Explanations for the Real Exchange Rate Development in the New EU Member States in Transition

Galina Boeva

BULGARIAN
NATIONAL
BANK

1879

ГОДИНИ
БЪЛГАРСКА
НАРОДНА
БАНКА

130 YEARS

YEARS
BULGARIAN
NATIONAL
BANK

Explanations for the Real Exchange Rate Development in the New EU Member States in Transition

Galina Boeva

DISCUSSION PAPERS

Contents

SUMMARY. Factors underlying the real exchange rate movements during the transition process are examined using panel data of ten Central and Eastern European countries between 1993 and 2006. The real exchange rate is decomposed into two components: the real exchange rate of the external sector, i.e. the terms of trade, and the price of tradables in terms of nontradables. For the purpose of the empirical analysis the economies are divided into a tradable and nontradable sector using the degree of openness of the main industries. The key results show that the real appreciation is mainly driven by shifts in total consumption towards nontradables as well as changes in the production structure in favor of goods and services of better quality and with higher technological content. In the longer run, the transition specific driving forces of the real exchange rate will become less important and mainly factors related to the real convergence are expected to have influence on the real exchange rate in the transition economies.

Galina Boeva, Department of Economics, University of Mannheim

Contact information: e-mail: gboeva@rumms.uni-mannheim.de, Phone: +49 621 1811817, University of Mannheim, Department of Economics, D-68131 Mannheim, Germany.

1. Introduction

Two decades of transition have brought about significant change in the structure of Central and Eastern European countries (CEEC). According to the report of the European Bank for Reconstruction and Development, many of these countries have almost finished the process of transition to a market economy.[1] The report for 2007 points out that nine of the ten new EU member states from Central and Eastern Europe have already achieved a very encouraging average of above 3.4 points of the transition indicators with four being the score for the advanced industrialized countries (EBRD 2007).[2] After the accession to the European Union in 2004 and 2007, the next step to be taken in these countries is the adoption of the euro. Slovenia and the Slovak Republic were the first to introduce the European currency at the beginning of 2007 and 2009 respectively. Three of the other countries are already participating in EMR2.[3] The remaining five countries are expected to join the system in the near future. However, the fulfillment of the Maastricht criteria has been often considered a hard task for the CEEC because the strong real appreciation as a result of the real convergence process and the transition specific changes since the breakdown of the COMECON[4] makes the simultaneous achievement of low inflation and nominal exchange rate stability impossible.

The development of the real exchange rate (RER) is one of the 'diagnostic' characteristics of the transition period (Fischer 2002) and is often seen as an indicator for potential loss of competitiveness in the export sector (see e.g. Oomes 2005). The collapse of the communist system was accompanied by a sharp nominal and real depreciation of Central and Eastern European currencies. To a large extent the depreciation was a result of the monetary overhang at the beginning of the transition process. However, the political and economic uncertainty explains the fact that the CEEC began the transition not only with depreciation but also with strongly undervalued currencies (Halpern/Wyplosz 1997, Krajnyák/Zettelmeyer 1998).[5] The real appreciation that followed was initially considered as a correction to the sharp depreciation. However, the real exchange rate continued to appreciate long after the

---

[1]The present paper covers ten countries in transition, namely those that acceded to the European Union in 2004 and 2007, because they can be considered a homogeneous group sharing similar characteristics and the common target of joining the European Economic and Monetary Union (EMU).

[2]Only in Slovenia the value amounts to 3.3.

[3]ERM2 already includes Estonia, Latvia and Lithuania.

[4]Council for Mutual Economic Assistance.

[5]E.g. in terms of PPP. The explanation proposed by Halpern and Wyplosz (1997) is based on the lack of confidence in the untested authorities. Uncertainties surrounding the equilibrium value of the exchange rate at the beginning of the transition made policymakers prefer to err rather on the side of undervaluation.

initial level had been reattained. The real appreciation turned out to be an equilibrium phenomenon characterizing the transition process.

The observed development of the RER led to a large body of literature. Many approaches were proposed to explain the CEEC equilibrium real appreciation. Some authors refer to productivity developments as in the Balassa–Samuelson framework focusing on the supply side (e.g. Golinelli/Orsi 2002, Jazbec 2002, Rother 2000, Sinn/Reutter 2001). Others claim that productivity differentials account only for a small part of the real appreciation and search for further determinants in other macroeconomic variables such as demand side factors or shifts of production towards new goods or goods of better quality (Backé et al 2003, Égert 2004, Égert et al. 2003, Mihaljek/Klau 2003). The present paper offers a comprehensive analysis of the driving forces of the real exchange rate in the new EU member states in the process of transition. Potential explanations for the development of the RER are discussed and empirically tested whereas the RER is decomposed in two components – the real exchange rate of the external sector of the economy and the price of tradable goods in terms of nontradables relative to a reference country. For the purpose of the empirical part the tradables/nontradables dichotomy is examined with regard to the countries of Central and Eastern Europe using the degree of openness of the main industries as an indicator.

The results partly differ from the existing body of literature exploring the real exchange rate movements in the transition countries. Contrary to the studies explaining the real appreciation as a result of productivity improvements in the tradables sector, the analysis shows that the main driving forces of the real exchange rate are the shift of the overall demand towards nontradable goods and the change in the production structure in favor of goods and services of better quality and with higher technological content. Other demand-side factors play only a limited role in explaining the real appreciation, while the productivity variable turned out to be insignificant in all regressions. This result illustrates that the tradables/nontradables dichotomy is crucial for the investigation of the Balassa – Samuelson effect. A close examination of the data indicates that productivity growth in the tradables sector is actually outpaced by productivity improvements in the newly emerging private sector of nontradable services in many countries.

The rest of the paper is organized as follows. Section 2 presents the theoretical explanations for the real appreciation in the CEEC. Section 3 investigates tradability in different industries and presents the data for the empirical analysis. In section 4 the main results of the empirical analysis are outlined. Finally, section 5 summarizes and contains a brief discussion of some recent developments in the CEEC.

2. Theoretical Background

The real exchange rate is defined as

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

or respectively

$$q = e + p^* - p \qquad (2)$$

expressed in logarithms. E refers to the nominal exchange rate as the price of the foreign currency in terms of home currency. P represents the overall price level; the asterisk denotes variables for the foreign country and the small letters the corresponding variables in logarithms. An increase in the real exchange rate therefore indicates a real depreciation of the home currency.

The price level in each country can be calculated as the geometric average of the price level in the tradables (T) and nontradables (N) sector:

$$p = \alpha p^T + (1-\alpha)p^N \qquad (3)$$

$$p^* = \alpha^* p^{T*} + (1-\alpha^*)p^{N*} \qquad (3a),$$

where α denotes the weight of the tradable goods in the price index and is calculated as the share of tradables in the overall consumption expenditure.

Substituting (3) and (3a) into (2) and rearranging leads to the following equation:

$$q = \left[e + p^{T*} - p^T\right] + \left[(1-\alpha)(p^T - p^N) - (1-\alpha^*)(p^{T*} - p^{N*})\right] \qquad (4).$$

The first term in parentheses can be interpreted as the real exchange rate of the external sector of the economy and is denoted q^T. According to relative purchasing power parity (PPP) it should be constant over time or at least revert to a constant mean value, since tradable goods are exposed to interna-

tional competition.[7] The second term is the price of tradable goods in terms of nontradables relative to that in the foreign country, respectively weighted by the share of nontradable goods in the overall consumption expenditure. It can be thought of as the real exchange rate of the sheltered sector and will be labeled q^N. Decreasing relative prices of tradables to nontradables at home relative to abroad lead *ceteris paribus* to a real appreciation. This effect can be strengthened by an increasing share of nontradables in the overall consumption in the home relative to the foreign country. Based on equation (4), the appreciation of the real exchange rate is thus the combined effect of the real appreciation in the external sector and the increase in the price of nontradables in terms of tradables relative to the foreign country:[8]

$$\hat{q} = \hat{q}^T + \hat{q}^N \tag{5}.$$

Equations (4) and (5) represent the basis for further discussion.

Figure 1 on the next page shows the development of the RER and its components in the transition economies. The Producer Price Index (PPI) serves as a proxy for the prices of tradables. The price of tradables in terms of nontradables (RelPr) is calculated as the quotient between the CPI-based[9] overall RER (RER(CPI)) and the RER of the external sector (RER(PPI)). All time series are expressed as indices with 2006 as reference. As obvious from the figure, the real exchange rate of the external sector moves considerably, therefore violating the PPP assumption even for the tradable goods. The dynamics of the relative price of tradables in terms of nontradables is rather modest and shows even an upward trend in Romania and Slovenia in the last few years. The conventional theoretical literature interprets the changes in the overall real exchange rate mainly as shifts in relative prices (Balassa 1964, Samuelson 1964, Bergstrand 1991, etc.). However, it seems necessary to look for explanations of the real exchange rate in the CEEC not only in terms of tradable to nontradable prices, but also in terms of domestic to foreign tradable prices.

---

[7]In a weakened version, the relative PPP has been often interpreted in the terms of a mean reversion process. The real exchange rate does not have to be constant but rather to follow a mean reversion process. The estimated deviation from the relative PPP has in many studies a half-life of four years. See e.g. Frankel/Rose (1995) for a panel projection of PPP.

