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Reasons for Real Appreciation in Central Europe

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The aim of this annual workshop is to offer a forum for young researchers from the field of International Economics to present and to discuss their current topics of research with other experts. The workshop also provides the opportunity to gain an overview of recent developments, problems and methodological approaches in this field.

Detailed information on past workshops and the planning for the 2006 workshop are available at http://www.vwl.wiso.uni-goettingen.de/workshop. Do not hesitate to contact Dr. Carsten Eckel, *CeGE* (carsten.eckel@wiwi.uni-goettingen.de) for further questions.

Reasons for Real Appreciation in Central Europe

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Abstract

The real economic effects of the considerably high appreciation in Central European Economies (CEE) are controversially disputed in the eve of the European Monetary Union (EMU) entry of several CEE economies. The Balassa-Samuelson-effect was made responsible for the expectation of higher inflation rates in CEE than in the EMU in the next years. Higher inflation rates will deteriorate the price competitiveness of the export sectors in the CEE countries because of real appreciation.

This paper focuses on the effects of labour productivity differences in several industrial and service sectors on the consumer prices. Labour productivity changes are affected by the technology impact on labour demand and by the relative wage increases following from tensions of regional labour markets because of rising prices and skilled labour shortage. Real appreciation is determined by labour productivity differences and by capital good imports. We conclude that the negative coherence between real appreciation and the endangered price competitiveness of the export sectors in CEE has to be taken into account, unless the negative experience of loss of competitiveness because of sudden real appreciation in Eastern Germany will take place on a large scale in the eastern part of the enlarged euro area.

Summary

The reasons of real Appreciation in the CEE Economies

Real appreciation in the new EU member states (NMS-8) may have an influence of the price stability in the euro area, in particular when these countries will join the European Monetary Union (EMU) without taking care of the structural heterogeneity of an enlarged EMU. The structural heterogeneity could be the trigger of divergent price developments, if the flexibility of prices and wages is not efficiently strong enough to compensate for the loss of exchange rate flexibility (Ohr and Schmidt 2001, 441).

In this paper we analyze empirically the variability of price differences between Central and Eastern Europe (CEE) and the euro area and search for reasons for the real appreciation of their currencies. Having a short look at the stylized facts of monetary integration of the CEE countries we discuss the role of the Balassa-Samuelson effect for the explanation of price differences between regions. We search for the reasons for the real appreciation and correlate the variability of the real exchange rates with the openness of the countries in CEE. If the variability is positively correlated with the openness, then the tendency of appreciation increases with relatively higher export and import growth. The view, that an economic catch-up process (higher per capita income) is connected with higher prices because of positive income and productivity effects, is widely shared in the literature (see Obstfeld and Rogoff 1999, 212).

Since 1995 in Central Europe most of the currencies experienced a real appreciation with respect to the US-Dollar (Brandmeier 2005, 474). In the economic literature two main explanations of the real appreciation have been provided: the Balassa-Samuelson effect (B-S-effect) and capital accumulation. The B-S-effect links the labour productivity growth differential between traded and non-traded good sectors with inflation differences, if labour markets are competitive within each country and the purchase power parity holds only for the tradable good sector. If we assume that the productivity growth rate is higher in the tradable sector than in the non-tradable sector because of the strong foreign competition, then the inflation rate is higher in CEE. The relative price of non-tradables is going to rise, if the wages in the non-tradable sector move up because of labour supply shortage in the non-tradable sector. Therefore the country in CEE will experience an appreciation of the real exchange rate.

The second explanation assumes capital accumulation and technical progress as the two sources of the labour productivity differential in newly industrialized countries (NICs) in East Asian. Wu (2004, 25) expects that the differences in the speed of capital accumulation cause the relative price of non-tradables to rise. The author focuses on micro foundation to explain why capital accumulation leads to higher relative prices of non-tradables in East Asia NICs. Differently from this explanation of non-tradables price differences Obstfeld and Rogoff (1999, 215) explained these inflation differences by total labour productivity and wage differences of skilled and unskilled labour.

In Central Europe we see that high foreign direct investment cause partly a change in the foreign trade structure in favour of human capital intensively produced exports to Western EU countries. It is interesting to see, however, that the catch-up process through intensified international trade has notably dampen the variability of the real exchange rate in CEE. We analyze also the reasons for inflation differences between Central Europe and the euro area and find, that instead of labour productivity the capital good import shares explain significantly negatively the Harmonized Index of Consumer Prices (HICP) differences between CEE countries and EMU countries. Using quarterly cross section data of each new EU member state we find that both demand-sided effects (through changes of the monetary stance and devaluation of the national currency) and supply-sided effects (productivity growth differential) explain significantly the inflation differences between seven CEE countries and the EMU.

The tendency of the export sectors in Central Europe to increase the human capital intensively produced exports do not hinder the expectation, that it is possible, that the entry into the European Monetary Union could boost the real appreciation of the CEE currencies in spite of the high degree of monetary integration in the new EU member states (Herrmann and Jochem (2003, 19). This would harm the competitiveness of the export sector and dampen considerably the catch-up process in CEE. The influence of these supply-sided effects may be overweighed by demand-sided effects on the inflation rate.

I. Introduction

Since 1995 in Central Europe most of the currencies experienced a real appreciation with respect to the US-Dollar. In the literature two main explanations have been provided: the Balassa-Samuelson effect links the labour productivity growth differential between traded and non-traded good sectors with inflation differences, if labour markets are competitive within each country and the purchase power parity holds only for the tradable good sector. If the productivity growth rate is higher in the tradable sector because of strong foreign competitors, then the inflation rate is higher in the home country, because the relative prices of non-tradables are going to rise, if the wages in the non-tradable sector move up because of labour supply shortage in the non-tradable sector. As one result the home country will experience an appreciation of the real exchange rate. The second explanation assumes capital accumulation and technical progress as the two sources of the labour productivity differential in newly industrialized countries (NICs) in East Asian (Wu 2004). Wu (2004, 25) expects that the differences in the speed of capital accumulation cause the relative prices of non-tradables to rise. The author focuses on micro foundation to explain why capital accumulation leads to higher relative prices of non-tradables in East Asia NICs. Obstfeld and Rogoff (1999, 215) explained the inflation differences by total labour productivity and wage differences of skilled and unskilled labour.

In Central Europe we see that high foreign direct investment inflow lead to a substantial change in the foreign trade structure in favour of human capital intensively produced exports to Western EU countries (see Brandmeier 2005, 396-400). The GDP growth rates in Central Europe are mainly export-driven.

This paper is structured as follows. Section 2 briefly reviews the empirical literature on the Balassa-Samuelson-effects in the new EU countries in Eastern Europe. In section 3 a model is outlined which captures both the Balassa-Samuelson-effect and their impact on wages, prices and trade volumes. Empirical results of the testable equations of section 3 are presented in section 4 to explain on the one hand the price differences between regions and on the other hand the real exchange rate volatility in CEE. In section 5 we analyse quarterly data of seven new EU member states to quantify the impact of supply-sided and demand-sided effects on the inflation differential between each new EU member state and the EMU. Brief conclusions are offered in section 6.

II. Related Research

Recently published articles about real exchange rate movements in transition countries (de Broeck and Slok 2001) and their effects on Labor Markets (Belke, Kaas and Setzer 2004) are discussing the subject on a quite aggregate level. De Broeck and Slok (2001) are using in their time series estimation one tradeable sector (industry and construction sector) and one non tradeable sector (services). Using panel data over the period 1993 – 1998 evidence of productivity-driven exchange rate movements in the Central Eastern European Countries (CEECs) and Baltic States is shown. The underlying Balassa-Samuelson model is based on the gap between the two exchange rates (PPP exchange rate and the nominal US-Dollar exchange rate of several transition countries) and the PPP per capita GDP. The tendency of log (exchange rate gap) and log (PPP GDP per capita) to converge with a confidence interval of a regression equation with a positive slope together with the catching up process of the former Visegrad countries (Czech Republic, Hungary, Poland and Slovak Republic) and Slovenia leads to the expectation that the real exchange rate of CEECs will appreciate. A narrowing of the income gap by one percent will be associated with a 0.4 percent real exchange rate appreciation. De Broeck and Slok (2001) argue that the inflation rate in the EMU accession countries should not be more than 1 ½ percentage point higher than the average rate of inflation in those three EU countries where inflation is the lowest.

In their paper Belke, Kaas and Setzer (2004) outline a different approach and connect the exchange rate volatility with costs of labor markets. In their view exchange rate volatility vis-à-vis the euro significantly lowers employment growth and raises the unemployment rate. The reason for this is the fact that all employment decisions have some degree of irreversibility and the exchange rate volatility negatively influence the volume of trade in emerging countries. The proposed higher import prices following a depreciation of the domestic currency are affecting inflation and hedging the exchange rate risk leads to higher interest rates. Both effects lower the employment growth rates. Therefore the smaller the exchange rate variability is, the greater the impact on employment growth would be. They do not explain with empirical facts whether the negative relationship between lower employment growth and rising exchange rate volatility is empirically significant.

Breuss (2003, 25) see the appreciations of the real exchange rates in the CEEC as the result of productivity gains in the tradable sector and as a "natural phenomena in catching-up countries like the CEECs". Chmielewski (2003) does believe that the Balassa-Samuelson-effect will harm the competitiveness of the tradeable sector. Downward wage and price rigidity cause the imperfect pass-through from the nominal exchange rate to the domestic prices and will end up in a higher real appreciation of the domestic currency than the Balassa-Samuelson-effect alone would imply. Fischer (2002) develops and tests a model with included an investment demand channel. Four production factors – capital, labour and two types of skills – produce three basic goods (non-tradeables, export and import goods). The Balassa-Samuelson-effect still exists and additionally the domestic demand affects the price of non-tradeables and therefore the real exchange rate (Fischer, 2002, 8). The model predicts, that capital demand depends negatively from the price of non-tradeables and from the interest rates, if plausible assumptions about the volume of relative labour and capital demand in both sectors are made.

