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## Competitiveness in Central-Europe: What Has Happened Since EU Accession?

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## IMF Working Paper

European Department

### Competitiveness in Central-Europe: What Has Happened Since EU Accession?

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#### Abstract

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Since EU accession, trade flows have exhibited strong dynamics in Central-Eastern Europe (CEE). During the period leading to the current global turmoil, the region has also experienced continuous exchange rate appreciation and rapid FDI inflows, both likely to have affected these countries' competitiveness. This paper describes how the determinants of exports and imports have evolved in CEE countries over 2002-07 and econometrically derives their contribution to trade, with a view to assessing competitiveness developments. The analysis reveals that the global and domestic upswings, along with rising trade market shares, go a long way toward accounting for trade developments in CEE countries until 2007, pointing to continuous nonprice competitiveness gains. It also finds that exchange rate appreciation did not unduly weigh on export and import growth, suggesting that most of it reflected an upward movement in its equilibrium value. While the region entered the current period of global slowdown from a strong competitiveness position, the crisis also exposed the vulnerability of its heavy reliance on global demand to a trade shock.

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## Contents

Page

I.	Introduction.....	3
II.	Developments in Key Determinants of Trade .....	4
III.	Econometric Analysis .....	7
IV.	Conclusion .....	13

## Tables

1.	Contribution of Net Exports to GDP Growth, 2002–07 .....	4
2.	Trade Balance, 2002–07 .....	4
3.	Real Effective Exchange Rate Based on ULCs, 2002–07 .....	5
4.	Geographic Orientation of Exports, 2002–07 .....	7
5.	Long-Term Elasticities Related to Nonprice Competitiveness.....	10
6.	Long-Term Elasticities to Price Competitiveness Indicators.....	11
7.	Cumulative Growth and Contribution of Trade Determinants, 2002–07 .....	12

## Figures

1.	Export Competitiveness Indicators, 1995–2007 .....	5
2.	Foreign Direct Investment Stock, 2002–07 .....	6
3.	Growth Rate of World Demand, 2002–07 .....	6
4.	Growth Rate of Domestic Demand, 2002–07 .....	7
5.	Accounting for Export and Import Growth, 2002–07 .....	9
6.	Dynamic Contributions to Export and Imports, 2002–07.....	14

## Appendices

I.	Data Sources .....	15
II.	Error-Correction Model for Trade Equations and Cointegration Tests .....	16
III.	Principle of Dynamic Contributions .....	20

References.....	22
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## I. INTRODUCTION

1. **Against rapid growth in the wake of European Union (EU) accession, trade flows have exhibited strong dynamics in Central-Eastern Europe (CEE) through 2007.** As background for assessing competitiveness in the region, this paper analyzes the developments in the external sector since 2002 in Poland, the Czech Republic, Hungary, and Slovakia on a comparable basis. It does not cover all possible factors underlying the differences in external sector performance and thus may need to be complemented with country-specific analysis as warranted.

2. **Until the reversal brought about by the current global financial crisis, the region had experienced continuous exchange rate appreciation, along with rapid foreign direct investment (FDI) inflows, both of which are likely to have affected these countries' competitiveness.** During 2004-07, these economies experienced trend currency appreciation. Exchange rate volatility also increased, and the authorities expressed concern that this would affect negatively trade performance. Overheating was also an issue, as rapid wage increases can erase these countries' comparative advantages against Western European countries, still their main trade partners. Still, EU accession and strong FDI have offered opportunities for nonprice competitiveness gains and increased access to global trade networks. In addition, the real exchange rate appreciation is likely to partly reflect a change in its equilibrium value, which would not jeopardize competitiveness.