[8]Again weighted by the share of nontradables in consumption.

[9]Consumer Price Index (CPI).

Figure 1

DEVELOPMENT OF THE RER AND ITS MAIN COMPONENTS
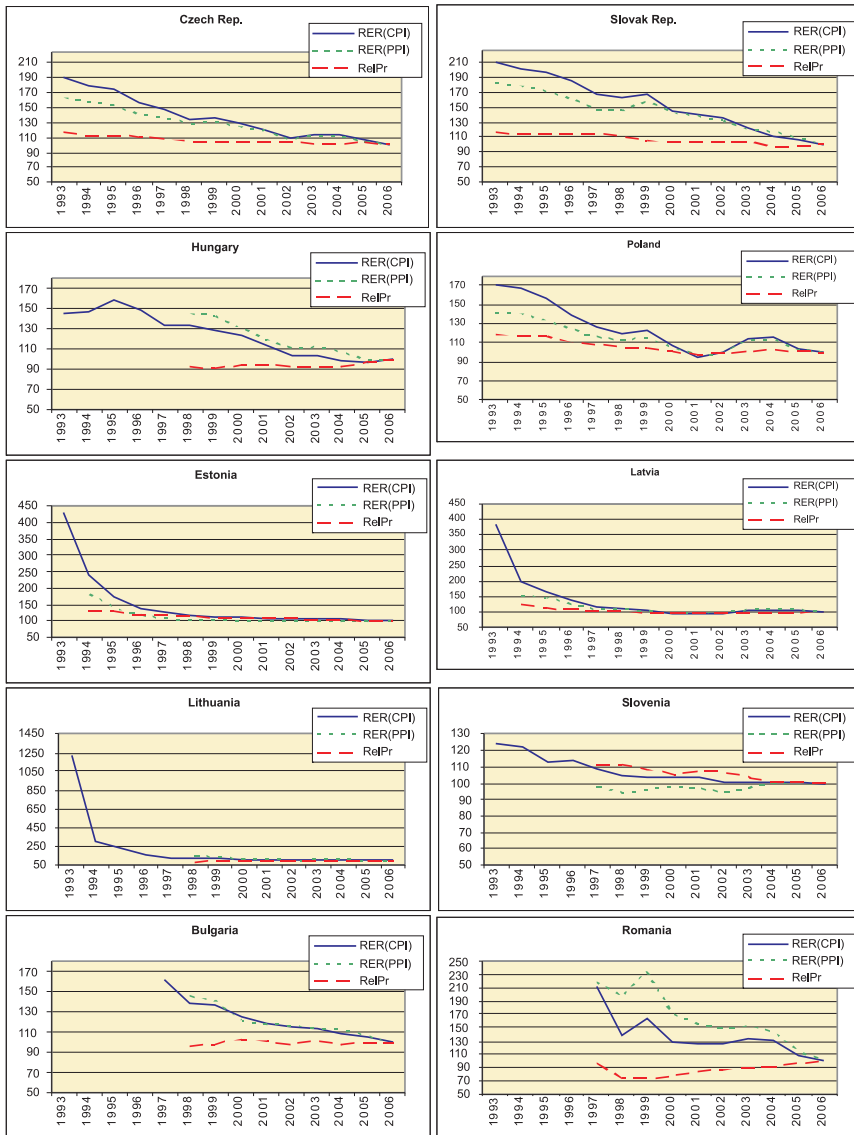
Source: Own calculations based on data from Eurostat (euro exchange rates) and UNECE (CPI and PPI). For more details, see Section 4.

2.1. Explanations for the Movement of the Real Exchange Rate in the External Sector

Quality Improvement in the Bundle of Tradables

Although the small open economies of Central and Eastern Europe cannot affect the prices of tradable goods on the world market, it is possible for them to experience a change in the structure or quality of the basket of goods forming the PPI. A change in the reputation of the home-produced goods on the world market, sound marketing measures and a shift of the production towards goods with higher technological content or of better quality could explain the relative increase in the prices of tradable goods compared to the world market level (see Égert/Lommatzsch 2004, Oomes 2005). An empirical investigation of this explanation is provided by Égert and Lommatzsch (2004) who assume that the better quality of the production is directly linked to the transmission channels between the productivity improvement in the tradables sector during the process of transition and the RER. However, using productivity as a proxy for the effect of quality improvement and better reputation of the home produced tradable goods on the world market does not allow for differentiating this effect from the conventional impact of productivity via the Balassa – Samuelson effect.[10] Alternatively, the effect can be approximated by the amount of foreign direct investment (FDI) inflows accumulated since the beginning of the transition process relative to the size of the economy, since it has been driven by and large by the import of know-how or broadly by the activity of foreign investors. An increase in foreign investment is expected to lead to quality improvement or a shift of the production towards goods with higher technological content, which, in turn, increases the prices of tradable goods produced in the home country and leads to appreciation of the real exchange rate of the external sector.[11]

Further explanations for the development of the real exchange rate in the external sector can be found in some transition specific changes in the CEEC. Fischer (2002) proposes to explore the effect of trade and price liberalization as well as that of the privatization process on the real exchange rate.[12]

---

[10]See Section 2.2.

[11]Depending on the industry in which the FDI are allocated, the same argumentation can also be applied to the real exchange rate of the sheltered sector.

[12]These explanations are possible under the assumption that PPP is violated even in the sector of tradables. As already shown, this assumption seems to be satisfied in the case of the CEEC.

Trade Liberalization

The liberalization of international trade, also associated with an increasing degree of openness, can lead to depreciation of the real exchange rate of the external sector in the long run because it intensifies the price competition on the national market of tradables. However, at the beginning of transition it is also possible to observe an adjustment of the home market to world market conditions improving marketing and the quality of exports.[13] Opening for international trade can then lead to real appreciation due to increasing prices of the tradable goods in which these countries have a comparative advantage.

Price Liberalization

The process of price liberalization[14] also affects the real exchange rate both in the medium and the long run. Most of the regulated prices in the CEEC in the later years of transition refer to nontradables like communication services and further basic goods and can affect the real exchange rate via the channel of both the relative prices and the RER of the external sector. The liberalization of prices directly affects the overall price level in the short to medium run through an adjustment of prices to the level of marginal costs. Given that the price regulation concerned mainly nontradable basic goods, deregulation will lead *ceteris paribus* to decreasing relative price of tradables in terms of nontradables. Furthermore, the negative income effect associated with increasing prices of basic goods combined with the inelastic demand for these goods are expected to affect negatively the demand for imported or luxury goods. The consequence of this secondary effect will be declining prices of domestically produced tradables both in terms of nontradables and relative to the foreign tradables. Therefore, the medium term effect of price liberalization on the real exchange rate is expected to lead to real depreciation of the RER of the external sector and to real appreciation of the sheltered sector. The exposure to price competition is expected to reinforce the real depreciation in the long run.

Privatization

Privatization and the increasing private sector share in gross domestic product (GDP) on the one hand increase the investment opportunities for home residents as well as for foreign investors. Improving technology in production can lead to better quality and higher prices of the home produced tradable goods. This effect should be captured to a large extent by the amount of FDI relative to GDP. Further on, an increasing private sector share

---

[13]This effect should occur independently of the activity of foreign investors.

[14]E.g. captured by the decreasing share of administered prices in the consumer price index.

in GDP means a lower share of subsidized prices. However, the direct effect of price liberalization can be captured by the share of administered prices in CPI, as described above.

On the other hand, it is also possible to observe a long-run depreciation of the RER when the private sector share in GDP increases since it is also associated with an intensification of competition. Moreover, depending on the industry to which the privatized enterprises belong, the private sector share in GDP can impact on both the RER of the external sector and the relative price of tradables in terms of nontradables.

In his empirical analysis Fischer measures the impact of the institutional arrangements respectively by the tariff revenues as a percentage of imports, the share of administered prices in CPI and the private sector share in GDP. The results show that only the privatization variable has a strongly significant coefficient implying appreciation of the RER as a result of progress in privatization between 1993 and 1999. In the present analysis, the influence of the transition specific changes will be further investigated using a longer time span and controlling for their impact on both components of the RER. The tariff revenues as a measure for the progress in trade liberalization will be replaced by the degree of openness, since it was not exactly the tariff policy which had blocked the international trade in the centrally planed economies.

The real appreciation of the external sector can be considered as one of the specific characteristics of the transition process. It is mainly driven by structural changes on the way to a market economy and the adaptation to world market conditions. It should diminish as the transition process goes forth.

2.2. Explanations for the Adjustment of the Relative Prices

Most of the theoretical work on the real exchange rate determinants relies on the assumption of holding relative PPP in the external sector. The fluctuation of the real exchange rate is then explained by variations in the relative price between tradables and nontradables. The theoretical approaches behind the adjustment of tradables prices in terms of nontradables can be broadly divided into two groups. The first group includes models which explain the relative price movements from the supply side of the economy. The best known two approaches are the Balassa – Samuelson effect and the relative factor endowments effect – as proposed by Bhagwati (1984). The second group of explanations refers to demand side factors such as shifts of private demand from tradables to nontradables (Bergstrand 1991), or increasing government spending or investment demand as a share of GDP and shift of overall demand toward nontradable goods (e.g. Edwards 1989, De Gregorio/Wolf 1994, Schröder/Pfadt 1998).