One strain of the theory of optimum currency areas holds a fairly high amount of foreign trade between countries for a prerequisite for exchange rate stability (Mc Kinnon 1963). The author proposes the degree of openness as an important factor in assessing the value of an independent currency. Goldberg (1999) criticize this traditional optimal currency area argument in applying these argument for transition economies. She considers the link between RER and output as weak and points out, that 'elasticity pessimism' is relevant for transition economies.[1] Others, like Engel (1999) also argue, that relative international tradables prices move very much in line with relative international non-tradables prices. One potential reason for this is the price setting of exporters, who preset export prices in the buyer's currency and meet demand at the posted local-currency prices in the short run (Obstfeld 2002, 28). Empirically for the euro area there was no strong increase in output prices in the wake of the euro'steep depreciation after its launch.

Although there are doubts about the amount of export and import elasticity of RER, we argue, that the effects of the integration process on the economies in CEE are responsible for considerably high inflation differences.

[1] Machlup (1950) firstly use the phrase ‚elasticity pessimism' to name the probably underestimation of trade elasticity of exchange rates (see Obstfeld 2002, 25).

The ECB (2003, 32) shows the varying results of empirical estimations of 'Equilibrium' inflation rates implied by the Balassa-Samuelson effect.

TABLE 1 – Results of empirical estimations of 'Equilibrium' inflation rates implied by the Balassa-Samuelson effect according to selected studies

Sample	Alberola and Tyrväinen 1975-1995	HICP proxy IMF	IMF (1999)	Canzoneri et al.	De Grauwe and Skudelny	Sinn and Reutter	Average of all columns
Belgium	3,1	2	3,8	2,6	2,1	1,8	2,6
Germany	1,3	1,9	1,5	1	1,7	1	1,4
Greece	-	2,7	2,8	-	-	5,3	3,6
Spain	3,1	2,3	-	2,4	2	2,5	2,5
France	1,7	1,9	2,8	2,4	1,6	2,3	2,1
Ireland	-	3,4	3	-	-	3,4	3,3
Italy	2,4	1,9	2,7	2,8	2,4	2,5	2,5
Netherlands	2,3	2,3	1,6	-	2	2,4	2,1
Austria	1,8	2,5	-	1,8	2,5	2,4	2,2
Portugal	-	2,7	4,3	-	2,1	1,8	2,7
Finland	2,4	2,3	2,9	2,4	1,4	3,7	2,5
Euro Area	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Max-min	1,8	1,5	2,8	1,8	1,1	4,3	2,2
Standard deviation	0,6	0,4	0,9	0,6	0,4	1,1	0,6

Source: Table 5 in European Central Bank (2003), Inflation Differentials in the Euro Area: Potential causes and policy implications, Sept. 2003, p. 32)

The deviations from the assumed inflation rate in the euro area are considerably high. The highest equilibrium inflation rates were calculated for Portugal with 4.3 percent (IMF 1999) and for Greece with 5.3 percent (Sinn and Reutter 2001).

Who is to blame for inflation differences between the CEE and the euro area? There are no significant results for East Asian data, comprising Hong Kong, Singapore, Indonesia, Thailand, and China, but some evidence to support the Balassa-Samuelson Hypothesis for Korea and Malaysia (Chai 1998). Like in East Asia the former transition countries in CEE are growing fast and all countries have a current account deficit in the last two years (Podkaminer, L. and V. Gligorov et al. 2006).

This paper focuses the effects of labour productivity changes on the sectoral trade volumes. Growing trade volumes are necessary for the catch-up-process in the CEECs. Labour productivity changes are affected by the technology impact on labour demand and by the relative wage increases following from tensions of regional labour markets because of rising prices and qualified labour shortage. Price effects may arise from different productivity growth rates in the tradable (manufacturing) and non-tradable sector (services). Therefore the Balassa-Samuelson effect could explain partly the inflation differential between the new EU member states and the 12 EMU member states.

Following Wu (2004) we explain the Balassa-Samuelson effects by capital accumulation. One crucial assumption is the interdependence between capital accumulation in the SOE and rising wage costs because of labour scarcity in the sector tradable good.

Although the next EMU enlargement is formally regulated in the amendment of the European Treaty[2] in 2003 the costs and benefits of an early adoption of the euro as common currency in the new EU member states are strongly disputed (see Kösters et al. 2003, Ketterer and Brandmeier 2003, Breuss 2003).

Apart from the fact that there are considerable risks for the competitiveness of the new EMU member states (Schäfer 2003, 97, Brandmeier 2005) monetary problems could appear before the entry into the euro area, when second-run price effects emerge, which arise from higher wage growth rates in the non-tradable sector than its productivity has grown. The resulting higher inflation rates have to be reduced by each national bank through tightening the money supply in the new EU member states willing to adopt the euro as common currency (Frenkel 2003, 105).

This paper is organized as follows. In the next section we sketch a simple model of a small open economy (SOE) to derive the theoretical explanation of causes of inflation differences between the SOE and the euro area. We use this model to check the relationship empirically in section III, whether the volatility of the real exchange rate becomes greater with the openness of the economy or whether the trade volume is comparatively hampered by a higher exchange rate volatility. We estimate the effect of the growth rate of labour productivity in the tradable and non-tradable sector on the inflation rate differences and discuss the role of the kind of exchange rate regime for the price stability and competitiveness of the SOEs. In the last section we draw some conclusions from the discussion of the economic aspects of EMU enlargement.

[2] See the amendment of the European Community Treaty, Article 124, from 23.09.2003 (resolution 2003/223/EG, Abl. L 236) in which the conditions of the EU accession of the 10 countries in Central and Eastern Europe are formulated.

III. Analytical Framework

In this simple trade model we follow the assumptions of Balassa (1964) and Samuelson (1964) who assume two sectors in the economy which produce tradable and non-tradable goods. Their model underlies the implicit assumption, that the same price increase in the non-tradable good sector as in the tradable good sector is the cause for systematic bias of the relationship between relative prices and real exchange rates, because it is reasonable to assume that the labour productivity in the tradable sector rise faster than in the non-tradable sector. From the beginning of economic integration the lower productivity in former planned economies has been risen through foreign trade and capital inflow, because in the transforming countries investors gain higher rates of returns, as long as the production factor capital and marketing know-how are scarcer there than in market economies with an efficient price and factor allocation. We extend the two-sector-model by introducing a research sector, providing know-how to use imported capital good in the tradable sector.

We follow Jones (1995) who assumes the following production function[3]

$$Y = L_Y^{1-\alpha} \int_0^A x_j^{\alpha} \text{ , in the SOEs and } Y^* = L_Y^{1-\alpha} * \cdot \int_0^{A^*} x_j^{\alpha} *, \tag{1}$$

with A measures the range of capital goods that are available to the final-good trade sector, which produces the homogenous tradable good Y. The symbol x_j denotes the intermediate capital good, which is partly imported from the EMU countries or produced by the research sector.[4] Solving the profit-maximization problem of each firm in the tradable sector:

$$\max_{L_Y, x_j} \left[L_Y^{1-\alpha} \int_0^A x_j^{\alpha} dj - wL_Y - \int_0^A p_j x_j dj \right] \tag{2}$$

and assuming perfect competition in the good and factor markets in both regions, then the first order conditions (foc) are:

$$w = (1-\alpha)\frac{Y}{L_Y}, \text{ for the factor labour , and} \tag{3a}$$

[3] An asterisk is placed beneath the symbol to denote the European Monetary Union as a whole. SOE stands for the eight small and open economies becoming member of the European Union on May the 1st in 2004.

[4] Intermediate capital good comprise also unfinished good, which has been sent for further labour intensive processing to production stages abroad.

$$p_j = \alpha L_Y^{1-\alpha} \cdot x_j^{\alpha-1}, \qquad \forall \text{ j} \tag{3b}$$

for each intermediate capital good, which has to be bought from the research and service sector. Therefore the sum of intermediate goods is the capital input for the final sector in each region:

$$\int_0^A x_j^{\alpha} = K\,. \tag{4}$$

To simplify the model we assume that the research sector produces each unit of intermediate goods with one unit of raw capital. From these assumptions it follows that

$$x_j = x = \frac{K}{A}. \tag{5}$$

The production function of the tradable sector in each region becomes then familiar again:

$$Y = K^{\alpha}\left(AL_Y\right)^{1-\alpha}. \tag{6}$$

Secondly, let us assume that capital is perfectly mobile both internationally and between the two sectors. The factor labour is only mobile between the two sectors but not internationally because of restrictions imposed by some incumbent countries of the EMU.[5]

Higher wages in the tradable sector because of specialization gains through foreign trade in both regions lead also to wage raises in the sector non-tradables (services), because labour supply moves to the sector with the higher wages and the stronger supply scarcity increases the price for the factor in the non-tradable sector too.

The relationship between labour productivity and real wages could be derived immediately from the profit maximization calculus (see equation 3a and 3b):

$$\frac{w}{p_j} = \left[\frac{1-\alpha}{\alpha}\right] \cdot x^{\alpha-1} \cdot \left(\frac{Y}{L_y}\right) \cdot L^{1+\alpha}, \tag{7}$$

[5] The restrictions will continue to be imposed by the German government (22.03.06) generally on the workers from Central and Eastern Europe willing to work in Germany and Austria until May 2009.

Using the price index and substituting $\delta = \frac{Y}{L_y}$ into the real wage ratio, we receive

$$\frac{w}{p} \Big/ \frac{w^*}{p^*} = \left[\frac{1-\alpha}{\alpha}\right] \cdot x^{\alpha-1} \cdot \delta \cdot L^{1+\alpha} \Big/ \left[\frac{1-\alpha^*}{\alpha^*}\right] \cdot x^{*\alpha^*-1} \cdot \delta^* \cdot L^{*1+\alpha^*}$$

Taking differences and rearranging terms leads to the following equation:

$$\begin{aligned} \Delta p - \Delta p^* = \Phi + \left(\Delta w - \Delta w^*\right) - \left(\Delta\delta - \Delta\delta^*\right) + \left(\alpha - 1\right)\Delta x_j - \\ -\left(\alpha^* - 1\right)\Delta x_j^* + \left(1-\alpha\right)\Delta L_y - \left(1-\alpha^*\right)\Delta L_j^* \end{aligned} \tag{8}$$

with $\Phi = \left[\left(\frac{\alpha-1}{\alpha}\right) - \left(\frac{\alpha^*-1}{\alpha^*}\right)\right]$.