3. **This paper describes the evolution of the determinants of exports and imports in each CEE country over 2002-07 and econometrically derives their contribution to trade, with a view to assessing competitiveness developments.** Section II reviews developments in price competitiveness, FDI stock, foreign demand addressed to each individual country, the geographical orientation of trade, and domestic demand. As these determinants affect trade performance in different directions, an econometric analysis is required to assess their cyclical and structural components and to shed light on competitiveness developments. Section III quantifies the dynamic contributions to export and import volumes of their main determinants, using univariate error-correcting models. The behavior of the residuals over the subsample period 2002-07 is also analyzed to see how well the determinants explain trade and to explore the influence of factors that are unobservable or omitted. Because it applies a similar methodology to all countries, this approach allows us to assess their relative position within the region. Obviously, given the strong structural changes over the period under study, caveats apply, and the results should be complemented by country-specific assessments. Section IV concludes.

4. **The analysis reveals that, until 2007, exchange rate appreciation had not unduly weighed on trade developments; meanwhile the rapid increase in export and import flows points to greater access to global trade networks and strong nonprice competitiveness gains since EU accession.** Global growth and the upswing in each of these countries following EU accession go a long way toward explaining the dynamism in trade

flows until 2007. Nonprice competitiveness gains are apparent from rising global market shares and FDI inflows. At the same time, relative trade price developments have not fully mirrored the appreciation trend in the real exchange rate, and their contribution to trade flows has remained subdued, a sign that over the 2002-07 period, price competitiveness has not been a problem. Still, observations at the end of the period suggest that this trend had started to partly reverse in 2006-07, particularly in Poland, and to some extent, in Slovakia. The strong reliance on foreign demand also proved a vulnerability as the global economy entered a period of severe recession, leading to a sharp deterioration in the growth outlook, particularly in the smaller countries in the region.

## II. DEVELOPMENTS IN KEY DETERMINANTS OF TRADE

**5. The external sector's contribution to growth differed markedly among the four CEE countries during 2002-07** (Table 1). While all countries experienced an increase in activity following EU accession in May 2004—although to a smaller extent for Hungary—net exports contributed very differently to growth performance: the contribution turned from negative to positive in the Czech Republic and Hungary, while the opposite happened in Poland. While positive throughout 2002-07, Slovakia's net export contribution to GDP growth declined markedly after EU accession. Over the full period, trade contributed from 15 to 25 percent of growth for the Czech Republic, Hungary, and Slovakia; in contrast, in Poland, net exports had a negative, although small, impact on growth.

Table 1. Contribution of Net Exports to GDP Growth, 2002–07  
(in cumulative percent)

	Memo item: Real GDP		Memo item: Real GDP		Memo item: Real GDP	
	2002-03		2004-07		2002-07	
Czech Republic	-3.1	5.6	8.4	26.4	5.3	33.5
Hungary	-5.0	8.7	10.5	14.9	5.5	24.9
Poland	1.4	5.4	-2.8	23.7	-1.4	30.3
Slovakia	6.1	9.8	4.8	34.3	11.0	47.4

Source: WEO.

**6. Still, trade balances strengthened throughout the region** (Table 2). The improvement was particularly marked in the three smaller countries, in contrast to Poland. Increased access to trade partners in the wake of EU accession and strong global demand until the global financial turmoil provided a boost to exports that more than offset the buoyancy of imports brought forward by stronger domestic

Table 2. Trade Balance, 2002–07  
(in percent of GDP)

	2002	2004	2007	2007-2002
Czech Republic	-2.1	0.1	4.8	7.0
Hungary	-2.3	-2.7	2.5	4.8
Poland	-3.2	-2.2	-2.7	0.5
Slovakia	-6.9	-3.0	-0.5	6.4

Source: WEO.

activity, investment efforts, and income convergence. In Poland, however, the improvement in trade balance was more moderate and actually reversed starting in 2005.