2.2.1. Supply-side Explanations

Relative Productivity

In the spirit of Balassa (1964) and Samuelson (1964) a rapid increase in the productivity of the tradable sector (mainly manufacturing) relative to that of the nontradable sector (mainly services) can lead to increasing relative prices of nontradables. If this effect is stronger in the home than in the foreign country and the real exchange rate of the external sector is constant in accordance with relative PPP, this implies a real appreciation of the home currency.[15] The starting point is a model of a small open economy, in which both tradable and nontradable goods are produced according to constant-returns production functions of capital and labor employed.[16] The capital costs are determined under the assumption of full capital mobility by the world market interest rate and PPP in the external sector links the price of tradables to the world market level. It is further assumed that intersectoral (but not international) labor mobility leads to nominal wage equalization between the two sectors of the economy and that operating under the conditions of perfect competition implies a real wage equal to marginal labor productivity in each sector. Therefore, increase of productivity in the external sector leads to rising nominal wage, which is then transferred to the closed sector, where the productivity improvement is smaller. Increasing labor costs in this sector are then compensated by raising the prices of nontradable goods. If the productivity growth in the external relative to the sheltered sector in the home country is larger than in the foreign country, the prices of nontradables increase faster at home than abroad which is reflected in a real appreciation of the home currency after accounting for the different weights of nontradables in consumption.

The fact that the Balassa – Samuelson effect is at work in the countries of Central and Eastern Europe has been empirically supported by and large. The only point of contention is the magnitude of the effect. In many empirical analyses strong evidence is presented that more than half the real exchange rate movements can be interpreted as driven by the productivity growth in the external sector of the CEEC (Golinelli/Orsi 2002, Jazbec 2002). However,

---

[15]As visible from the decomposition of the RER, the weight of nontradables in the overall consumption expenditures has also to be accounted for (see equation 4). Significantly lower weights of nontradables in the CEEC than in industrialized countries can be considered as an explanation for the low power of approaches ascribing the real appreciation to the movements of the relative prices (see e.g. Égert et al. 2003). The increase in the price of nontradables relative to tradables in the home country can only result in real appreciation if it exceeds the increase in the corresponding relative price abroad by an extent accounting for the different share of nontradables.

[16]For a mathematical representation see e.g. Obstfeld/Rogoff (1996).

a second strand of the literature claims that the productivity development in the CEEC explains less than half the real appreciation (Backé et al. 2003, Égert et al. 2003, Mihaljek/Klau 2003). The assumptions underlying the Balassa – Samuelson effect are separately analyzed in Breuss (2003), Égert et al (2003) and Nenovsky and Dimitrova (2002). The main reason why the latter studies find only a weak Balassa – Samuelson effect in the CEEC is the violation of PPP in the external sector. Further on, low flexibility of the labor market and the relatively low weight of nontradables in overall consumption expenditure compared to the industrialized countries can also be considered as factors which limit the impact of the Balassa – Samuelson effect. A main drawback of the empirical analyses of the Balassa – Samuelson effect thus far is the insufficient examination of the relative productivity between tradables and nontradables. A differentiation of the sectors of tradables and nontradables is missing and the relative productivity is mostly proxied by productivity in manufacturing or by overall labor productivity.

World Market Interest Rate

The assumptions made by the usual general equilibrium framework used to reproduce the implications of increasing productivity incorporate a further potential supply side explanation for the dynamics of the relative prices. According to the perfect capital mobility assumption the cost of capital is set by the world market real interest rate. Assuming that the production of tradables is relatively capital intensive,[17] an increase in the real interest rate raises the cost of capital and, similarly to the considerations underlying the Stolper – Samuelson theorem, leads to increasing relative prices of tradables.[18]

Relative Factor Endowment

The general equilibrium framework is also applied by Bhagwati (1984) to explain the differences in relative prices among countries. In addition to the Balassa – Samuelson approach, Bhagwati's explanation relies on the different relative factor endowments: poor countries tend to be endowed with more labor relative to capital compared to rich countries and thus have lower wage-rental ratios. This is the reason why nontradables are relatively cheaper in poor countries, since these goods are labor-intensive compared to the

---

[16]As compared to the labor intensive production of nontradables.

[17]The Stolper – Samuelson theorem states that an increase in the relative price favors the factor used relatively intensively in the production of the product under consideration (See Stolper/ Samuelson 1941, Dixit/Norman 1980). It is the reverse thought applied here. See e.g. De Gregorio/ Wolf (1994). Assuming perfect capital mobility, in their theoretical model the real interest rate appears in the denominator of the equation that determines the relative price of nontradables in terms of tradables.

tradables. The operationalization of this approach has been often carried out by including GDP per capita as a proxy, since no reliable data about the capital stock are available. However, this variable does not discriminate between the factor endowment effect and other explanations, like the Balassa – Samuelson effect or demand shifts if the latter are not explicitly accounted for.

Assuming perfect capital mobility and PPP in the external sector, the relative price of nontradables to tradables in the general equilibrium framework is entirely determined by the supply side of the economy. However, there is a range of approaches explaining the dynamics of the internal real exchange rate which relax the assumption of full capital mobility and consider the impact of demand side factors. They are the focus of the remaining part of this section.

2.2.2. Demand-side Explanations

Relative Consumption

Bergstrand (1991) proposed to explain the real exchange rate development by shifts in the structure of the consumption expenditure. His considerations rely on the Linder – Hypothesis that with higher income 'products filling new needs are added' (Linder 1961). Assuming non-homothetic preferences of the representative household, Bergstrand shows that the nontradables (tradables) demand exhibits income elasticity larger (smaller) than one. Therefore, increasing income leads to a change in the composition of private consumption with demand for nontradable goods showing a disproportionately high growth. The shift of private consumption toward nontradables raises their relative price and causes an appreciation of the real exchange rate.[19] In the literature thus far, only Coricelli and Jazbec (2004) allow explicitly for an adjustment of the consumption structure in their analysis of the real exchange rate in the CEEC.

Public Expenditure

The structure of total demand can be further influenced by public expenditure. On the one hand, fiscal policy can bring about a change in the relative price of nontradables via its income and substitution effects. If an increase in government expenditure is financed by taxes, it lowers the income of the representative household and can thus lead to real depreciation as in Bergstrand (1991). Furthermore, the crowding out effect of an expansionary fiscal policy can negatively affect private activity and in this way contribute to the income effect. On the other hand, the structure of government expenditure should

---

[19]The changing composition of the private consumption expenditure with increasing income is also obvious from the convergence of the weights of tradables and nontradables to the level of the industrialized countries.

also be accounted for. Given the labor-intensive nature of public goods, it can be assumed that a large share of the expenditure is attributed to nontradable goods such as public services. If this is the case, an increase in government spending will alter the structure of total demand in favor of nontradable goods and will lead to real appreciation (De Gregorio/Wolf 1994). By and large, the empirical evidence confirms the positive effect of an expansionary fiscal policy on the real exchange rate (De Gregorio/Giovannini/Wolf 1994, Edwards 1989). In regard to the countries of Central and Eastern Europe, Égert, Halpern and MacDonald (2005) list ten empirical works showing the positive impact of the government expenditure on the real exchange rate and two in which the effect is negative.

Investment Demand

Most of the evidence on the appearance of productivity-driven real appreciation relies on the transmission channel of the Balassa – Samuelson effect. However, Fischer (2002) shows that technological advances can influence the real exchange rate via a second channel as well, namely through increasing investment demand. The model assumes that part of the investment expenditure falls on nontradable goods, such as the installation of new capital goods. In accordance with the proposition of Schröder and Pfadt (1998), Fischer demonstrates that the technological progress attracting home and foreign direct investment lead to an increasing demand for nontradables and thus contribute to the real appreciation via increasing relative prices of nontradables in terms of tradables.

2.3. Interdependency between Both Components of the Real Exchange Rate

Even though the relative prices of tradables in terms of nontradables constitute a component of the overall real exchange rate on their own, the possibility of an additional effect via the real exchange rate of the external sector cannot be ruled out. In empirical investigations involving the tradables/nontradables dichotomy it has been a hard task to find a price index capturing solely the prices of tradables. Whatever price index used, it always has some nontradable components, including nontradable services like distribution, marketing, before and after sales services, etc. (see among others Kravis/Lipsey 1978). Thus a secondary effect of the relative price of tradables in nontradables on the RER comes from the real exchange rate of the external sector (see e.g. Égert et al 2005).

Furthermore, the relative price of nontradables can be affected by the real exchange rate of the external sector, since it depicts in a way the terms of trade of the home country. An increase in the terms of trade can be due to

increasing export prices accompanied by a positive income effect and/or decreasing import prices initiating substitution from nontradable goods to imported ones (see e.g. De Gregorio/Wolf 1994, Ruddies 2008). These two effects work in opposite directions as regards the relative price of tradables in terms of nontradables. If the substitution effect prevails, the increase of the terms of trade will be reflected in increasing relative prices thus implying a depreciation of the real exchange rate. If however the income effect outpaces the substitution effect, a real appreciation will be the result of the positive change in the terms of trade. Although both outcomes are theoretically possible, it is the second one that has been mostly confirmed by the data with regard to the transition economies (see among others Beguna 2002, Csajbók 2003, Rawdanowicz 2003 in Égert et al 2005).