The inflation difference between regions depends positively on the difference in the wage growth rate and negatively on the labour productivity change. The change of capital good accumulation and the employment change refer to the degree of economic integration between SOE and EMU.

Using this equation we want to answer the question whether the higher inflation rates in the SOE will arise from the supply side of the economy or whether it is accused by rising wage costs. The supply side of a SOE is highly affected by the economic integration process, which is determined by capital inflow to equalize the deficit in the balance of trade during the integration process. For simplicity, we do not explicitly consider the external impacts on consumer prices, because we assume that in both regions the impact of higher energy prices is equally distributed across countries.[6]

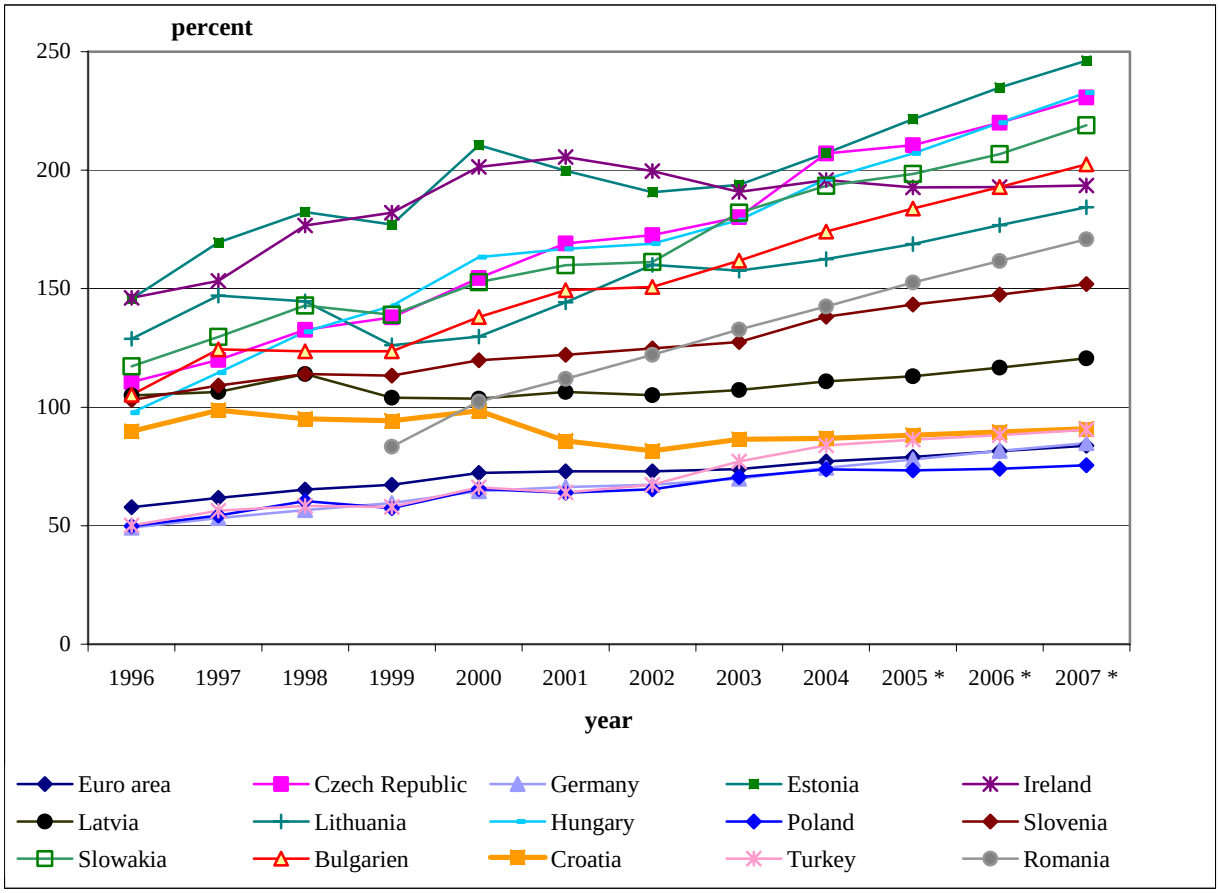
In the next section we test for the empirical evidence of the potential causes of inflation differences between CEE and the euro area.

[6] The ECB (2003, 18) suggests, that changes in import costs tend to account for the inflation differentials of most countries with a relatively high degree of openness and/or oil dependency.

IV. Panel and Time Series Estimations with annual data

To answer the first question we focus on the role of the real exchange rate. The elasticity approach in international economics assumes a positive relationship between net exports (NX) and the real exchange rate (RER), if the absolute value of the sum of export and import demand elasticities is greater than unity (Marshall-Lerner condition).[7] A priori, it is theoretically not clear, whether there will be a positive or negative relationship between NX and RER. Therefore, we substitute the variable NX by the degree of openness to describe the exposure of the single SOE on globalization forces.

Chart 1 – Degree of openness in several European countries

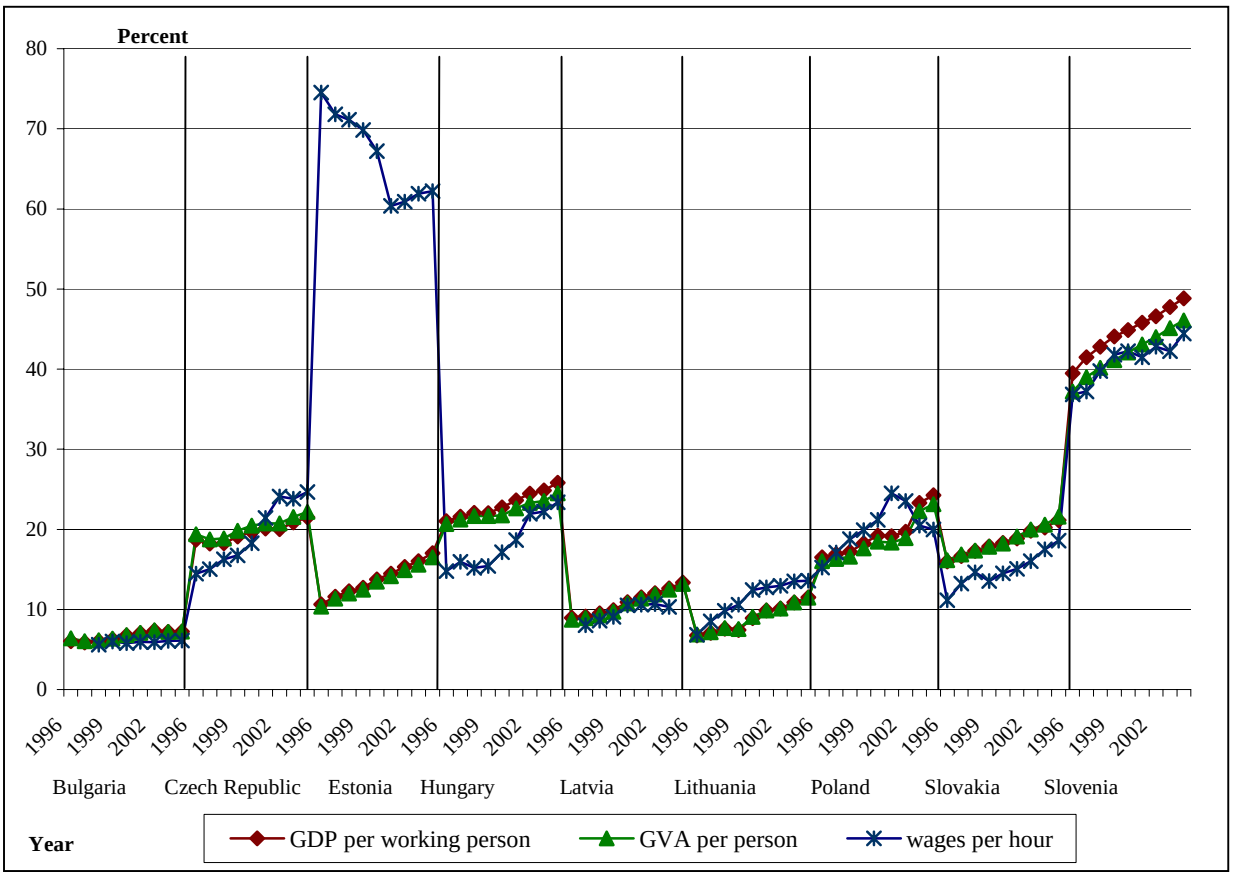


Source: Eurostat Luxembourg; *)For 2005 - 2007 the values are estimated. Euro area: EUR-11 and Greece until 31.12.2000 / EUR-12 from 1.1.2001)

[7] The balance of payment is always balanced. If the Marshall-Lerner-condition holds and the current balance was also balanced, an increase of the real exchange rate (real appreciation of the foreign currency) leads to a surplus. Notably, the capital balance becomes a debit balance to finance the net exports of good and services.

Égert et al. (2003) test successfully the crucial assumption that real wages in the tradable sector are connected to productivity growth. Therefore we can conclude that in countries with the degree of openness greater than 1 the tradable sector (industries that import and export goods) supports on a large scale the GDP growth, which is correlated with real wages dynamics. From chart 1 we see that the new EU member states (without Poland) and the EU candidate countries (without Croatia and Turkey) show rising degrees of openness above 1. Germany and the euro area have values below 1. The expanding tradable sector may have considerably high impacts on the prices. We argue that the expanding tradable sector is responsible for high labour productivity changes, that allow increasing real wages.