**7. The improvement in the external position over 2002-07 came despite a trend of real exchange rate appreciation, partly because relative export prices exhibited more muted variations.**

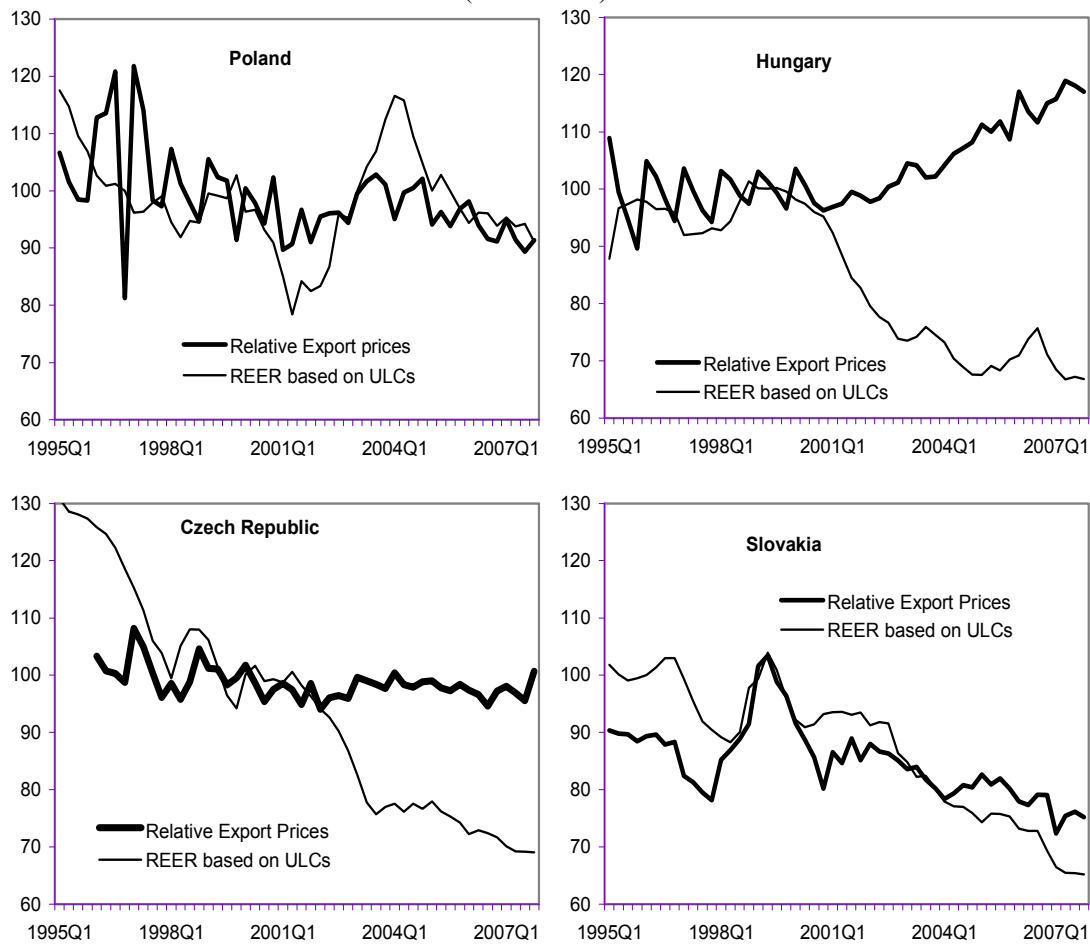
Except in Poland, where the impact of the Russian crisis at the end of the 90s was stronger and more protracted, the countries in the region experienced a continuous real effective exchange rate (REER) appreciation over 2002-07 (Table 3).

Table 3. Real Effective Exchange Rate based on ULCs, 2002-07  
(in cumulative percentage change, +=depreciation)

	2002-03	2004-07	2002-07
Czech Republic	-20.1	-10.3	-28.3
Hungary	-9.9	-10.4	-19.3
Poland	36.3	-19.0	10.4
Slovakia	-14.2	-18.7	-30.2

Source: European Commission

Figure 1. Central Eastern Europe: Export Competitiveness Indicators, 1995-2007  
(1999 = 100) 1/

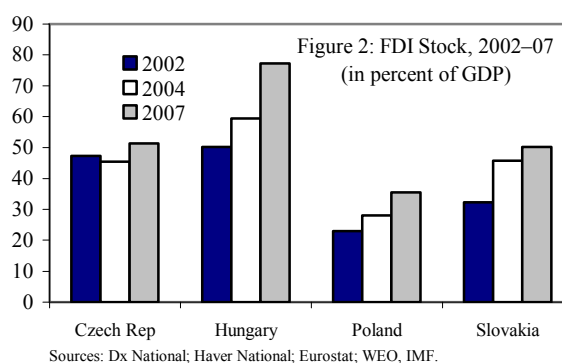


Source: European Commission, Direction of Trade Statistics and WEO, IMF, Staff calculations.