Figure 2 on the next page summarizes the factors for the dynamics of the real exchange rate in the CEEC. Before proceeding with the empirical investigation of the theoretical explanations, the next section examines the tradables/nontradables dichotomy. The *ad hoc* classification proposed here should shed light on the controversy regarding the magnitude of the Balassa–Samuelson effect in the transition economies.

Figure 2

THEORETICAL EXPLANATIONS FOR THE RER DYNAMICS IN THE CEEC
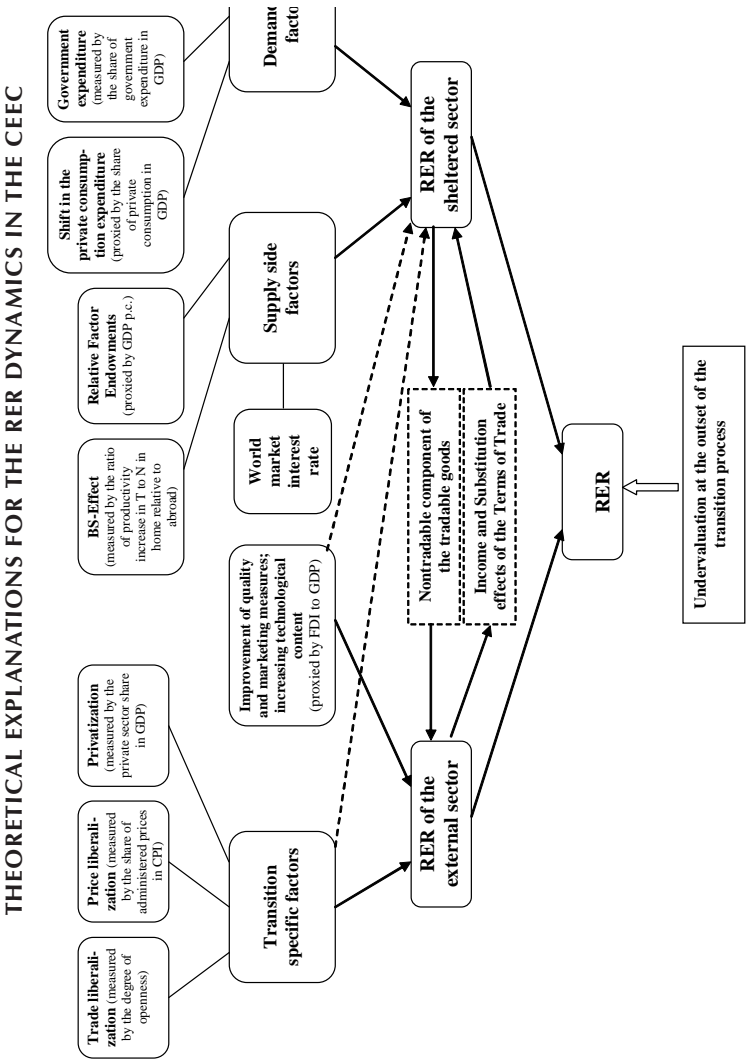
Note: Dashed lines indicate that the corresponding explanation has been introduced in the section about the driving forces of the RER in the external sector but can also apply for the RER of the sheltered sector depending on the goods or prices the measures actually affect. Dashed boxes stand for the indirect effect between the two components of the overall RER.

3. Data

3.1. Defining Tradability

The tradables/nontradables dichotomy is a central starting point for many research topics such as the determination of inflation in open economies, the specification and estimation of international trade flows and the theory of real exchange rate determination (Goldstein/Officer 1979). Despite its significance to economic theory, to the best of my knowledge there has been no empirical analysis regarding the distinction between tradable and nontradable goods for the case of the economies in transition. In the present section a short overview of the related literature regarding industrialized countries is presented and the main findings are applied to the case of the CEEC.

In accordance with the varying object of the different studies and the nature of the data used in these studies, diverse tradables/nontradables classifications have emerged in the literature (Dwyer 1992, Goldstein/Officer 1979). At one end of the spectrum the tradables sector consists of a narrow class of goods which enter into international trade (exports and imports) and satisfy the law of one price (e.g. Viner 1937). At the other end there is a broad class of goods which either earn or save foreign exchange (exports and import replacements) or could do so at a certain relative price. Aukrust (1970) defines as sheltered industries those whose products are left relatively free of foreign price competition (either because of the nature of the products or because of government protection). Goldstein and Officer (1979) apply three complementary criteria in their definition of the tradables and nontradables sector, namely the degree of foreign trade participation (it should be substantially higher for tradables), the cross-country correlation of price changes (it should be higher for tradables), and the degree of substitutability between domestic and traded goods from other countries (tradables should be closer substitutes for actually traded goods). In later analyses De Gregorio, Giovannini and Wolf (1994) and De Gregorio and Wolf (1994) propose rating a sector as tradable if exports amount to more than 10 per cent of the production value. According to their definition, the sector of tradable goods includes agriculture, mining, manufacturing and transportation services. All other products belong to the sector of nontradables. However, the main purpose of distinguishing between tradables and nontradables in the present analysis is to find industries in which the prices are largely driven by the conditions of world market competition. Using only the share of exports in production as reference point does not allow for having industries with low production levels but high imports and thus high consumption or investment expenditure. More suitable criteria for the purpose of the empirical analysis of the real exchange rate are

proposed by Dwyer (1992) and Knight and Johnson (1997), that is, the degree of export orientation and the degree of import substitution. They define an industry as part of the tradables sector if the share of its total supply accounted for by exports and/or the percentage of demand accounted for by competing imports exceed 10 per cent.

In accordance with the criteria of export orientation and import substitution/substitutability the present paper ascribes an industry to the tradables or nontradables sector of the economy using the degree of openness. The value of trade (imports plus exports) is divided by the value of the production of the industry. A certain problem arising from this methodology is the specification of the threshold value above which an industry should be defined as tradables. Given that the overall degree of openness (ODO) exceeds 100 per cent in most of the CEEC, the previously used value of 10 per cent exports or imports relative to the production value seems to be an inadequate threshold for a sector in which the prices should be mainly driven by world market competition. Thus, in the present analysis the classification of the industries is carried out in a way that the degree of openness is much higher in the sector of tradables than in the sector of nontradables.[20]

Data about foreign trade are taken from the statistics database of the World Trade Organization and the production value data stems from Eurostat. Table 1 shows the degree of openness of the main industries, for which reliable data for the transition economies are available.[21] The year 2004 is taken as reference partly because of data constraints and partly because in that year most of the transition-specific reforms should have been completed. Only industries with high private sector participation are considered. This leaves government-provided services including electricity, gas and water supply out of the analysis, since in many CEEC countries the latter had not yet been privatized.[22] Their prices were highly regulated and cannot be considered as market-determined. Data constraints make it impossible to include the sector of financial services, too.[23]

---

[20]This criterion is similar to the first criterion in Goldstein/Officer (1979), namely the degree of foreign trade participation.

[21]The last two rows of the table provide a comparison to two industrialized countries. Germany is chosen because it is the main trading partner of most of the countries, and Austria will be used as reference country in the empirical analysis (see below).

[22]This can be considered a serious drawback if one wishes to apply the classification to the calculation of relative prices or relative consumption. However, since it will be applied only to the relative productivity in the present analysis, the exclusion of the public sector is rather unproblematic (see below).

[23]It should be stressed that certain divergence in the classification of the industries in the data about the trade value and those about the production value is possible, since it was impossible to use data provided by one source.

Apart from the mining sector where the degree of openness is extremely high in some countries (the highest value is to 27.49 in Lithuania),[24] but relatively low in others (the lowest value has been found in Romania, 1.63), the highest tradability can be found in the sectors of travel, manufactures and agriculture. In the travel sector the degree of openness ranges from 0.98 in Romania to 4.75 in Bulgaria, whereas in manufacturing the degree of openness is the highest in Estonia, 1.76, and the lowest in Poland, 0.79. The highest value for the sector of agriculture has been found in Estonia, 3.39. However, the lowest values are found to lie far below the overall degree of openness, namely in Romania, 0.22, and in Bulgaria, 0.52.

At the other end of the spectrum are the sectors of transportation and other services. The highest degree of openness in transport has been found in the Slovak Republic, 0.93, and the lowest in the Czech Republic, 0.32. In other services the degree of openness is extremely low in Poland, 0.05, and the highest in Hungary, 0.27.

The data point toward a fairly clear cut distinction between the sector of tradables (mining, travel, manufactures) and the sector of nontradables (transport and other services). The sector of agriculture is the only exception. It will be left out of the following analysis, partly because of the large differences among the countries, and partly because of the nature of the price-setting mechanism, since in many countries the prices in agriculture have been highly regulated. Also regarding the relative degree of openness defined as the degree of openness of the particular industry relative to the ODO, the sector of transport and other services shows relatively lower values than in the other industries.