CHART 2 – Relationship between labour productivity and real wage differences in new EU member and candidate countries.



Source: Eurostat Luxembourg database
Notes: Period: 1996 – 2004, indicators relative to euro area in percent

From chart 2 we see that with the exception of Estonia the two indicators of labour productivity share CEE relative to the values calculated for the euro area are highly correlated with the corresponding values of the hour wages. Therefore we can assume that labour productivity changes in the tradable sector are likely the same as wage increases.

After showing that the wage policy in CEE is almost productivity oriented, we check the relationship between the real exchange rate (RER) and the degree of openness to answer the question, whether the economic integration has an direct impact on the change rate of the RER. The relationship between RER and the degrees of openness in the eight new EU member states is plotted in chart 3.

CHART 3 – relationship between RER and degree of openness in new EU member states

From chart 3 we see a negative relationship between the deviations of RER and the deviation of the degree of openness in the new EU member states.

The increasing exposition of the SOEs to globalization explaines the reduction of the change rate of the RER. Therefore the international trade contributes to stabilization of the growing economies in Central Europe and makes them less vulnerable for exchange rates speculations, because an increasing percentage of the inflow of foreign currencies resulted from exporting goods and services to the euro area.

An increase in the real appreciation of their currency is significantly negative correlated with the positive change of the degree of openness. The coefficient amounts to –0.179 and is significant (see table 2). The variable GDP per each employed person, which is calculated with Purchasing Power Parity (PPP) contributes significant positively to the explanation of the variance of the RER deviations.

TABLE 2 – Regression of RER deviations on several factors

	Unstandardized Coefficients		**Collinearity Statistics**	
	B	Std. Error	Tolerance[8]	VIF
(Constant)	-19.234**	6.004		
First difference of degree of openness	-0.179*	0.076	0.954	1.048
Fix exchange rates	5.373*	2.374	0.347	2.883
GDP per each employed person in KKP (EU25 = 100 %)	0.283 **	0.099	0.351	2.847

Notes:

$R^2 = 0.186$; F-value = 4.582 **; The symbol ** means significance at the 99 %, * at the 90 percent confidence level. Number of observations = 64; White-Test:
$W = T \cdot R^2 = 64 \cdot 0.028 = 1.806 < \chi_5^2(0.95) = 11.07$.
The Jarque-Bera-Test statistics JB = 9.14 > χ^2 (0.95) = 5.99.

From the result of the White test statistic follows, that the assumption of homogenous residuals cannot be rejected, because there is no significant correlation between the squared residuals and the four regressors of the regression. The Jarque-Bera-Test is used to test the assumption of normal distribution of the residuals.[9] The assumption of normal distribution of residuals has to be rejected.

From table 2 we see, that there is a significant negative correlation between the change of the real exchange rates and the deviation of the degree of openness in comparison with the degree of openness of the preceding year. Therefore we argue that, the greater the deviation of the degree of openness is, the lower the change of the real exchange rate will be.

[8] The tolerance (TOL_j) of each regressor j is defined as: $TOL_j = 1 - R_j^2$. The Variance Inflation Factor (VIF_j) is the reciprocal value of the tolerance of each regressor.

[9] The test statistics is defined as: $JB = \frac{T-(k+1)}{6}\left[S^2 + \frac{1}{4}(K-3)^2\right]$, with S = Skewness and K = Kurtosis of the distribution.

This is an evidence, that a stronger exposition of the SOE or dependence of the economy on foreign trade is correlated with a lower change of the real exchange rate. This result is robust, if the different exchange rate regimes and labour productivity are taken into account.

Chart 4 shows the significant relationship between the price differences NMS – EMU and the labour productivity share of the NMS versus the EMU countries. In section III we derived an equation, which explains the inflation differences by labour productivity changes.

CHART 4 – Relationship between price differences and labour productivity

The results of the regression shown in table 3 and the chart 4 emphasize both the accented role of the labour productivity in explaining the price differences. We do not use the prices for tradables and non-tradables here, because these data contain a lot of missing values and we do not use them for this regression. The dependent variable of the regression HVPI difference is defined as HVPI (NMS) minus HVPI (euro area). The same method is used to calculate the labour growth rate difference and the unit labour costs (ULC) growth difference. The labour productivity indicators – gross value added per working person and gross domestic product per working person – are calculated as well relative to the correspondent labour productivity indicators in the euro area (100 %).

From table 3 we see the positive and significant coefficient of the labour productivity, calculated as gross value added per working person. This result is robust, if we use alternatively GDP per working person as explaining variable in the OLS-regression.

Some assumptions of the classical regression model are tested. The White Test delivers no evidence that the residuals have a heterogenous variance, but the Jarque-Bera Test JB signals, that the residuals are not normally distributed. The independent variables of the regression do not depend linearly from each other (see footnote 8).

TABLE 3 – Results of the regression of price differences (HVPI) and labour productivity

Model 1	Unstandardized Coefficients		Collinearity Statistics	
	B	Std. Error	Tolerance[10]	VIF
(Constant)	11.643*	5.788		
GVA per working person	0.844**	0.246	0.990	1.011
Labor growth difference	0.981	1.111	0.978	1.023
ULC growth rate difference NMS- EMU12	-6.837	4.426	0.986	1.014
Model 2	Unstandardized Coefficients		Collinearity Statistics	
	B	Std. Error	Tolerance	VIF
(Constant)	12.394*	5.576		
GDP per working person	0.786**	0.228	0.990	1.011
Labor growth difference	0.978	1.110	0.978	1.023
ULC growth rate difference NMS- EMU12	-6.838	4.422	0.986	1.014

Notes: The symbol ** means significance at the 99 %, * at the 90 percent confidence level.
Model 1: $R^2 = 0.207$; F-value = 5.221**. Observation: 64, White-Test:

$$W = T \cdot R^2 = 64 \cdot 0.071 = 4.544 < \chi_5^2(0.95) = 11.07.$$

The Jarque-Bera-Test statistics JB = 17.45 > χ^2 (0.95) = 5.99

Model 2: $R^2 = 0.209$; F-value = 5.273**; White-Test:

$$W = T \cdot R^2 = 64 \cdot 0.074 = 4.736 < \chi_5^2(0.95) = 11.07.$$

The Jarque-Bera-Test statistics JB = 17.808 > χ^2 (0.95) = 5.99.

In both specifications the labour productivity indicator explains significantly the consumer price differences between the eight new EU member states (NMS-8) and the EMU. A positive correlation shows that the higher inflation in the NMS-8 could be explained by the higher labour productivity growth in these countries. This higher labour productivity growth results from the on average lower wage level in the NMS-8 relative to EMU.[10] The productivity in export industries rises with the use of new technology.

[10] Paternoster (2003) calculates that on average in 13 accessing countries (without Turkey and Malta) the labour costs per hour in 2000 are only 3.92 Euro or 16.76 % of EU-13 average (without Belgium and Ireland).

The unit labour costs do not explain the price differences. Therefore we could conclude that the price differences are more supply-driven than caused by wage increases in the NMS-8. The reasons for the higher price increases in the new EU member states in comparison to the EMU, which leads to the real appreciation of their currencies, are the labour productivity changes in these countries. We argue that the increases of the labour productivity are caused by capital good imports (see equation 8).

The capital good import shares are calculated by using the BEC classification scheme.[11] The source of this variable are the imports of NMS-8 from the EU12 countries (EU without Austria, Sweden and Finland). If we include the variable capital good import shares into the regression, then the former significant indictor GVA per working person becomes insignificant, because there is partly multi-colinearity between these regressors:[12] The capital good import share and the labour productivity indicator GVA per person are significantly negative correlated with each other (see table 4).

TABLE 4 – Correlations between factors of price differences between regions

Pearson correlation coefficient	Degree of openness	GVA per person	Annual change rate of real exchange rate vs. euro	Capital good import shares	ULC growth rate difference NMS - EMU12
GVA per person	-0.083				
Annual change rate of real exchange rate vs. euro	-0.088	0.15	1		
Capital good import shares	-0.136	-0.528(**)	0.169	1	
ULC growth rate difference NMS - EMU12	-0.015	-0.024	0.261 (*)	0.144	1

Notes:
** Correlation is significant at the 0.01 level (2-tailed).
Number of observations = 64.

[11] The abbreviation BEC stands for the UN classification by Broad Economic Categories, published in the Statistical Papers, Series M, No. 53, Rev. 3, New York 1989.

[12] The VIF is below 10. We expect no co-linearity because the two variables are calculated from different sources (trade statistics vs. national account statistics and employment data, which are collected from the databank of Eurostat Luxembourg.

From table 5 we see a significant positive coefficient of the capital good import shares. A one percent increase of the capital good import shares means that the consumer inflation differences between both regions increase by 0.56 percent.[13]

TABLE 5 – Regression results of inflation differences NMS-8 and capital good imports shares – Period: 1997 - 2004

Model 1	Unstandardized Coefficients		Collinearity Statistics	
	B	Std. Error	Tolerance[14]	VIF
(Constant)	19.649**	3.39		
Degree of openness	-0.025*	0.011	0.981	1.019
ULC growth rate difference NMS- EMU12	3.238**	0.792	0.979	1.021
Capital good import shares	0.566**	0.139	0.961	1.040

Notes:
$R^2 = 0.352$; F-value = 10.878**. The symbol ** means significance at the 99 %, * at the 90 percent confidence level. Observation: 64
White-Test: $W = T \cdot R^2 = 64 \cdot 0.125 = 8 < \chi^2_{10}(0.95) = 18.31$. The Jarque- Bera-Test statistics $JB - Test: \; JB = 27.178 > \chi^2_2(0.95) = 5.99$.

In section III we derived from profit maximization calculus the equation 8, which shows the factors explaining the price differences between two regions. The empirical analysis in section IV confirms that the inflation differences between the NMS-8 and the euro area could be explained by capital good import share and by labour productivity either. An higher increase in labour productivity in NMS-8 than in the euro area explains positively and highly significantly the inflation differences.

