistency in stock-flow measures and therefore raise numerous statistical problems, can still provide a good approximation of the medium-term level of equilibrium exchange rates. (Bouveret, 2010).

Égert-Halpern (2005) take advantage of a meta-regression analysis to reassess empirical findings and conceptional statements on equilibrium exchange rates and investigate eight new EU member states' exchange misalignment. They justify that different exchange rate theories (BEER, FEER, PEER) deliver different levels of currency misalignment and the methodology might also distort estimation results. As different methodologies and different equilibrium exchange conceptions provide rather diverse picture on countries' currency rate tendencies it is worth examining more economies in a panel framework to discover similarities in the relationship between macroeconomic fundamentals and exchange rates within a greater dataset consisting of various countries with possibly similar development characteristics. A panel estimation therefore seems to be reasonable when analysing exchange rates of emerging economies such as new and future EU members.

2.   METHODOLOGICAL BACKGROUND

Before fixing exchange rates in a common currency area equilibrium exchange rate calculations are essential to avoid wrong determination of final values against the common currency. When assessing factors affecting changes in currency value of catching-up economies we can draw on the experiences of countries moving towards a monetary integration fifteen or twenty years ago.

Alberola et al. (1999) use panel cointegration techniques to identify time-varying equilibrium real exchange rates and bilateral equilibrium nominal rates in order to gauge whether EMU member countries' choice of fixed parity

towards the euro basket of currencies was well established before entering the eurozone in an internal-external equilibrium model. By defining an external balance as proposed by Frenkel and Mussa (1985) and an internal equilibrium condition of Balassa and Samuelson (1964) they decompose the exchange rate of a country into a ratio of the prices of foreign and domestic tradables and the price ratio of domestic tradables and non-tradables. They relate the concept of equilibrium exchange rate with that of cointegration on a sample of data consisting of the US dollar, the Canadian dollar, yen and the eurozone countries' former currencies and opt-out EU countries' currencies. They explain equilibrium exchange rates with net foreign asset data (as a sum of current account balances) and an index of relative sectoral prices' (as described by the above price ratio) impact on exchange rates. With this methodological solution they were able to conclude that the dollar was overvalued towards the euro at the beginning but the four major currencies were well locked to the common currency at the time of the creation of the eurozone.

Exchange rate estimations usually emerge when discussing Central and Southern Eastern European Countries in the context of how to define the right equilibrium exchange rate for the time of new EU countries' entrance to the ERM II. Apart from the difficulty in accessing data on these countries an important issue to be addressed is the strong undervaluation of these currencies after the shift to market economy. Despite the dispputed sectoral Balassa-Samuelson effect at least the question of productivity differentials can not be disregarded if emerging economies' exchange rate is discussed. In a cross-sectional interpretation the gap between PPP based and nominal exchange rates can be well approximated by productivity indicators. The ECB (2004) provides a methodological overview on how to tackle this problem and first of all recommends the usage of a panel data framework. By estimating the behavioural exchange rate of emerging countries one have to cope with problems of missing and extremely volatile data. For a better estimation the ECB (2004) proposes first of all that instead of assessing what factors affect long-term exchange rates in a country-by-country analysis it is more advisable to use a panel framework with economies of similar size and of similar macroeconomic fundamentals. With a more extended database the estimation results will significantly improve, however, the inclusion of too many different economies might also lead to false conclusions. In their two-step method one should first select a panel of market economies with long history and reliable data and use the intercept and other parameter values of the cointergation panel of these countries' data to test emerging economies' statistics one by one by extrapolation. For the panel group of advanced economies first the presence of cointegration should be tested then it is worth using more estimation methods such as dynamic OLS or pooled mean estimations.

Hassan and Holmes (2012) was investigating less developed markets to detect the relationship between income remittances and the real exchange – defined as ratio of tradables and non-tradable price indices – in a panel data

analysis. Apart from the two variables under examination they included real GDP per capita, government expenditure, terms of trade and six-month US interest rate. They found some evidence for income remittances causing real appreciation in the home country in the long-run.