Given the data limitations, it would be optimistic to argue that the tradable nontradable dichotomy shows a high degree of precision. This classification, however, explicitly accounts for specific characteristics and trade patterns of the CEEC and is, therefore, more suitable than previous ones for the empirical analysis of the real exchange rate movement in these countries. As stated above, especially the estimation of the Balassa – Samuelson effect is expected to gain accuracy by using this *ad hoc* classification in the calculation of the relative productivity. It could also be useful to apply the tradables/nontradables classification to the calculation of relative consumption expenditure and the two components of the real exchange rate. However, no comparable data are available for these variables. The next section presents the data and a short overview of the variables representing potential explanations discussed in the theoretical part of the paper before proceeding to the results of the empirical analysis.

---

[24]The extremely high values here are possibly due to data peculiarities.

Table 1

DEGREE OF OPENNESS OF THE MAIN INDUSTRIES

	Agriculture (1)	Mining (2)	Manufacture (3)	Transport (4)	Travel (5)	Other Services (6)	Overall
Bulgaria	0.52 (0.41)	4.12 (3.27)	0.94 (0.75)	0.55 (0.44)	4.75 (3.77)	0.13 (0.10)	1.26
Czech Rep.	1.78 (1.27)	3.54 (2.53)	1.16 (0.83)	0.32 (0.23)	1.62 (1.16)	0.10 (0.07)	1.40
Estonia	3.39 (2.17)	5.19 (3.33)	1.76 (1.13)	0.62 (0.40)	3.29 (2.11)	0.18 (0.12)	1.56
Latvia	2.67 (2.57)	18.35 (17.64)	1.32 (1.27)	0.77 (0.74)	1.85 (1.78)	0.10 (0.10)	1.04
Lithuania	1.58 (1.42)	27.49 (27.77)	1.23 (1.11)	0.71 (0.64)	4.36 (3.93)	0.06 (0.05)	1.11
Hungary	0.89 (0.68)	15.99 (12.30)	1.30 (1.00)	0.38 (0.29)	3.42 (2.63)	0.27 (0.21)	1.30
Poland	0.79 (1.03)	1.91 (2.48)	0.79 (1.03)	0.32 (0.42)	2.66 (3.45)	0.05 (0.06)	0.77
Romania	0.22 (0.27)	1.63 (2.01)	1.10 (1.36)	0.45 (0.56)	0.98 (1.21)	0.11 (0.14)	0.81
Slovenia	1.64 (1.38)	12.14 (10.20)	1.27 (1.07)	0.47 (0.39)	2.36 (1.98)	0.11 (0.09)	1.19
Slovak Rep.	1.43 (0.94)	20.44 (13.45)	1.46 (1.04)	0.93 (0.61)	4.26 (2.80)	0.20 (0.13)	1.52
Germany	2.01 (2.79)	8.26 (11.47)	0.76 (1.06)	0.45 (0.63)	2.03 (2.82)	0.14 (0.19)	0.72
Austria	2.66 (2.66)	11.04 (11.04)	1.35 (1.35)	0.75 (0.75)	1.70 (1.70)	0.17 (0.17)	1.00
Classification		**Tradables**	**Tradables**	**Nontradables**	**Tradables**	**Nontradables**	

(1)   Agricultural products (including food and raw materials)
(2)   Fuels and Mining Products (including ores and other minerals, fuels, non-ferrous metals)
(3)   Manufactures (including iron and steel, chemicals, machinery and transport equipment
         textiles, clothing and other manufactures)
(4)   Transport (including transportation services)
(5)   Travel (including lodging, food and beverages, entertainment and transportation, gifts and souvenirs)
(6)   Other commercial services (including communication, construction, business services,
         personal, cultural and recreational services)

The degree of openness is defined as the ratio of the trade volume (exports+imports) to the production value of the industry.
The overall degree of openness is defined as the ratio of the overall trade volume to GDP.
Values in parentheses represent the degree of openness in the particular industry relative to the overall degree of openness.
Source: Own calculations.
Disaggregated data about the trade volume are taken from WTO statistical database.
Data about the overall trade volume, GDP and the production value are taken from EUROSTAT.

3.2. Definition of the Variables and Data Sources

The empirical estimation makes use of an unbalanced panel of ten CEEC with annual data between 1993 and 2006.[25] The overall real exchange rate (Q) and the real exchange rate in the tradables sector (Q^T) are represented respectively by the CPI- and the PPI-based real exchange rate between the local currency and the euro with Austria serving as the reference country.[26] The relative price of the tradables in terms of nontradables (Q^N) is calculated as the ratio between the CPI-based and the PPI-based real exchange rate. Data about the nominal exchange rate is taken from Eurostat and the price indices stem from the UNECE[27] statistical database. All three dependent variables are expressed as indices relative to 2006.

The quality and reputation improvement of tradable goods is proxied by the accumulated FDI inflows provided by the UNECE statistical database relative to GDP. Data about GDP and the euro/USD exchange rate needed to convert the FDI into euro is taken from Eurostat. The variable capturing the effect of quality improvements on the real exchange rate is named *fdi*. The expected sign is negative, since better quality leads to higher prices of tradables relative to abroad.

The influence of price liberalization and privatization on the development of the RER is measured respectively by the share of administered prices in CPI (*adm*) and the private sector share in GDP (*priv*), both provided by the EBRD transition reports. As in the section about the implementation of the tradables/nontradables dichotomy, the degree of openness as a measure for the progress in trade liberalization (*open*) is calculated as the trade volume ratio to GDP with data from Eurostat. The expected sign of the variable *priv* is positive, since increasing private sector share is associated with an intensification of competition and should thus lead to the development of better technology and lower prices in the home country. Likewise, the long term effect of price liberalization and trade liberalization is expected to be a real depreciation (positive sign of the coefficient of the variable *open* and negative of the variable *adm*). However, because of the short time span of the analysis, it is also possible to observe the opposite sign for trade liberalization, thus capturing the effect in the medium run.

The productivity in the tradables and nontradables sector is proxied by the production value divided by the number of persons employed in the sector

---

[25]See footnote 1.

[26]It would be preferable to choose Germany as a reference country. However, there are not enough comparable data for the productivity variable which is essential for the analysis of the Balassa – Samuelson effect. This is why Austria serves as a reference country instead.

[27]United Nations Economic Commission for Europe.

relative to the reference country Austria. According to the Balassa – Samuelson effect the productivity improvements in the economies as a whole should be more pronounced in the tradables sector than in the nontradables sector. The controversy of the results in the literature about the magnitude of this effect thus far deserves a closer look at the productivity data. Figure 3 shows the development of productivity in the two sectors of the economy.

Figure 3

TRADABLES AND NONTRADABLES PRODUCTIVITY
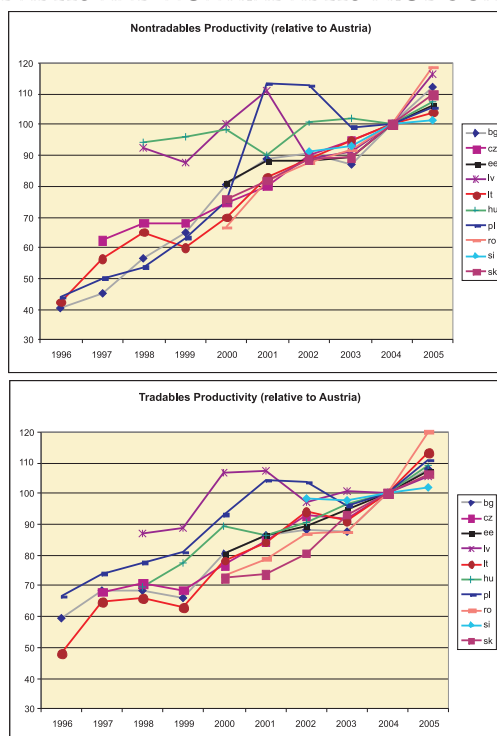
Source: Own calculations based on data from Eurostat

It is obvious that productivity improvements can be observed not only in the tradables sector, but also in the sector of nontradable goods.[28] Especially

---

[28]In fact, increasing nominal productivity in the nontradables is the expected outcome of the Balassa – Samuelson effect, since the productivity improvements in the tradables sector result in decreasing labour demand in the sector of nontradables implying a movement along the productivity curve an increasing prices in this sector. However, in the present case this development is accompanied by an increasing number of persons employed in the sector of nontradables, which can be explained by a shift of nontradables productivity that outpaces the productivity improvement in the tradables sector.

in the first decade of transition, this outcome can be expected, since most of the services were provided by the state sector during the social regime (Nenova 2004). The emergence and further development of the private service sector has been favored since the beginning of the transition process. Therefore, there has been high potential in the countries in transition for fast growth in productivity both in the tradables and nontradables sector. Besides the failure of the PPP in the external sector, productivity development in the nontradables sector is a second factor that could lead to a lower explanatory power of the Balassa – Samuelson effect with regard to the movements of the real exchange rate. A similar behavior of the productivity is also reported by Nenovsky and Dimitrova (2002) for the case of Bulgaria.