[13] We have to concede that the residuals are not normal distributed. The White test statistics shows, that the assumption of homoscedasticity can still not be rejected.

Therefore a relatively high capital good import from the euro area provides the fast growing economies in Central Europe with resources to increase their capital stock and has the effect to increase the inflation differences. This empirical result is a confirmation of the Balassa-Samuelson explanation of inflation differences. The Balassa-Samuelson effect assumes a positive pass-through of productivity changes from the tradable sector to the non-tradable sector, that the relative price of non-tradable goods reflect relative productivities between the two sectors. Darvas (2001, 54) finds, that the law of one price cannot be applied to tradable goods, "since prices of traded and non-tradable goods respond similarly to nominal exchange rate shocks." Égert et al. (2003, 569) name "the shift to goods of higher quality with correspondingly higher prices" as one explanation for the increase in the price level in transition countries. The authors argue that the measured inflation rate of consumer prices is probably exaggerated because of the quality bias. This argument seems to be misled, because firstly the HICP data for all EU countries are harmonized since 1997 and second the measurement of HICP data in all countries faces the problem of quality bias, although they use different methods to tackle it.[15]

Testing a fixed effects model with annual Panel data of 10 Central and East European EU accessing countries for the period 1994 – 1999 Fischer (2002, 18) shows empirical evidence of a significant impact of labour productivity in both sectors on the variation of the real exchange rate. The author argues, that a significant negative relationship between the dependent variable – real effective exchange rate – and the real interest rate, which is calculated as the difference between long-term government bond yields and the ex-post inflation rate, confirms the relevance of the investment demand channel to explain the real appreciation in eight CEE countries but not for Bulgaria and Romania.

In the next section we search for country-specific effects. Therefore we test the impact of labour productivity increases on inflation for seven new member states with quarterly cross section data.[16]

[15] Haschka (2005, 17) notes that the option price adjustment method, which is used in Lithuania and Hungary, and the hedonic regression method being used in Germany, are close together in the case of PC (Linz (2004).

[16] For Poland we were not provided with observations of productivity in the non-tradeable sectors

V. Time Series Estimations with Quarterly Cross Section Data

The results of the empirical analysis above could be interpreted as a controversial outcome, because the number of observations is rather low, because of the relatively short observation period. One may also argue, that there may be other effects – besides the BS-effect – which explain the differences of the development of the consumer price indices too.

To face both of these objections we use quarterly data from the Eurostat Luxembourg database to search for significant impact of productivity change in various industrial sections effects in each of the eight new EU member states. The following regression results are calculated with the statistical software package Eviews 5, taking into consideration cross section effects and helping to analyse the dynamics of time series. All variables of the country specific regressions are seasonal adjusted.

The observation period extends from the forth quarter of 1995 until the second quarter of 2005. Because of data availability we divide four sectors (by class. Nace Rev. 1):

- D – Manufacturing without construction,
- F – Construction,
- G – I Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods, Hotels and restaurants, Transport, storage and communication
- J, K Financial intermediation, real estate, renting and business activities.

Only the first sector manufacturing is classified as tradeable sector. We introduce a dummy variable to check, whether in the tradeable sector the inflation rate difference in each of the 8 new EU member states (NMS-8) in comparison to the inflation rate in the European Monetary Union (EMU) is significantly higher than the difference in the three non-tradeable sectors.

To estimate the equation (8) of the section III we calculate as explaining variable the productivity growth difference between NMS-8 and EMU, the productivity growth in NMS-7. The productivity is defined as real gross value added divided through all employed persons in each sector. To take the demand side effects on the inflation rate into account we use the share of the gross value added in these 4 sectors of the NMS-8 relative to the EMU, which approximate the impact of wage income on the inflation rate.

The change rate of the exchange rate of the national currency with respect to the euro stands for the impact of devaluation on the inflation rate. The growth rate of M2 takes the monetary side of the economy into consideration.

The SUR option (PCSE model) corrects the residuals for heteroscedasticity of the variance and contemporaneous correlation.

Regression results with Cross-Section data for the Czech Republic

Table 6: GLS-Estimation of inflation rate differences between the Czech Republic and the EMU

Dependent Variable: CZ_REP_P
Method: Panel Least Squares
Date: 05/09/06 Time: 12:24
Sample (adjusted): 1996Q3 2005Q2
Cross-sections included: 4
Total panel (balanced) observations: 144
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CZ_KRONE	0.035200	0.015509	2.269626	0.0248
CZ_REP_P(-1)	1.395787	0.102848	13.57138	0.0000
CZ_REP_P(-2)	-0.839060	0.156184	-5.372241	0.0000
CZ_REP_P(-3)	0.189479	0.098334	1.926898	0.0561
CZ_REP_PROD(-1)	0.006010	0.004791	1.254474	0.2118
M2_CZ(-1)	0.091101	0.031104	2.928926	0.0040
TRADEABLE	-0.094150	0.106821	-0.881387	0.3797
C	-0.358350	0.238039	-1.505424	0.1345

R-squared	0.862684	Mean dependent var	1.176563
Adjusted R-squared	0.855616	S.D. dependent var	1.533904
S.E. of regression	0.582852	Akaike info criterion	1.812185
Sum squared resid	46.20139	Schwarz criterion	1.977174
Log likelihood	-122.4773	F-statistic	122.0590
Durbin-Watson stat	1.912518	Prob(F-statistic)	0.000000

Source: Eurostat Luxembourg, own calculations

The Jarque-Bera tests of normal distribution of the residuals cannot be rejected. The productivity variables were insignificant for the explanation of the inflation differences as well as the gross value added change rate. The inclusion of lag variables of the dependent variable corrects the regression result for auto correlation of the residuals.

In the Czech Republic the relevant regressors for inflation differences vs. the euro area are the growth rate of M2 and the change rate of the CZ-Euro exchange rate.

Regression results with Cross-Section data for the Slovak Republic

Table 7: GLS-Estimation of inflation rate differences between the Slovak Republic and the EMU

Dependent Variable: SK_P
Method: Panel Least Squares
Date: 05/03/06 Time: 14:25
Sample (adjusted): 1996Q2 2005Q1
Cross-sections included: 4
Total panel (unbalanced) observations: 138
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SK_P(-1)	1.239089	0.085591	14.47686	0.0000
SK_P(-2)	-0.590093	0.083188	-7.093530	0.0000
SK_PROD	-0.037963	0.021076	-1.801279	0.0740
SK_PROD(-2)	-0.022318	0.019797	-1.127369	0.2616
SK_PROD(-1)	0.060548	0.030471	1.987059	0.0490
TRADEABLE	-0.153369	0.112893	-1.358525	0.1766
C	0.469857	0.129740	3.621541	0.0004

R-squared	0.777927	Mean dependent var	1.258062
Adjusted R-squared	0.767755	S.D. dependent var	1.720996
S.E. of regression	0.829379	Akaike info criterion	2.513114
Sum squared resid	90.11088	Schwarz criterion	2.661597
Log likelihood	-166.4048	F-statistic	76.48247
Durbin-Watson stat	1.955204	Prob(F-statistic)	0.000000

Source: Eurostat Luxembourg, own calculations

Table 7 shows that the lag value of the productivity difference between the Slovak Republic and the EMU explains significantly the inflation difference between this country and the EMU at the 5 percent significance level. The significant coefficients for lags of the dependent variable show the dynamic of the cross section time series of inflation differences.

The variables of the demand side (Gross value added and M2 change rate) do not additionally explain significantly the inflation difference.

The tests of the residuals of the GLS-estimation find no evidence of autocorrelation or heteroscedasticity of their variance. The Jarque-Bera test of normal distribution of the residuals cannot be rejected by the data.

Regression results with Cross-Section data for Slovenia

Table 8: GLS-Estimation of inflation rate differences between Slovenia and the EMU

Dependent Variable: SL_P
Method: Panel Least Squares
Date: 05/17/06 Time: 14:23
Sample (adjusted): 1996Q3 2005Q2
Cross-sections included: 4
Total panel (balanced) observations: 144
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SI_TOLAR	0.009210	0.004150	2.219256	0.0281
SL_P(-1)	1.550219	0.088178	17.58064	0.0000
SL_P(-2)	-0.828893	0.144744	-5.726607	0.0000
SL_P(-3)	0.143745	0.084196	1.707269	0.0900
SL_PRODIFF(-1)	0.004371	0.002421	1.805426	0.0732
C	-0.110038	0.027076	-4.064110	0.0001

R-squared	0.917318	Mean dependent var	-0.388455
Adjusted R-squared	0.914323	S.D. dependent var	0.352991
S.E. of regression	0.103323	Akaike info criterion	-1.661143
Sum squared resid	1.473234	Schwarz criterion	-1.537401
Log likelihood	125.6023	F-statistic	306.2104
Durbin-Watson stat	1.807186	Prob(F-statistic)	0.000000

Source: Eurostat Luxembourg, own calculations

Table 8 shows that the lagged growth rate of labor productivity explains positively and significantly the inflation difference between Slovenia and the EMU at the 10 percent significance level, but the dummy variable for tradeable goods is significant. The coefficient of the change rate of the Tolar/Euro exchange rate is highly significant (10 percent significance level) and positive. The usual tests of the residual of the equation show, that these are independent and normal distributed and not correlated with other regressors or with their lagged terms.