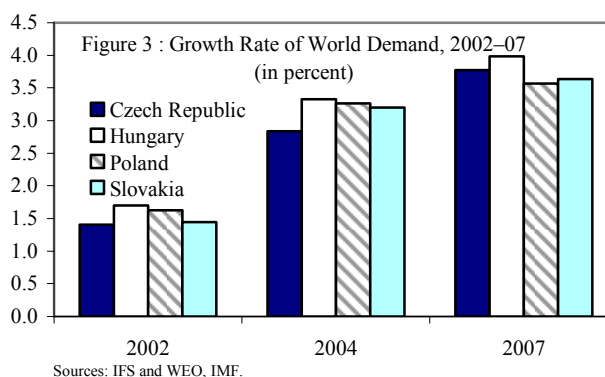
1/ For each indicators, an increase reflects an improvement in competitiveness through real depreciation.

However, this appreciation was not fully reflected in the relative prices faced by exporters: in the sectors more open to foreign trade, export prices did not deteriorate by as much, thus preserving more strongly their price competitiveness (Figure 1).<sup>2</sup> This is particularly the case in Hungary—where export prices actually grew less rapidly than its trade partners’ prices—and the Czech Republic—where export prices evolved similarly to those of its trade partners’. Several factors might contribute to these features. First, part of the real exchange rate appreciation during this period is likely to reflect a change in its equilibrium value, brought forward by the catch-up process and materializing in higher costs and prices in the nontradable sector. This is a natural and even welcome development that should not have any negative implication for trade price competitiveness. Second, this feature might also suggest that these countries were particularly good at identifying the sectors in which they had the largest potential comparative advantages. By investing massively in these sectors, they were able to reap the largest productivity gains, allowing prices to remain particularly competitive there.

8. **Large FDI inflows have been key to export performance.** All four CEE countries witnessed large FDI inflows prior to or just after EU accession (Figure 2). While the Czech Republic and Hungary were the first countries to benefit from foreign investors’ interest, the stock of FDI in percent of GDP consistently increased in the whole region over 2002-07. These investments were mostly in export-oriented sectors (automobiles and “white” appliances like flat screen television sets), and from developed European and Asian companies eager to take advantage of relatively low wages, an educated workforce, and the region’s proximity to mature markets.



9. **The export performance across the region has also benefited from accelerating foreign absorption** (Figure 3). The improvement in trade balance experienced over 2002-07 partly stems from the good cyclical position of its trade partners: Western Europe, which still accounts for the bulk of export destination,



<sup>2</sup> Relative export prices are defined as the ratio of the prices of foreign competitors, expressed in domestic currency, to domestic exporters’ prices. For a more detailed description of the data definition and sources, see appendix I.

underwent a strong recovery over the period. Moreover, with EU accession, trade networks within the region solidified, and the CEE countries strengthened trade routes with their eastern neighbors, and, to a lesser extent, with emerging Asia (Table 4). This redirection of trade toward fast-growing areas, over time, made for structurally more dynamic foreign demand addressed to CEE exporters.