An even more striking conclusion can be derived by constructing a third indicator, the relative productivity of the tradable goods to the nontradables, again relative to Austria (*prod*). Figure 4 shows that there is no clear-cut pattern of the development of the relative productivity. Especially in the early years of transition the CEEC exhibit higher productivity growth in the sector of nontradables than in the industries producing tradable goods. This transition-specific characteristic seems to diminish hand in hand with the progress in transition and the relative productivity shows in most of the countries an increasing trend in the last years. Over the whole period under consideration the Balassa – Samuelson effect is not expected to make a large contribution to the real exchange rate appreciation. However, the relative productivity as a part of the real convergence is expected to gain in influence in the near future.

Figure 4

RELATIVE PRODUCTIVITY
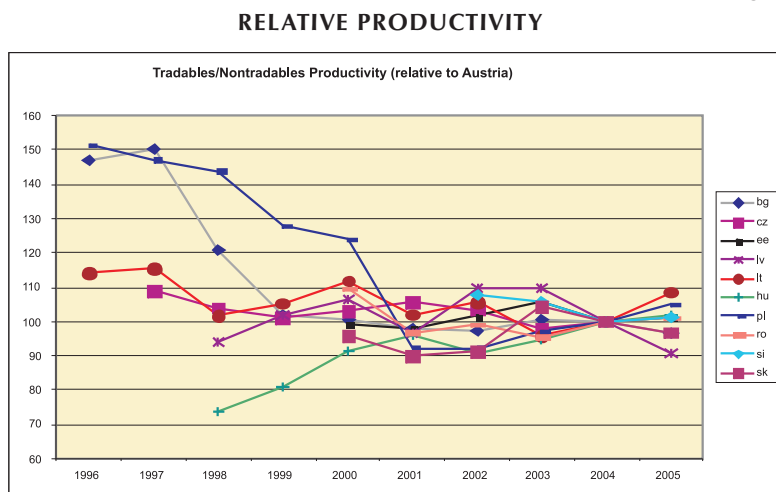
Source: Own calculations based on data from Eurostat

Data about the variables capturing demand side explanations for the RER appreciation as well as data about the GDP p.c. as a proxy for the effect of the relative factor endowments are taken from Eurostat. The shift of private consumption towards nontradable goods is approximated by the share of total consumption in GDP, since there is no reliable data about the consumption in both sectors. All four variables are expressed in relative terms with Austria as a reference country. The expected sign of the variables is negative, thus implying increasing prices of nontradables in terms of tradables with growing values of the variables. Increasing values of the GDP p.c. (*gdp*) are positively associated with the stage of development and thus with a higher capital/labor ratio in the economy. As a result the relative price of labor intensive goods, mostly nontradables, is expected to be an increasing function of GDP p.c. As regards the demand side factors, higher values of private consumption in GDP (*cons*), government expenditure (*gov*) and investment (*inv*) are associated with a shift of the overall demand toward nontradable goods and with lower relative price of tradables in terms of nontradables.

The world market interest rate is calculated as the average of the German and US long term interest rate as provided by UNECE. To achieve the real interest rate, the inflation rate measured by the annual growth rate of the consumer prices is subtracted. The expected sign of the variable *int* is positive in accordance with the Stolper – Samuelson theorem.

The terms of trade (*tot*) are derived from the Export and the Import Value Index provided by Eurostat. The ratio between the two indices is then converted into an index variable with 2006 as reference year. Depending on the magnitude of the income and substitution effects caused by the change in the terms of trade, the sign of the estimated coefficient can be either positive or negative.

All variables except the real interest rate are converted into logarithms. The equations to be tested in the fixed effects model are as follows:

$$q_{it}^T = \beta_0^T + \beta_{0i}^T + \beta_1^T open_{it} + \beta_2^T adm_{it} + \beta_3^T priv_{it} + \beta_4^T fdi_{it}$$
$$+ \beta_5^T \mathrm{int}_{it} + \beta_6^T prod_{it} + \beta_7^T gdp_{it} + \beta_8^T cons_{it} + \beta_9^T gov_{it} + \beta_{10}^T inv_{it} + u_{it} \qquad (7)$$

$$q_{it}^N = \beta_0^N + \beta_{0i}^N + \beta_1^N open_{it} + \beta_2^N adm_{it} + \beta_3^N priv_{it} + \beta_4^N fdi_{it}$$
$$+ \beta_5^N \mathrm{int}_{it} + \beta_6^N prod_{it} + \beta_7^N gdp_{it} + \beta_8^N cons_{it} + \beta_9^N gov_{it} + \beta_{10}^N inv_{it} + \beta_{11}^N tot_{it} + u_{it} \qquad (8)$$

$$q_{it} = \beta_0 + \beta_{0i} + \beta_1 open_{it} + \beta_2 adm_{it} + \beta_3 priv_{it} + \beta_4 fdi_{it}$$
$$+ \beta_5 \mathrm{int}_{it} + \beta_6 prod_{it} + \beta_7 gdp_{it} + \beta_8 cons_{it} + \beta_9 gov_{it} + \beta_{10} inv_{it} + \beta_{11} tot_{it} + u_{it} \qquad (9)$$

The first equation contains all explanatory variables of the RER in the external sector, but also those for the relative price of tradables except the terms of trade. The reason is the possibility of having a nontradable component in the producer prices which is impacted by the same variables as the RER in the sheltered sector. The second and the third equation include all variables described above, since the explanations for the development of the RER in the tradables sector can also apply for the nontradables sector depending on the industry in which the measures are brought about. The terms of trade capture the interdependency between the RER of the sheltered and that of the external sector.

3.3. Unit Root Test

The stationarity of the time series is tested using the Fisher test for panel data proposed by Maddala and Wu (1999). Similarly to the IPS Test (Im/Pesaran/Shin 1997) they use separate unit root tests for the N cross-section units instead of pooling the data. The combination of the observed significance levels from the different tests in the test by Maddala and Wu is brought about using the additive property of the χ^2 variables as suggested by Fisher (1932). The advantage is that the test does not require a balanced panel as in the case of the IPS Test and thus can be applied for the present data set.

The first column of Table 2 reports the χ^2 values of the Fisher test. The null hypothesis of non-stationarity is rejected for most of the variables at least at the 5 per cent level. The only exceptions are the RER of the external sector, the world market interest rate and the variable for the investment demand. However, in the case of these three variables the null hypothesis is rejected using the Fisher test including time trend. Thus, it seems reasonable to carry out the empirical analysis under the alternative hypothesis of stationarity around a deterministic trend for these three variables, and the alternative of stationarity without trend for the other time series.

To avoid the problem of spurious correlation, the time trend in a trend-stationary variable can either be removed by replacing the variable by the residuals of a regression of this variable on time or by including a deterministic time trend as one of the regressors (Harris 1995). In the following, the second approach is used. The trend variable is labeled time and is included in each regression.

Table 2

FISHER-TEST FOR STATIONARITY

* significant at 10 per cent, ** significant at 5 per cent, *** significant at 1 per cent		
Variable	**Fisher-χ^2**	**Fisher-χ^2 , incl. trend**
q	270.771***	
q^T	16.272	117.036***
q^N	52,798***	
open	42.132***	
adm	36.634**	
priv	387.856***	
fdi	130.236***	
int	6.1489	134.043***
prod	101.451***	
gdp	46.078***	
cons	123.184***	
gov	41.112***	
inv	17.342	31.299*
tot	69.188***	

4. Results

Table 3 on the next page shows the results of the empirical analysis. In the first step the usual standard errors are used to test the significance of the estimated coefficients. The Hausman test (Hausman 1978, see Baltagi 2005) is used to test the fixed versus the random effects model. In all three regressions the null hypothesis of no difference between the estimated coefficients of the fixed and the random effects model has been rejected (see Table 3). The joint significance of the fixed effect terms has also been tested by performing an F-Test (see Baltagi 2005). The null hypothesis is rejected in all regressions indicating a preference for this specification over a pooled model. The modified Wald statistic (Green 2000) is used to test for group-wise heteroscedasticity in the fixed effects model. The null hypothesis of homoscedasticity has been rejected in all three regressions so that the Huber/White heteroscedastic consistent variance estimator is used in the next step (Huber 1967, White 1980, see Wooldridge 2002). When using the robust estimators, the null hypothesis of the Hausman specification test was rejected only in the first two regressions. Thus, in the regression of the overall real exchange rate the random effects estimators are used since these are consistent and efficient under the null hypothesis. In the other two regressions the fixed effects model should be used despite the inefficiency of the standard errors since the estimates of the random effects model are inconsistent under the alternative. The overall F-statistic is also reported in Table 2 and is significant for all three regressions.

Table 3

RESULTS OF THE EMPIRICAL ANALYSIS

Standard errors in parentheses. The χ^2 value refers to the Hausman specification test for the H_0 of no significant difference between the coefficients of the fixed and the random effect model, in which case the estimates of the random effect model are the efficient ones. However, these are No. refers to the number of observations included in the corresponding regression.

* significant at 10 per cent, ** significant at 5 per cent, *** significant at 1 per cent, FE Fixed effects, RE Random effects, StE standard errors.