Regression results with Cross-Section data for Hungary

Table 9: GLS-Estimation of inflation rate differences between Hungary and the EMU

Dependent Variable: HU_P
Method: Panel Least Squares
Date: 05/10/06 Time: 13:08
Sample (adjusted): 1996Q2 2005Q2
Cross-sections included: 4
Total panel (balanced) observations: 148
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GVA_HU	0.125260	0.074513	1.681055	0.0949
HU_FORINT	0.004594	0.001508	3.047059	0.0028
HU_P(-1)	1.452869	0.065279	22.25647	0.0000
HU_P(-2)	-0.621746	0.063799	-9.745394	0.0000
C	-0.169479	0.056879	-2.979617	0.0034

R-squared	0.910861	Mean dependent var	-0.389020
Adjusted R-squared	0.908367	S.D. dependent var	0.349374
S.E. of regression	0.105758	Akaike info criterion	-1.622118
Sum squared resid	1.599434	Schwarz criterion	-1.520860
Log likelihood	125.0367	F-statistic	365.3079
Durbin-Watson stat	1.770500	Prob(F-statistic)	0.000000

Source: Eurostat Luxembourg, own calculations

We find a different result for Hungary: The inflation difference between Hungary and the EMU depends positively on the gross value added share (GVA_HU). This could be seen as an evidence for the effects of the rising wage costs on the inflation rate in Hungary in comparison to the EMU. An increase of the change rate of the euro exchange rate (devaluation of the Forint against the euro) leads to an increase of the inflation difference between Hungary and the euro area.

The coefficient of the productivity growth rate is insignificant. The supply-sided effect may be overweighted by the demand-sided effects on the inflation rate in Hungary. The residuals have the desired properties of stationarity and are normally distributed.

Regression results with Cross-Section data for Poland

Table 10: GLS-Estimation of inflation rate differences between Poland and the EMU

Dependent Variable: POLEN_P
Method: Panel Least Squares
Date: 05/19/06 Time: 11:57
Sample (adjusted): 1996Q2 2002Q4
Cross-sections included: 4
Total panel (balanced) observations: 108
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2_PL	0.045706	0.017965	2.544108	0.0124
PL_PROD	0.069009	0.031822	2.168604	0.0324
POLEN_P(-1)	1.153701	0.133191	8.662027	0.0000
POLEN_P(-2)	-0.391615	0.138533	-2.826873	0.0056
C	-1.089816	0.456976	-2.384844	0.0189

R-squared	0.819887	Mean dependent var	1.174769
Adjusted R-squared	0.812893	S.D. dependent var	2.414052
S.E. of regression	1.044220	Akaike info criterion	2.969608
Sum squared resid	112.3108	Schwarz criterion	3.093781
Log likelihood	-155.3589	F-statistic	117.2160
Durbin-Watson stat	2.072033	Prob(F-statistic)	0.000000

Source: Eurostat Luxembourg, own calculations

From table 10 we see, that the demand side and the supply side explain significantly the inflation differences between Poland and the EMU. The growth rate of M2 is positively correlated with the inflation differences, which are also explained significantly by the differences of labour productivity growth rates. The variable GVA per person, the exchange rat change rate and the dummy variable tradeable were omitted from the equation because of multicollinearity of regressors. The tests of the residuals of the GLS estimation confirm the assumptions of a OLS estimation.

Regression results with Cross-Section data for Estonia

Table 11: GLS-Estimation of inflation rate differences between Estonia and the EMU

Redundant Variables: TRADEABLE

F-statistic	0.365785	Prob. F(1,137)	0.546311
Log likelihood ratio	0.383962	Prob. Chi-Square(1)	0.535490

Test Equation:
Dependent Variable: EE_P
Method: Panel Least Squares
Date: 05/10/06 Time: 15:31
Sample: 1996Q2 2005Q1
Cross-sections included: 4
Total panel (balanced) observations: 144
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EE_KRONE	0.204315	0.047875	4.267698	0.0000
EE_P(-1)	1.082089	0.080905	13.37488	0.0000
EE_P(-2)	-0.373856	0.071966	-5.194882	0.0000
EE_PROD	-0.025890	0.012217	-2.119135	0.0359
EE_PROD(-1)	0.023019	0.012332	1.866596	0.0641
C	0.272395	0.086943	3.133024	0.0021

R-squared	0.846100	Mean dependent var	1.303385
Adjusted R-squared	0.840523	S.D. dependent var	1.268767
S.E. of regression	0.506676	Akaike info criterion	1.518883
Sum squared resid	35.42741	Schwarz criterion	1.642625
Log likelihood	-103.3596	F-statistic	151.7367
Durbin-Watson stat	1.755076	Prob(F-statistic)	0.000000

Source: Eurostat Luxembourg, own calculations

Table 11 shows that the inflation differences depend strongly on the currency board regime (EE Krone) and the autoregressive dynamics of the time series. The productivity differences between the two regions are also highly significant to explain the variation of inflation differences. An increase of the change rate of the euro exchange rate (devaluation of the Estonian Crown against the euro) leads to an increase of the inflation difference between Estonia and the euro area. The residuals of the GLS estimation are not correlated with the regressors or with each other.

Regression results with Cross-Section data for Lithuania

Table 10: GLS-Estimation of inflation rate differences between Lithuania and the EMU

Dependent Variable: LIT_P
Method: Panel Least Squares
Date: 05/10/06 Time: 15:53
Sample (adjusted): 1996Q2 2005Q2
Cross-sections included: 4
Total panel (unbalanced) observations: 124
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIT_LITAS	0.084561	0.024670	3.427627	0.0008
LIT_P(-1)	1.229521	0.091867	13.38368	0.0000
LIT_P(-2)	-0.366751	0.084734	-4.328280	0.0000
LIT_PROD(-1)	-0.024200	0.012457	-1.942693	0.0544
M2_LT(-1)	-0.080879	0.018261	-4.429127	0.0000
C	2.033845	0.365753	5.560708	0.0000

R-squared	0.927145	Mean dependent var	1.955141
Adjusted R-squared	0.924058	S.D. dependent var	2.527627
S.E. of regression	0.696552	Akaike info criterion	2.161830
Sum squared resid	57.25185	Schwarz criterion	2.298295
Log likelihood	-128.0334	F-statistic	300.3319
Durbin-Watson stat	2.049472	Prob(F-statistic)	0.000000

Source: Eurostat Luxembourg, own calculations

For Lithuania the productivity and the monetary stance (M2 growth rate) have an negative impact on the inflation differences between Lithuania and the EMU. The higher the difference of the labour productivity growth rate, the lower the inflation difference will be. The coefficient of the lag variable of the M2 annual growth rate is rather low like the coefficient for the euro exchange rate. An increase of the change rate of the euro exchange rate (devaluation of the Litas against the euro) leads to an increase of the inflation difference between Lithuania and the euro area.

Regression results with Cross-Section data for Latvia

Table 11: GLS-Estimation of inflation rate differences between Latvia and the EMU

Dependent Variable: LV_P
Method: Panel EGLS (Cross-section SUR)
Date: 05/10/06 Time: 16:12
Sample (adjusted): 1996Q3 2005Q1
Cross-sections included: 4
Total panel (balanced) observations: 140
Linear estimation after one-step weighting matrix
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LV_PROD	-0.031831	0.016328	-1.949513	0.0533
LV_P(-1)	1.391092	0.079890	17.41259	0.0000
LV_P(-2)	-0.890403	0.118645	-7.504790	0.0000
LV_P(-3)	0.298922	0.077624	3.850893	0.0002
M2_LV(-1)	-0.030407	0.011274	-2.697153	0.0079
TRADEABLE	-0.287545	0.145124	-1.981374	0.0496
C	1.117380	0.290581	3.845336	0.0002

Weighted Statistics

R-squared	0.852584	Mean dependent var	1.302870
Adjusted R-squared	0.845934	S.D. dependent var	2.405572
S.E. of regression	1.018653	Sum squared resid	138.0080
F-statistic	128.2017	Durbin-Watson stat	1.966940
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.797376	Mean dependent var	1.676339
Sum squared resid	189.6927	Durbin-Watson stat	1.968721

Source: Eurostat Luxembourg, own calculations

In the regression shown in table 11 both productivity variables become significant, if we use cross section weights in the GLS estimation to correct for cross section heteroscedasticity. A significant coefficient of the dummy variable tradeable means, that the inflation difference becomes lower in the tradeable sectors. The negative coefficient for the difference of the labour productivity growth rate can be interpreted in the same way. The inflation differences are considerably higher in the non-tradeable sectors than in the tradeable sectors.

To sum up:

Using quarterly data for each country we find that the impact of productivity on inflation differences is probably superimposed by the growth rate of the monetary stock or by influences from the demand side of the economy. For Lithuania we find evidence that the exchange rate regime plays a significant role for the explanation of the inflation differences.

VI. Conclusions

The previous sections showed theoretically and empirically the relationship between inflation differences and their varying determinants in the NMS-8 versus the euro area and the reasons for the tendency to real appreciation of their currencies. The inflow of capital through direct investment and import of capital good is an important cause for the increase of labour productivity in the new EU member states in Central Europe. The positive impact of these foreign direct investment on employment and economic growth becomes visible, when we take a look at the diversification of the foreign trade structure and the improvement of the competitiveness of the export good industries, showing high growth rates. These positive effects are accompanied by the rise of good prices, which follows from former wage increases.

The economic integration process driven by privatisation, foreign capital investments and international trade leads to restructuring of the economy, that increase the number of job losses. The labour productivity, calculated as GDP per employee, rise, if new labour saving technologies and factory closures reduce the demand of employees for the production of industrial good at a larger scale, than new jobs in several industries were created by foreign direct investments.

The adoption of the euro as a common currency in some new EU member states has on average little effect on the EMU inflation rate, but the higher consumer price increases in Central Europe than in the euro area have notably the negative effect that a real appreciation of their currencies vs. the euro is the consequence, if the nominal adaptation of the currency is not able to compensate for it.

During the 15 years of economic transformation in Central Europe the consumers and firms have undergone a period of deep restructuring, but it is controversially disputed, whether the Euro adaptation as a legal tender will harm their competitiveness (Brandmeier, Ketterer, 2003 Breuss, 2003).