Table 4. Geographic Orientation of Exports, 2002-07

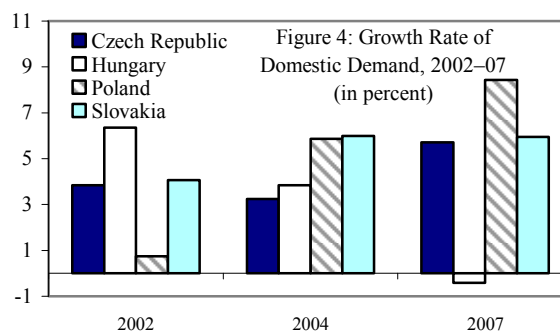
	Czech Republic		Hungary		Poland		Slovakia	
	2002	2007	2002	2007	2002	2007	2002	2007
Exports to euro area	61.8	57.1	66.3	53.9	57.9	52.2	57.6	51.8
Exports to other Western European countries 1/	8.0	8.2	9.8	6.3	13.0	12.8	4.3	7.5
Exports to CEE	14.9	18.0	5.5	12.6	7.7	10.5	26.0	24.8
Exports to the Baltics	0.6	0.8	0.3	0.6	3.3	2.9	0.5	0.6
Exports to Russia, Ukraine and Belarus	2.0	3.5	2.1	5.5	6.8	9.5	2.2	3.8
Exports to emerging Asia 2/	1.9	2.1	2.0	2.3	1.4	1.6	0.9	1.4

Source: IFS, IMF.

1/ Denmark, Norway, Sweden and United Kingdom.

2/ Asia excluding Japan

10. **Conversely, asymmetrical developments in domestic demand have affected import performance** (Figure 4). Among the four CEE countries, Poland experienced the sharpest improvement in domestic demand, which would partly explain why its trade balance did not improve as much as its neighbors over 2002-07. At the opposite end of the spectrum, the slowdown of activity in Hungary after EU accession brought about a cyclical improvement of its trade balance. Slovakia and the Czech Republic were in an intermediate position, with domestic absorption strengthening gradually over the period.



### III. ECONOMETRIC ANALYSIS

11. **To quantify and break down the respective roles of the determinants of export and import volumes, reduced-form equations were estimated for each of the four countries.** Data were quarterly, going as far back as availability permitted, usually starting in 1995, except for the Czech Republic, where relevant data were available only from 1996 onward (see appendix I for a description of the data sources), and using data up to 2007. In a first step, each of the eight equations was estimated univariately in levels and tested for the existence of cointegrating relationships. As a second step, to capture the complete dynamics, full error-correction models were estimated. The choice of the lag structure was determined using Hendry's strategy: nonsignificant lags were eliminated sequentially, starting with the least significant one until only significant variables were left. Detailed results of the individual estimates and cointegration tests are reported in appendix II. In a final step, dynamic contributions were computed to assess the role of the various explanatory variables



in the evolution of trade over the last few years. Rather than just providing elasticities, this method combines such elasticities with the evolution of the explanatory variables to quantify their impact in any given period, taking into account the entire lag structure of the models (see appendix III for an exposition of the methodology).<sup>3</sup> While caution is warranted in interpreting these equations because the sample is short and these economies are still experiencing large structural changes, this approach has the merit of providing a first analysis on a comparable basis for the region as a whole, while still allowing for different values for elasticities in each country.<sup>4</sup>

**12. Aside from the core variables of price competitiveness and domestic and foreign demand, plausible variables were added to some equations to achieve a satisfactory fit.**

Cost competitiveness was represented by a relative price variable: for export equations, it was the ratio of foreign competitors' prices to domestic exporters' prices, whereas for import equations, the ratio of importer prices to domestic demand prices was used.<sup>5</sup> This indicator captures not only the labor costs incurred by the various producers, both for domestic and foreign competitors, but also the margin behavior of market participants, as well as shifts in preferences.<sup>6</sup> Because each of these countries is "small" in the global trade networks, exporters are assumed to be "price takers", aligning directly their prices to the ones applied abroad. Importers, conversely, are assumed to have more latitude to be "price makers", by using home currency pricing. Trade-weighted foreign demand and domestic demand represented the usual scale variables for exports and imports, respectively. In addition, the high import content of exports led to the incorporation of exports as an explanatory variable in the import equations, in addition to domestic demand. On the export side, the stock of FDI was added, as most of these investments were made in export-intensive sectors. Trends were also retained where they were found to be significant.

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<sup>3</sup> A similar approach was used for large euro area countries (Allard and others, 2008).

<sup>4</sup> This would not be the case in a traditional panel regression, where one would have to assume that elasticities are identical across the countries in the region, a result that the current exercise seems to invalidate (Tables 5 and 6). A panel model allowing for heterogeneity of elasticities across countries would have required longer time series than what was available.