3.   EMPIRICAL RESULTS

Drawing on previous research results I analyse the quarterly time series of the nominal exchange rate of the euro expressed in units of national currency and the real effective exchange rate – where applicable – for a panel of 15 Central and Southern European countries. The examination period spans the years 1999-2012. The period is first of all determined by data availability but is also important to note that by 2000 a significant real appreciation of these currencies had taken place (ECB 2004) and a less strong positive tendency, if any, has continued until today.

Data were collected from the IMF IFS, Ameco and Eurostat databases. The idea behind also using nominal data was to trace the relationship between the exchange rate and inflation as well as financial market processes as proposed by the underlying theories of exchange parity conditions. Among the selected countries under examination some maintain or maintained fixed exchange rates which of course means that countries with rigid exchange regimes (such as the Baltic countries and Bulgaria with their currency board system) serve as control group for the analysis. Similarly those Central European countries which have acceded the eurozone (Slovenia, Malta, Cyprus, Slovakia and Estonia) have had no fluctuation in their currency rates against the euro but still have their own real effective exchange rate data. Major deficiencies in the dataset appeared in the case of Croatia, Serbia and Turkey, therefore I had to, for instance, estimate productivity statistics based on national (annual) labour market survey for Serbia (SORS, 2012) and use mixed values of IMF and Eurostat statistics for Turkey and Croatia. Croatian and Serbian exchange indices were missing in Eurostat and therefore replaced by bruegel.org (2012) on the basis of the methodology of Darvas (2012).

Based on earlier research I use a basic relation which I earlier tested on the data of value of the euro against the Hungarian and Polish currency and the USD-euro exchange rate (Vámos, 2012). The starting equation suggests an equilibirium exchange rate that evolves under balance of payment equilibrium in its original form described by MacDonald (2000):

$$s_t = \alpha_0 + \alpha_1(s_{t-1}) + \alpha_2(p_t - p_t^*) + \beta_1(y/emp_t) - \beta_2(y/emp_t^*) + \gamma_1(i_t - i_t^*) + \gamma_2(debt_t) + u_t$$
(1)

where s_t denotes the period t (and s_{t-1} is the t-1) nominal exchange rate, p_t is the period t inflation, y/emp_t is the productivity (GDP/employed persons), $debt_t$ is the

public debt to GDP ratio, i_t is the 3-month money market rate and u_t is the error term (variables marked by an asterisk stand for the same variables of the foreign sector). With the inclusion of the public debt-to-GDP variable I presume that countries suffering under the disadvantages of enormous debt services payable observe a depreciation of their currencies mainly in times of global financial crises when investors tend to be more risk averse than under more stable world market circumstances. (It replaces net foreign assets when explaining financial account processes). Productivity data, inflation and interest differentials reflect deviations from eurozone average (changing composition) statistics. Because of difficulties in data availability of quarterly tradable and non-tradable price indices I do not control for sectoral effects within the internal economy, only for external price competitiveness with the help of terms of trade indices.

In the first step I calculated the gap between real exchange rates and nominal exchange rates against the euro area for 1999 and 2006 in a cross-sectional dataset.
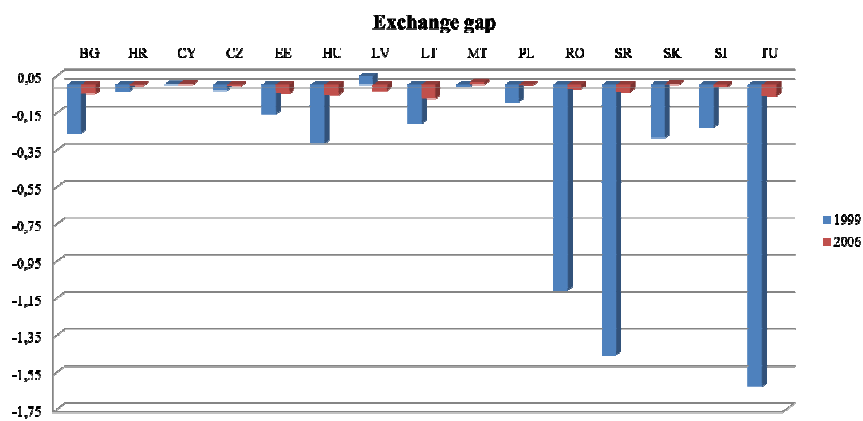