The productivity increases in the tradeable sector induced significant effects to the overall inflation differences in the NMS-8 and may could harm their economic growth prospects, because the strong economic growth rates in NMS-8 are mainly export-driven and their exports are mainly destined for the EMU. In addition to the productivity explanation of real appreciation the tendency towards rising relative prices for non-tradables will be further boosted by a better price transparency after EMU entry because of the visible trend to factor price equalization, if transaction costs could be neglected. Therefore the NMS-8 countries are more or less in a sandwich-position: On the one side they take advantage of their comparatively lower labour costs and of their ability to produce a similar product quality like the production sites being located in the EMU. On the other side they compete with countries in eastern Europe and far east with still lower production costs.

The negative effects of real appreciation may be reduced by using flexible exchange rates as a kind of buffers to secure competitiveness of the export industries. The competitiveness of the NMS-8 countries still depends on lower production costs.
The lessons from the German unification process for the EMU candidate countries could be summed up as follows (Maier and Cavelaars, 2003, 21) :

- Real appreciation follows from different price levels in countries which form a currency union.
- The real appreciation process have to be controlled through the gradual nominal appreciation of the candidate countries' exchange rates.
- To avoid output losses it is advisable to limit high inflation rates because of fixing the exchange rate of candidate countries too early.
- "High trend inflation rate in the accession countries are likely to prevail" (Maier and Cavelaars, 2003, 19).

Higher inflation rates in Central Europe decrease not only the competitiveness of the firms located there, but also the perspectives for sustained and balanced economic growth, if not private consumption is supported by a productivity oriented wage policy.

The EU could help by damping down the negative effects of the intensified location competition throughout the enlarged European Union.

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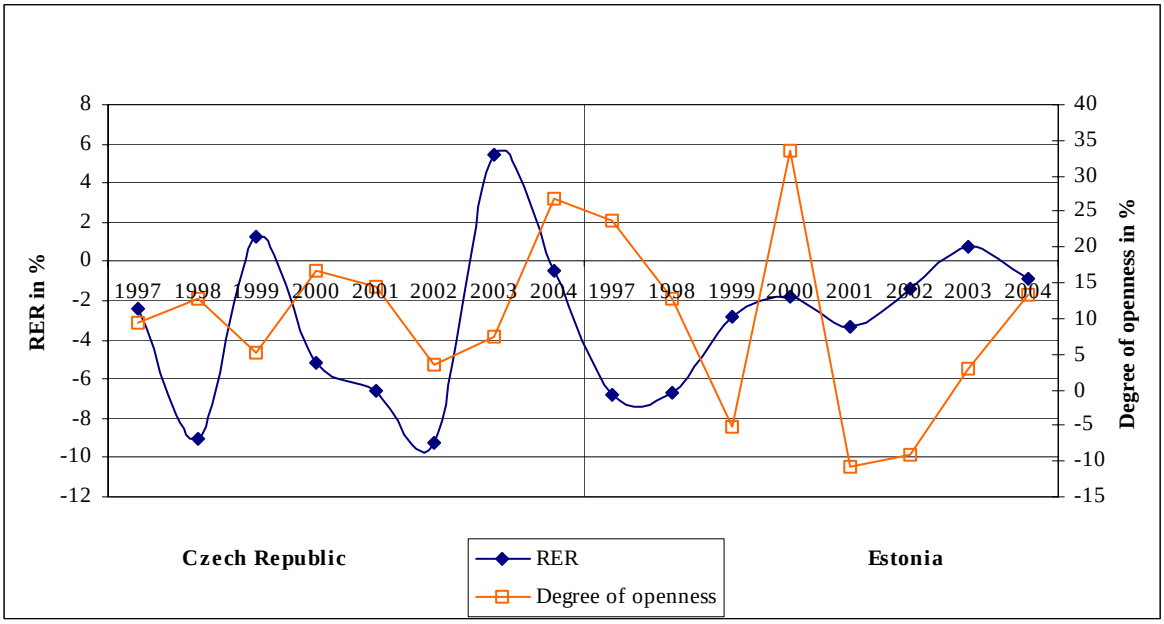
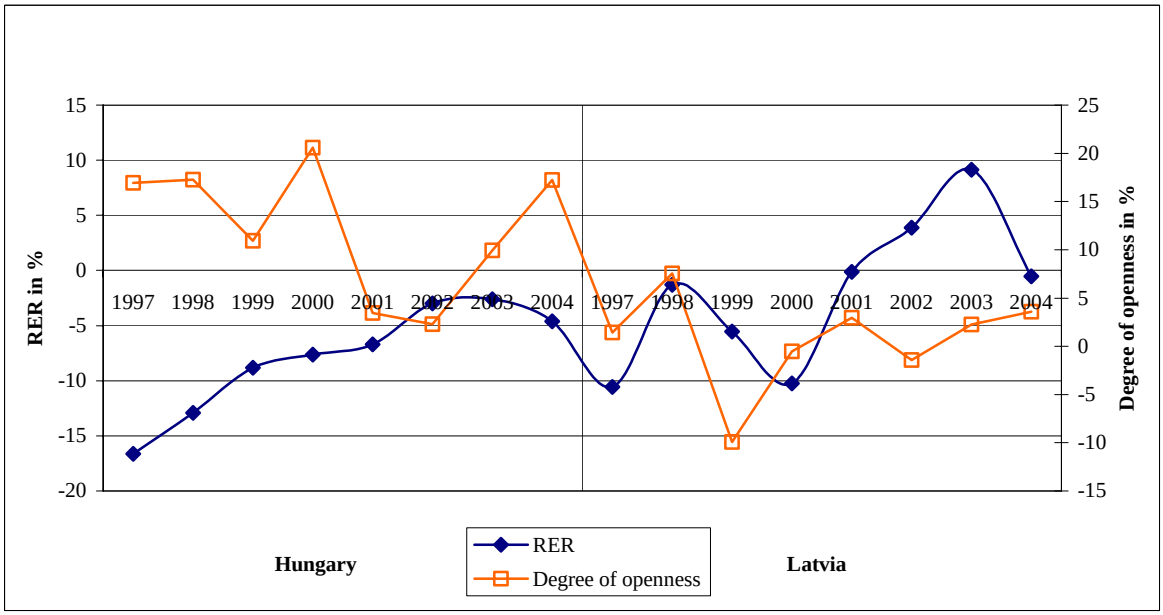
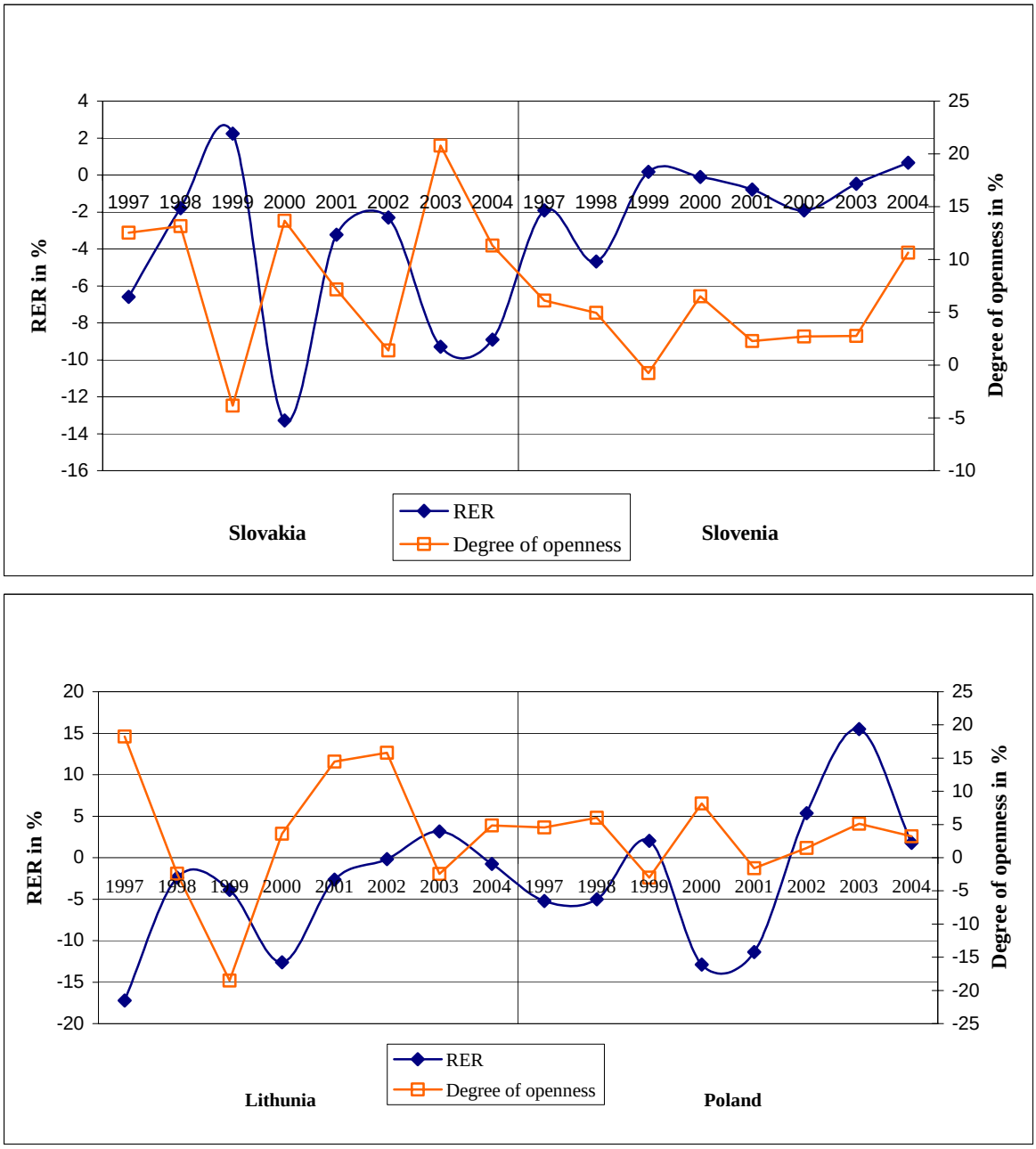