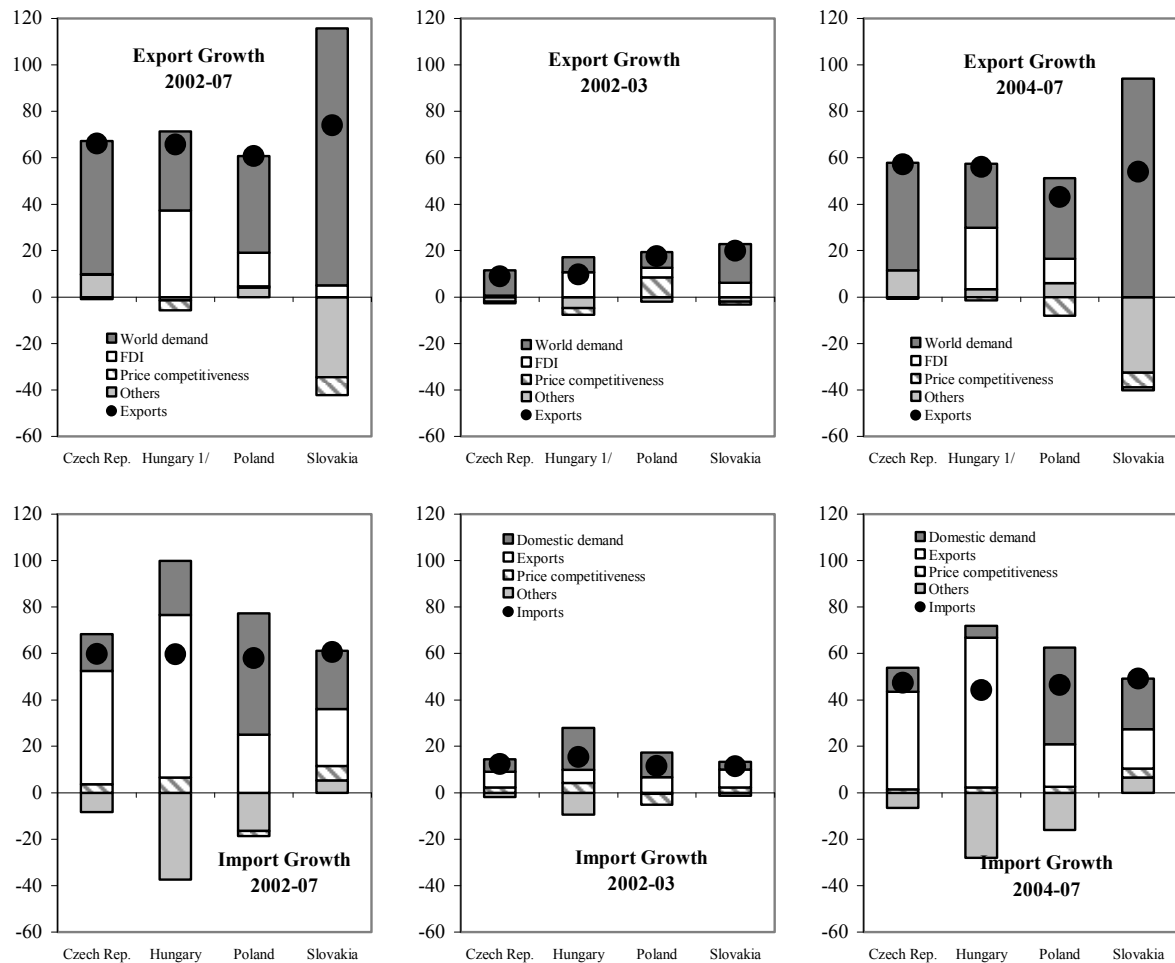
<sup>5</sup> This definition, particularly on the export side, is not entirely satisfactory due to data limitations. It would have been preferable to have a price index of tradable goods for foreign competitors. By using the GDP deflator instead, the variable may be contaminated by Balassa-Samuelson effects. However, this is mitigated by the fact that the CEE main trade partners are industrialized countries, less likely to be affected by more dynamic nontradable prices.