Variable	q^T(FE)	q^N(FE)	q (RE)
open	-.3654***	.2030***	-.0041
	(.0750)	(.0665)	(.0766)
adm	-.0743***	.1151***	-.0459*
	(.0245)	(.0214)	(.0245)
priv	.0287	.7320***	.2846
	(.2495)	(.2177)	(.2437)
fdi	-.0793**	-.0984***	-.1506***
	(.0363)	(.0270)	(.0438)
int	-.9928	-1.3555	3.9384
	(1.6538)	(1.0627)	(2.7348)
prod	.0565	-.0111	.0743
	(.0654)	(.0519)	(.0492)
gdp	-.8843***	-.0013	-.3405***
	(.0751)	(.0601)	(.0417)
cons	-1.0183***	.5705***	-1.529***
	(.2897)	(.1689)	(.2121)
gov	-.1999**	.1925**	-.3546***
	(.0924)	(.0760)	(.0980)
inv	.3960***	-.0625	.0733
	(.0607)	(.0513)	(.0865)
tot		.2206***	.2556
		(.0749)	(.1697)
time	.0379***	-.0040	.0263**
	(.0089)	(.0058)	(.0112)
constant	2.9101**	-.0023	-3.7977***
	(1.2254)	(1.0873)	(1.4427)
F	48.87***	7.70***	268.85***
F ( )	18.10***	23.96***	9.89***
Wald χ^2	992.89***	47.43***	38.79***
Hausman χ^2	28.05***	61.71***	41.47***
Hausman χ^2 (robust StE)	77.33***	192.37***	5.00
No.	72	72	73
R^2(within)	.9070	.6177	.7429

In the first regression regarding the driving forces of the RER of the external sector, two of the transition specific variables, *open* and *admin*, exhibit highly significant negative coefficients. An increase in the degree of openness and the share of administered prices in CPI both bring about a real appreciation of the RER of the tradables sector. The sign of the variable capturing the degree of price liberalization is the expected outcome both in the medium and the long run. Lower share of administered prices is associated with negative income effects in the medium run leading to decreasing prices of non-basic goods, and with an intensification of the price competition in the long run. As regards the sign of the degree of openness, it is rather the short to medium term effect captured by the coefficient. An increasing degree of trade liberalization is associated with an adaptation to the world market conditions both regarding quality and prices of exported goods, implying a real appreciation in the external sector. The sign of the variable capturing the effect of progress in privatization on the RER is not significant in this regression.

Depending on the particular market they refer to, the transition specific factors can also impact on the relative prices of tradables in terms of nontradables. This is apparent from the second regression where all three variables show highly significant positive coefficient. Increasing private sector share in GDP as well as increasing degree of openness both lead to higher price of tradables in terms of nontradables, while a lower share of administered prices in CPI is associated with decreasing relative price of tradables. The sign of the coefficient of the variable open is consistent with the result with regard to the RER of the external sector. The progress in trade liberalization concerns mostly goods and services which are or could be internationally traded. According to the first regression an increase in the degree of openness raises the price of home tradables relative to abroad and therefore also increases *ceteris paribus* the price of tradables relative to nontradables. The same thought also applies to the decreasing share of administered prices during the process of transition, since the variable has an opposite coefficient in the regressions regarding the RER of the tradables sector and the relative price of tradables. As a result of the price liberalization process the prices of (nontradable) basic goods rise inducing a negative income effect and decreasing prices of (tradable and nontradable) non-basic goods. The overall effect is an increase of the relative price of nontradables. The effect of the progress in the process of privatization is the expected one - increasing private sector share in GDP intensifies the competition and leads to decreasing prices of nontradables in terms of tradables. The assumption underlying this consideration is that the privatization measures are taken mainly in the sector of nontradables.

The combined effect of the transition-specific factors on the overall real exchange rate is rather negligible. Only the variable capturing the effect of price liberalization has a weakly significant negative coefficient. Thus the process of price liberalization is associated with an intensification of the price competition and real depreciation of the home currency.

One important explanation for the real appreciation in all three regressions can be seen from the negative and highly significant coefficient of the aggregated inflows of FDI. The import of marketing know how and the ability to produce goods and services of better quality and with higher technological content is associated with a shift of the overall domestic production both in the tradables and nontradables sector toward new basket of goods with higher prices.

From the supply side factors only the variable capturing the shift of the relative factor endowments has significantly negative effect in the first and in the third regression. Increasing GDP p.c. drives the RER of the external sector and the overall real exchange rate towards real appreciation. This effect occurs over and above the shifts in productivity and consumption associated with higher GDP p.c., since the regressions explicitly allow for the influence of these factors *via* the variables *prod* and *cons*. The growth of GDP p.c. associated with an increasing capital to labor ratio leads to decreasing relative prices of the capital intensive tradable goods. However, the coefficient of the variable is not significant in the regression of the RER in the sheltered sector pointing out that there is probably further connection between the GDP p.c. and the RER. As regards the influence of the Balassa – Samuelson effect, in all three regressions the coefficient of the productivity variable is not significant. This result stays in contrast to many previous studies of the RER in the transition economies and indicates that the tradables/nontradables dichotomy is crucial for the investigation of the Balassa – Samuelson effect. One of the particular characteristics of the transition process is the emergence and development of the service sector. As already seen in the previous section, the relative productivity moves in a way, which is in contrast to the predictions of the Balassa-Samuelson hypothesis. Thus the insignificant coefficient of the productivity variable has been an expected result.

More empirical validation has been found with respect to the demand side explanations for the real appreciation. The coefficients of all three variables are highly significant in the regression of the RER of the external sector. In the second regression regarding the driving forces of the relative price of tradables in terms of nontradables only the variables cons and gov exhibit coefficients significantly different from zero. These two variables have the correct negative sign in the regression of the RER of the external sector but not

in that of the RER in the sheltered sector. An explanation for this result can be given as follows. An increase in government and private consumption as a share of GDP is associated with a shift of the overall consumption expenditure towards nontradable goods and is thus expected to lead to real appreciation via decreasing relative price of tradables. If however the overall demand is shifted toward services forming the nontradable component of the PPI, the outcome will be a real appreciation of the RER based on PPI and the difference to the overall real exchange rate intended to capture the relative prices will exhibit a real depreciation. This is what is obvious from the coefficients in Table 2. As mentioned earlier, the usage of PPI as a proxy for the tradable prices is not free of concerns. The effect of these two variables on the overall real exchange rate is correctly signed and highly significant, since the distinction between tradables and nontradables is not crucial anymore. The coefficient of the third variable capturing the influence of the investment demand is significant only in the first regression. Contrary to the theoretical explanation presented in section 2, it has a positive sign. An increase in investment leads to depreciation of the RER in the external sector, a result which is rather hard to explain.

The indirect effect of a RER appreciation in the external sector on the relative prices of tradables in terms of nontradables has been verified. The significantly positive coefficient of the variable tot in the second regression indicates that the substitution effect dominates and the increase in the terms of trade is associated with a shift of the overall demand toward imported tradable goods. As regards the overall real exchange rate, the effect of the terms of trade is not significant.

5. Concluding Remarks

The purpose of the present analysis was to examine empirically the driving forces of the real exchange rate during the process of transition. Both transition specific factors and factors due to real convergence were investigated using unbalanced panel of ten CEEC over the period 1993–2006, whereas the real exchange rate was decomposed into its main components, the RER of the external sector and the relative price of tradables in terms of nontradables. Special attention has been paid to the impact of productivity developments, since the magnitude of the Balassa – Samuelson effect represents a common topic of controversy in the literature thus far. More comprehensive analysis of the Balassa–Samuelson effect has been carried out by investigating the classical tradables-nontradables dichotomy. Using the degree of openness as criterion for the definition of the tradables sector, the empirical analysis fails to confirm the effect of relative productivity on the real ex-

change rate. The real appreciation is rather driven by the accumulation of FDI and the associated improvement of quality and reputation of home production, as well as by factors originating in the convergence process like the shift in relative factor endowments and in the demand structure of the economies.

The impossibility to fulfil the criteria for exchange rate and price level stability simultaneously appears to be a serious problem for the countries of Central and Eastern Europe because of the sustainable RER appreciation. However, the recent developments in these countries as result of the unfavourable world economic situation have turned the attention away from the real appreciation to other challenges on the way to the euro area. Increasing economic uncertainty and substantial capital outflows put pressure on the exchange market and the interest rates in the new EU member states. The countries with flexible exchange rates had to cope with double-digit nominal depreciations between July 2008 and June 2009, which exceeded 30 per cent in Poland. The relatively low interest level in the euro area combined with increasing risk premia since the beginning of the crisis explains the fact that by the end of 2008 only the Czech Republic from the non-euro area countries exhibited an interest rate in accordance with the Maastricht criterion whereas in April 2008 it was a problem only in Romania and Hungary (see Szapary 2009). Further challenges originate from the public finance situation. Slow down in economic activity and the need for state interventions lead to increasing general government deficit in most of the countries (Allam 2009). On the other hand, these adverse developments could not be recorded in the Slovak Republic, probably because of the protective effect of being almost a member of the euro area by the end of 2008.

Although slowed down by the repercussions of the world economic crisis, the process of real convergence and the associated real appreciation of the currencies are still not over. The impact of the current crisis on the path of real appreciation as well as its implications with regard to the euro area accession are topics on which further research is needed.