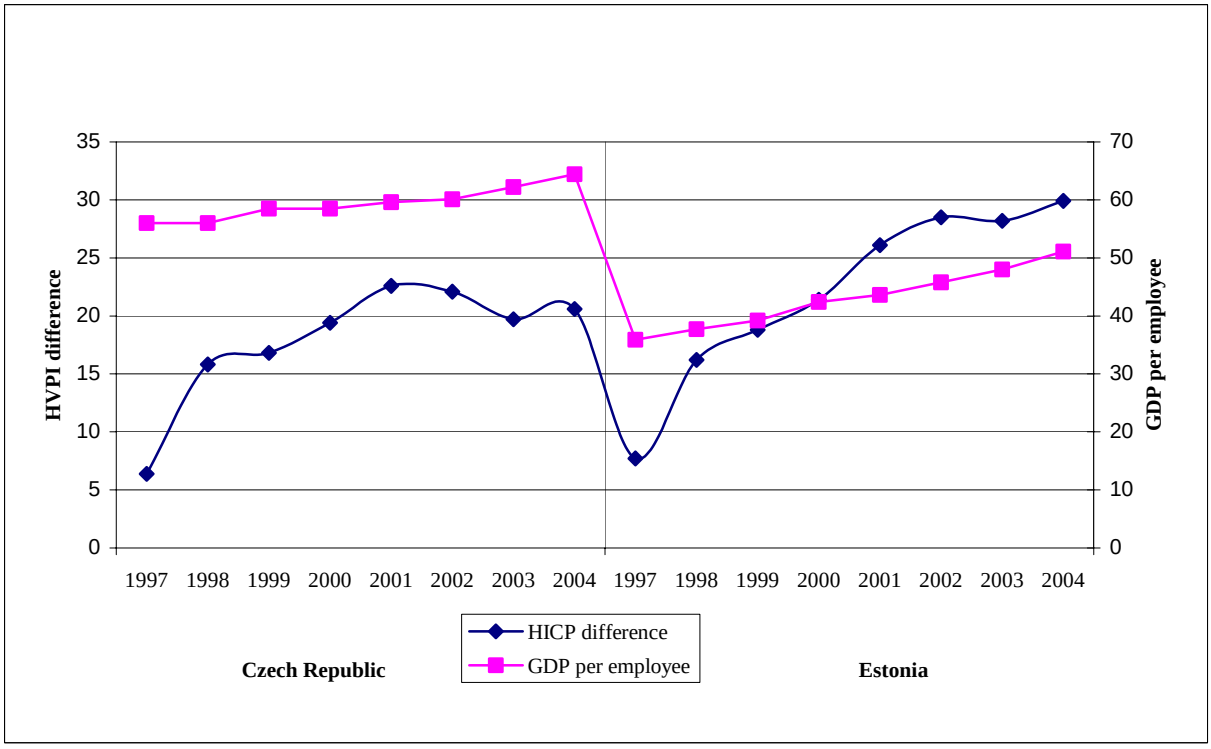
Source: Eurostat Luxemburg, own calculations, RER = deviations real exchange rate

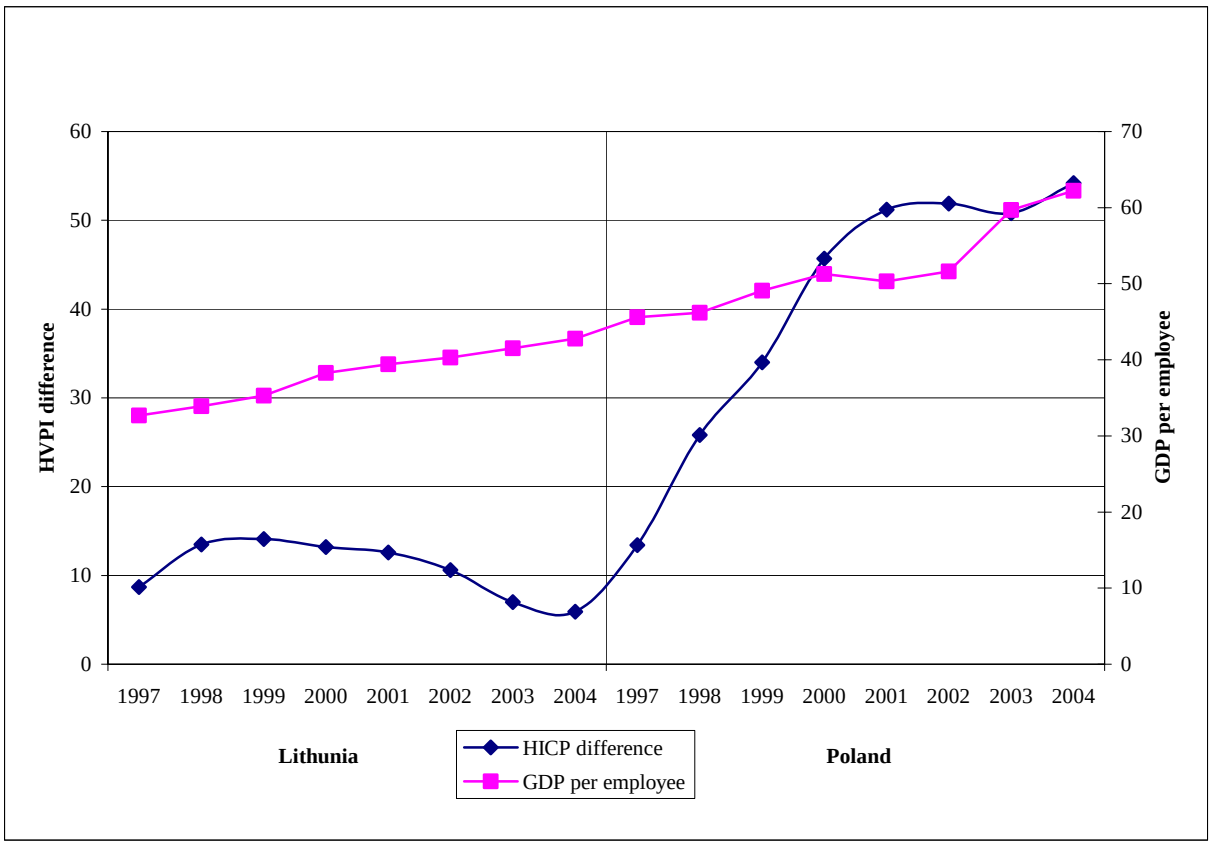
CHART 3 – relationship between RER and degree of openness in new EU member states



Source: Eurostat Luxemburg, own calculations, RER = deviations real exchange rate

CHART 4 – Relationship between price differences and labour productivity for several CEE countries





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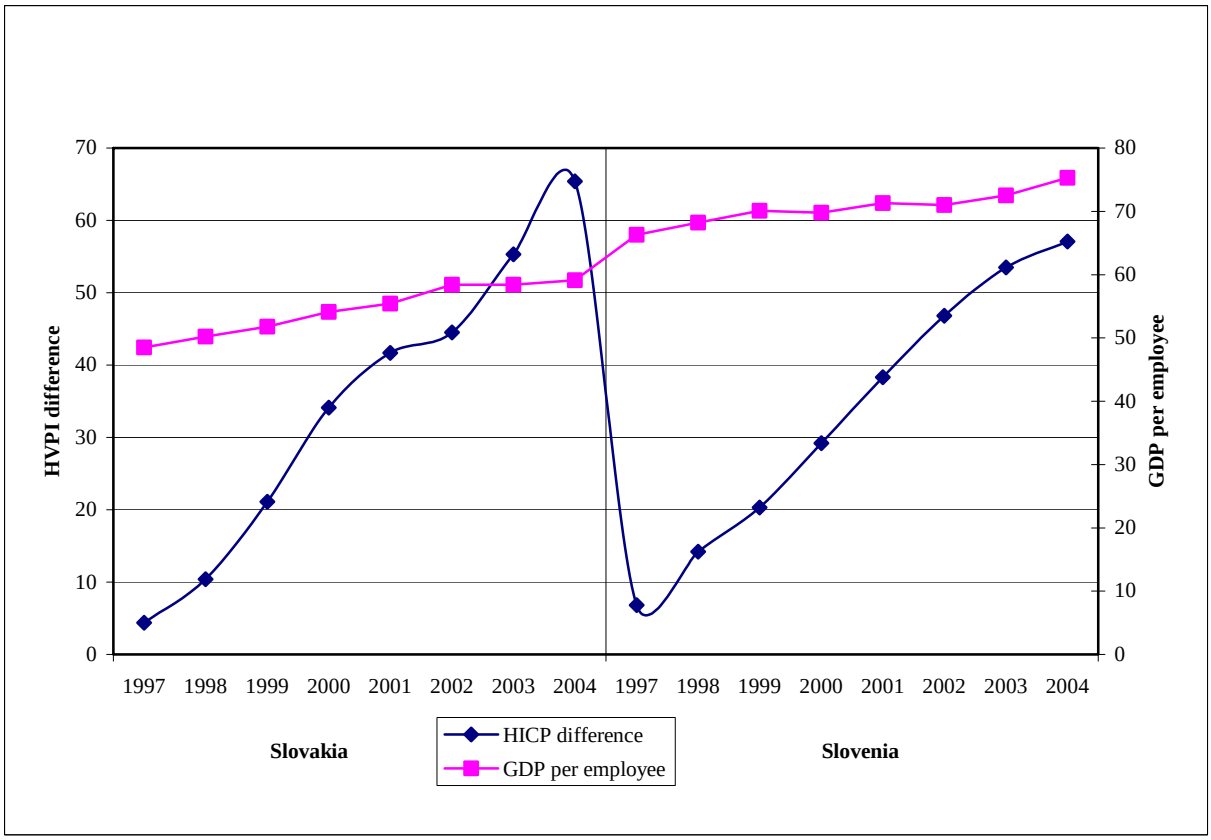

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