Figure 1 Gap between real and nominal effective exchange rates

Notes: BG=Bulgaria, CY=Cyprus, CZ=Czech Republic, HR=Croatia, EE=Estonia, HU=Hungary, LV=Latvia, LT=Lithuania, MT=Malta, PL=Poland, RO=Romania, SR=Serbia, SK=Slovakia, SI=Slovenia, TU=Turkey

Source: AMECO, bruegel.org, 2013, author's figure

The exchange gap was still significant in 1999 and had moderated by 2006 which was the last year when all these countries kept up independent currency regimes. By approximating exchange gap in the two selected years by GDP per capita PPS and GDP per employed person (in PPS) we find strong link between the different measures of productivity and a remarkable elasticity in 1999 especially if we use a dummy for countries with currency board. In 2006, however, as the gap is getting narrow, the elasticity significantly reduces and also R^2 figures decline, moreover, the dummy appears with a negative coefficient.

	1999		2006	
	without dummy	*with dummy*	*without dummy*	*with dummy*
GDP/capita	coefficient		coefficient	
	0,750727 (0,03171)	1,10893 (0,00124)	0,0425218 (0,06240)	0,034884 (0,08174)
	adjusted R^2		adjusted R^2	
	0,254929	0,562694	0,183890	0,388288
GDP/employed person	coefficient		coefficient	
	0,706739 (0,04282)	1,07463 (0,00199)	0,0492247 (0,04731)	0,031385 (0,21040)
	adjusted R^2		adjusted R^2	
	0,223901	0,528468	0,213413	0,305612

Table 1 Gap between real and nominal effective exchange rates

During the computation of the regression (with OLS) I employed the logarithmised values of data indexed to the average of 2005 for quarterly time series as Eurostat publishes real effective exchange rates and productivity indices with a base index of 2005. I also inserted a crisis dummy variable to control for above average exchange shocks between 1999 and 2000 as well as 2008 and 2009. These variables are applied to explain major speculative attacks and the global financial crisis. Euro introduction and currency board countries were also controlled for.

I conducted the testing of nominal and real effective exchange rates by involving the dummies and inserting other fundamentals one by one. Among all explanatory variables applied in the model the productivity differential appeared with a characteristic positive sign in real exchange estimations but had to be replaced by trade balance to GDP data for testing nominal exchange rates. The currency board dummy was significant in both tests though with ambiguous coefficients (depreciating nominal exchange and appreciating real), eurozone entrance dummy seemed to appreciate nominal and less affecting real exchange, whereas the crisis dummy only had explanatory power for real data. Openness dynamics (measured as data indexed to 2005) makes currencies stronger in contrast with the results of ECB (2004), the level of public debt (its indexed dynamics were not significant), as suspected, accounts for a significant depreciation. The explanatory power of other variables involved in the models (terms of trade index, M2/GDP levels, interest differentials, euro growth and fixed capital formation to GDP levels) vary according to whether nominal or real values are explained. It is interesting to note, that interest differentials were involved in nominal terms and still approximate real values better. (Inflation

differentials only had significant coefficients in the case of the real effective exchange rates but were disregarded for methodological reasons.)