References

Allam, M. (2009) The Adoption of the Euro in the New EU Member States: Repercussions of the Financial Crisis, EIPASCOPE 2009/1.

Aukrust, O. (1970) PRIM I: A Model of the Price and Income Distribution Mechanism of an Open Economy, *Review of Income and Wealth* 16(1): pp. 51–78.

Backé, P.; Fidrmuc, J.; Reininger, T.; Schrdax, F. (2003) Price Dynamics in Central and Eastern European EU Accession Countries, *Emerging Markets Finance and Trade* 39(3): pp. 42–78.

Balassa, B. (1964) The Purchasing Power Party Doctrine: A Reappraisal, *Journal for Political Economy* 72(6): pp. 584–596.

Baltagi, B.H. (2005) *Econometric Analysis of Panel Data*, 3rd ed., Wiley & Sons, Chichester.

Beguna, A. (2002) Competitiveness and the Equilibrium Exchange Rate in Latvia, *EuroFaculty Working Paper in Economics* 16, August. Riga: University of Latvia and EuroFaculty.

Bergstrand, J. H. (1991) Structural Determinants of Real Exchange Rates and National Price Levels: Some Empirical Evidence, *The American Economic Review* 81(1): pp. 325–334.

Bhagwati, J. N. (1984) Why are Services Cheaper in the Poor Countries?, *The Economic Journal* 94(374): pp. 279–286.

Breuss, F. (2003) Balassa – Samuelson Effects in CEEC: Are they Obstacles for Joining the EMU?, *IEF Working Paper* No. 52.

Coricelli, F.; Jazbec, B. (2004) Real Exchange Rate Dynamics in Transition Economies, Structural Change and Economic Dynamic 15: pp. 83–100.

Csajbók, A. (2003) The Equilibrium Real Exchange Rate in Hungary: Results from Alternative Approaches, Paper presented at the 2nd Workshop on Macroecomic Policy Research, National Bank of Hungary, October 2–3.

De Gregorio, J.; Giovannini, A.; Wolf, H. (1994) International Evidence on Tradables and Nontradables Inflation, *European Economic Review* 38: pp. 1225–1244.

De Gregorio, J.; Wolf, H. (1994) Terms of Trade, Productivity, and the Real Exchange Rate, *NBER Working Paper* 4807.

Dixit, A. K.; Norman, V. (1980) *Theory of International Trade: A Dual, General Equilibrium Approach*, Cambridge University Press.

Dwyer, J. (1992) The Tradeable Nontradeable Dichotomy: A Practical Approach, *Australian Economic Papers*, vol. 31, 59: pp. 443–459.

EBRD (2006) Transition Report 2006: Finance in Transition, European Bank for Reconstruction and Development.

EBRD (2007) Transition Report 2007: People in Transition, European Bank for Reconstruction and Development.

Edwards, S. (1989) *Real Exchange Rates, Devaluation, and Adjustment*, Cambridge.

Égert, B. (2004) Assessing Equilibrium Exchange Rates in CEE Acceding Countries: Can We Have DEER with BEER without FEER? A Critical Survey of the Literature, *BOFIT Discussion Papers* 2004, 1.

Égert, B.; Halpern, L.; MacDonald, R. (2005) Equilibrium Exchange Rates in Transition Economies: Taking Stock of the Issues, *ONB Working Paper* No. 106.

Égert, B.; Lommatzsch, K. (2004) Equilibrium Exchange Rates in Central and Eastern Europe: The Tradable Price-based Real Appreciation and Estimation Uncertainty, *William Davidson Institute Working Paper* 676.

Égert, B.; Drine, I.; Lommatzsch, K.; Rault, C. (2003) The Balassa – Samuelson Effect in Central and Eastern Europe: Myth or Reality?, *Journal of Comparative Economics* 31(3): pp. 552–572.

Fischer, C. (2002) Real Currency Appreciation in Accession Countries: Balassa – Samuelson and Investment Demand, *Economic Research Center of the Deutsche Bundesbank Discussion Paper* 19/02.

Fisher, R.A. (1932) *Statistical Methods for Research Workers,* Oliver & Boyd, Edinburgh, 4th ed.

Frankel, J.; Rose, A. (1995) A Panel Project on Purchasing Power Parity: Mean Reversion Within and Between Countries, *NBER Working Paper* 5006.

Goldstein, M.; Officer, L. H. (1979) New Measures of Prices and Productivity for Tradable and Nontradable Goods, *Review of Income and Wealth* 25(4): pp. 413–27.

Golinelli, R.; Orsi, R. (2002) Modelling Inflation in EU Accession Countries: The Case of the Czech Republic, Hungary and Poland, in: W.W. Charemza and K. Strzala, eds., *East European Transition and EU Enlargement: A Quantitative Approach.* Berlin: Springer Verlag, pp. 267–290.

Green, W. (2000) *Econ014tric Analysis*, Prentice Hall, New York.

Halpern, L.; Wyplosz, Ch. (1997) Equilibrium Exchange Rates in Transition Economies, IMF Staff Papers 44(4): pp. 430–461.

Harris, R. I. D. (1995) Cointegration Analysis in Econometric Modelling, Prentice Hall.

Hausman, J. A. (1978) Specification Tests in Econometrics, Econometrica 46: pp. 1251–1271.

Huber, P. J. (1967) The behavior of Maximum Likelihood Estimates under Nonstandard Conditions, in: *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*. University of California Press, Berkeley, CA, vol. 1, pp. 221–223.

Im, K. S.; Pesaran, M. H.; Shin, Y. (1997) Testing for Unit Roots in Heterogeneous Panels, Mimeo, Department of Applied Economics, University of Cambridge.

Jazbec, B. (2002) Real Exchange Rates in Transition Economies, *William Davidson Working Paper*, 482.

Knight, G.; Johnson, L. (1997) Tradables. Developing Output and Price Measures for Australia's Tradable and Nontradable Sectors, *ABS Working Paper* 97/1.

Krajnyák, K.; Zettelmeyer, J. (1998) Competitiveness in Transition Economies: What Scope for Real Appreciation?, *IMF Staff Papers* 45(2): pp. 309–362.

Kravis, I. B.; Lipsey, R. E. (1978) Price Behavior in the Light of Balance of Payments Theories, *Journal of International Economics* 8: pp. 193–246.

Linder, S.B. (1961) *An Essay on Trade and Transformation*, New York: Wiley.

Maddala, G. S.; Wu, S. (1999) A Comparative Study of Unit Root Tests with *p*anel Data and a New Simple Test, *Oxford Bulletin of Economics and Statistics*, Special Issue (1999): pp. 631–652.

Mihaljek, D.; Klau, M. (2003) The Balassa – Samuelson Effect in Central Europe: A Disaggregated Analysis, *BIS Working Paper* 143.

Nenova, M. (2004) The Relationship between Real Convergence and the Real Exchange Rate: the Case of Bulgaria, *BNB Discussion Paper* 41/2004.

Nenovsky, N.; Dimitrova, K. (2002) Dual Inflation Under the Currency Board: The Challenges of Bulgarian EU Accession, *William Davidson Institute Working Papers Series* 487.

Obstfeld, M.; Rogoff, K. (1996) *Foundation of International Macroeconomics*, MIT Press, London.

Oomes, N. (2005) Maintaining Competitiveness under Equilibrium Real Appreciation: The case of Slovakia, *Economic Systems* 29(2): pp. 187–204.

Rawdanowicz, L.W. (2003) Poland's Accession to EMU: Choosing the Exchange Rate Parity, *CASE Studies&Analyses*.

Rother, C.P. (2000) The Impact of Productivity Differentials on Inflation and the Real Exchange Rate: An Estimation of the Balassa – Samuelson Effect in Slovenia, *IMF Country Report*. Republic of Slovenia: Selected Issues 56: pp. 26–39.

Ruddies, A. (2008) *Argentiniens Erfahrungen mit dem Currency Board System und seinen flankierenden Strukturreformen*. Eine kritische Bewertung, Verlag Dr. Kovac, Hamburg.

Samuelson, P.A. (1964) Theoretical Notes on Trade Problems, *Review of Economics and Statistics* 46(2): pp. 145–154.

Schröder, J.; Pfadt, R. (1998) Investment Installation Costs and the Impact of Fundamental Supply Side Factors on the Real Exchange Rate and the Current Account, *Jahrbuch für Wirtschaftswissenschaften* 49: pp. 161–179.

Sinn, H. W.; Reutter, M. (2001) The Minimum Inflation Rate for Euroland, NBER Working Paper No. 8085.

Stolper, W. F.; Samuelson, P. A. (1941) Protection and Real Wages, *Review of Economic Studies* 9 (November): pp. 58–73.

Szapary, G. (2009) Euro Area Enlargement in the Wake of the Financial Crisis: Prospects and Challenges, in: The Financial Crisis and its Impact on Euro Adoption, Brussels: European Parliament.

Viner, J. (1937) Studies in the Theory of International Trade, Harper, New York.

White, H. (1980) A heteroscedasticity-consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity, *Econometrica* 48: pp. 817–830.

Wooldridge, J.M. (2002) *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Cambridge, MA.

DISCUSSION PAPERS

DISCUSSION PAPERS

DISCUSSION PAPERS