<sup>6</sup> In one instance, Hungary, the unit labor cost (ULC)-based REER rate was used instead, as the relative price variable did not prove to be able to explain export behavior properly in this country. In this case, it means that labor costs were the most relevant aspect of price competitiveness—a result that fits wage developments in Hungary, which have been more buoyant than in its neighbors in the region.

13. **The behavior of volume variables explains most of the recent behavior of trade flows, especially since EU accession (Figure 5):**

- The acceleration in **global demand** accounts for the bulk of export buoyancy over 2002-07, with the strongest impact in the Czech Republic and Slovakia. This is not related to an exposure to more dynamic trade partners, as Figure 3 shows that the global demand addressed to each of the four CEE countries exhibited a similar dynamism. Instead, this buoyancy reflects the ability of the smaller countries to expand their market share more systematically since transition, a result mirrored in higher elasticities to world demand (Table 5).

Figure 5. Accounting for Export and Import Growth, 2002–07  
(percent; cumulated growth rate)



Source: Eurostat; and IMF, *International Financial Statistics*, *World Economic Outlook*, and staff calculations.

1/ for Hungary's exports, the price competitiveness variable is the ULC-based REER.

- The buildup in **FDI investments** also contributed to export growth over 2002-07. This was more pronounced in Hungary and Poland than in the Czech Republic and Slovakia: as the two latter countries had benefited earlier from FDI inflows, the most profitable

projects might have been already implemented in those countries by the time of EU accession, and the marginal contribution of the new investments to export performance might have been lower. This result might also explain why the estimated elasticity of FDI to exports drops slightly after EU accession in Slovakia, and why FDI was found to not influence exports in the long run in the Czech Republic (Table 5). Conversely, in Poland in particular—where FDI inflows had been lagging behind—the confidence effect of EU accession contributed to attract new investors, leading to more export-oriented new projects after 2004.

Table 5. Long-Term Elasticities Related to Nonprice Competitiveness

	Czech Rep.	Hungary	Poland	Slovakia 1/
Exports				
World demand	3.63	1.92	2.40	7.03
FDI stock	0.00	0.56	0.19	0.07
Imports				
Domestic demand	0.57	1.18	1.81	0.85
Exports	0.73	1.10	0.42	0.32

Source: IMF staff calculations.

1/ For Slovakia, the long-term elasticity of exports to FDI shown here applies to data after 2004. Before 2004, the elasticity is marginally higher.

- On the import side, strong **domestic demand** played a key role as expected, but **export** growth also drove imports up, as a sign of the growing import content of exports. As trade barriers gradually fell in the run-up to EU accession, trade networks within the region and with Western Europe developed in which part of the manufacturing production of goods was conducted in one of the CEE countries before being reshipped abroad, requiring imported inputs to feed the export production. The Czech Republic and Hungary exhibited the strongest pattern in this respect, a feature that, combined with the more robust nonprice competitiveness of their economy, is reflected in their relatively strong elasticities of imports to exports (Table 5). As the other end of the spectrum, Poland's imports appear to be much more dependent on domestic demand: in that country, imports reacted more strongly not only to accelerating private consumption after EU accession, but also, on a more positive note for nonprice competitiveness, to a strong investment effort.

14. **Price competitiveness does not appear to have weighed significantly on trade developments since EU accession** (Figure 5 and Table 7). While, over 2002-07, the evolution of relative prices generally contributed negatively to exports and boosted imports, the overall size of these impacts remained muted. This result suggests that most of the trend appreciation of the real exchange rate reflected more a shift of the equilibrium value than a loss in price competitiveness, although some deterioration might have been in the offing in Poland and Slovakia since EU accession. In those countries, the contribution of price

competitiveness has been increasingly negative, as exhibited in the time profile of the dynamic contributions (Figure 6). In addition, the sensitivity to price competitiveness indicators varies considerably across the region (Table 6). The elasticity is relatively low in the Czech Republic—where exports were found not to react at all to relative prices<sup>7</sup>—and in Hungary. It is much higher in Poland, possibly reflecting a different technology content of export goods: the smaller countries in the region would have been better able to move up the quality and technology ladder than Poland, giving them more of a price-setting ability, a result that is consistent with the findings of Igan, Fabrizio, and Mody (2007).