Nominal exchange rate

	Coefficient	Std. Error	t-ratio	p-value
const	-1,12061	0,0914831	-12,2493	<0,00001
euro	-2,38463	0,103568	-23,0248	<0,00001
currency board	0,395861	0,0786269	5,0347	<0,00001
openness_dynamics	-0,665062	0,210346	-3,1618	0,00163
trade balance/GDP	-0,0116737	0,00402607	-2,8995	0,00384
debt/GDP	1,1173	0,178767	6,2500	<0,00001
terms_of_trade	1,46827	0,549641	2,6713	0,00771
M2/GDP	0,242523	0,0261471	9,2753	<0,00001

R-squared	0,472544	Adjusted R-squared		0,467894

Real exchange rate

	Coefficient	Std. Error	t-ratio	p-value
const	0,224078	0,0232622	9,6327	<0,00001
euro	0,0167882	0,0109465	1,5337	0,12553
currency board	0,031717	0,00828201	3,8296	0,00014
crisis	-0,024007	0,0095771	-2,5067	0,01239
openness_dynamics	0,0809191	0,0242199	3,3410	0,00088
GDP/employed differ.	0,364334	0,0268943	13,5469	<0,00001
debt/GDP	-0,167151	0,0200518	-8,3360	<0,00001
interest differential	-0,263474	0,0572918	-4,5988	<0,00001
euro_growth	-0,00986752	0,00174168	-5,6655	<0,00001
gross capital to GDP	-0,00515332	0,00075549	-6,8212	<0,00001

R-squared	0,453815	Adjusted R-squared		0,447406

Table 2 Nominal (euro) and real (effective) exchange rate estimations in panel

Source: Eurostat, IMF, AMECO, bruegel.org, 2013, author's calculation

As last step I also conducted the panel regression for the exchange gap of real and nominal effective exchange rates against the eurozone countries. The results were in line with the above described findings and proved to be more robust than in the previous tests. Among dummy variables currency board and eurozone entrance remain significant, GDP per employed persons differential henceforward strongly contributes to real appreciation, just like openness

dynamics. Debt-to-GDP, interest differential, eurozone growth and gross capital formation to GDP remain important regressors decreasing the gap between real and nominal exchange rate. It is interesting to note that the indexed (and logarithmised with 2005 as basis year) terms of trade indicator appears with a strong positive sign increasing the value, whereas the level of openness (expressed as a percentage of GDP) tends to decrease the value of national currencies in line with ECB (2004). The reason why also capital formation depreciates currency might be that capital invested in these countries mostly flows in in the form of FDI and because of profit remittances abroad finally decreases the real value of the national currency.

Exchange gap

	Coefficient	Std. Error	t-ratio	p-value
const	0,239912	0,0208333	11,5158	<0,00001
euro	-0,0373973	0,0113542	-3,2937	0,00103
currency board	0,0191337	0,00814469	2,3492	0,01907
GDP/employed differ.	0,413638	0,0272093	15,2021	<0,00001
openness_dynamics	0,22452	0,0264783	8,4794	<0,00001
debt/GDP	-0,101194	0,0185827	-5,4456	<0,00001
interest differential	-0,677907	0,0604447	-11,2153	<0,00001
euro_growth	-0,0104817	0,00158891	-6,5968	<0,00001
grosscapital to GDP	-0,00317091	0,000571369	-5,5497	<0,00001
openness (to GDP)	-0,0544974	0,0109716	-4,9671	<0,00001
terms of trade	0,5049	0,0640661	7,8809	<0,00001

R-squared	0,618530	Adjusted R-squared	0,613471

Table 3 Exchange gap estimations in panel

Source: Eurostat, IMF, AMECO, bruegel.org, 2013, author's calculation

4. CONCLUSIONS

After a period of strong devaluation of Central and South (Eastern) European currencies, mainly due to economic transition and political shifts, by 2006 these countries currencies' have strongly converged to their market value as suggested by the mitigation in the gap between real and nominal effective exchange rates. Based on BEER exchange estimation we have a great abundancy of variables with possible significant effect on emerging countries' exchange rates. Among the macroeconomic fundamentals having most significant explanatory power on long-term exchange path productivity and interest differentials, public debt-to-GDP ratio, openness can be identified as best fitting ones. The OLS framework used in the present analysis, however, suffers from

numerous methodological discrepancies, which makes it reasonable to continue the research with the above data in a panel cointegration framework to set up a model capable of forecasting and provide a reliable judgement of the possible over- and underratedness of currencies.

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