Table 6. Long-term Elasticities to Price Competitiveness Indicators

	Czech Rep	Hungary 1/	Poland	Slovakia
Exports	0	0.15	0.73	0.63
Imports	-0.15	-0.23	-0.52	-0.38

Source: IMF staff calculations

1/ For Hungary's exports, the price competitiveness variable is the ULC-based REER, as opposed to the other countries where it is the relative price faced by exporters.

15. **The contribution of the residuals in the export equations suggests nonprice competitiveness gains might have started to taper off** (Table 7). While, statistically, these residuals average zero over the sample period, their behavior over any subsample period may reflect, apart from data issues, an inflection in the factors that are not explicitly included in the explanatory variables. For the export equations, these include the overall business climate, the sectoral orientation of trade, or other nonprice competitiveness indicators that are not easily captured. In this respect, it is notable that, from EU accession until 2007, the residuals have contributed negatively to exports in all four countries, although to a lesser extent in the Czech Republic. While this is in continuation with developments prior to accession in 2002-03 in Poland and in the Czech Republic, it signals a change in trend both in Hungary and in Slovakia. In all countries, these negative residuals are likely to reflect less dynamic nonprice competitiveness gains as the catch-up proceeds and these economies converge toward Western European standards.

16. **Conversely, the time profile of import residuals may signal a declining reliance on foreign goods beyond the preaccession surge.** Taking into account the dynamism of domestic absorption, the export content of imports, and relative price developments, imports were relatively more dynamic before accession in Hungary and Poland (positive residuals), but have turned less dynamic in all countries since 2004 (negative residuals). This could suggest that after the strong surge in imports prior to and right after accession—both because

<sup>7</sup> The low elasticity might be partly explained by the Czech exporters' extensive use of hedging, thanks to which they protect themselves from exchange rate fluctuations.

households brought forward some consumption and firms upgraded their investment stock in expectations of stronger growth—this additional momentum is gradually losing steam, a feature that should contribute positively to external sustainability.<sup>8</sup>

Table 7. Cumulative Growth and Contribution of Trade Determinants, 2002-07

(In percentage points)

Czech Republic	Exports				Imports		
	2002-07	2002-03	2004-07		2002-07	2002-03	2004-07
Cumulative growth	66.1	8.9	57.2	Cumulative growth	59.7	12.4	47.3
Contributions:				Contributions:			
World demand	57.2	10.9	46.3	Domestic demand	57.2	5.4	10.3
FDI	-0.9	-0.7	-0.2	Exports	0.2	6.8	42.1
Price competitiveness	0.2	0.6	-0.4	Price competitiveness	-0.9	2.3	1.4
Trend	11.0	-0.8	11.7	Trend	11.0	-0.1	-5.4
Unexplained	-1.3	-1.9	-0.2	Unexplained	-1.3	-1.5	-1.1

Hungary	Exports				Imports		
	2002-07	2002-03	2004-07		2002-07	2002-03	2004-07
Cumulative growth	65.6	9.6	56.0	Cumulative growth	59.6	15.4	44.2
Contributions:				Contributions:			
World demand	34.0	6.4	27.5	Domestic demand	23.3	18.1	5.2
FDI	37.3	10.8	26.5	Exports	69.9	5.6	64.3
Price competitiveness	-4.3	-2.8	-1.4	Price competitiveness	6.7	4.3	2.4
Trend	-2.1	-7.1	5.0	Trend	-41.3	-13.7	-27.6
Unexplained	0.8	2.4	-1.7	Unexplained	2.1	2.2	-0.1

Poland	Exports				Imports		
	2002-07	2002-03	2004-07		2002-07	2002-03	2004-07
Cumulative growth	60.6	17.5	43.1	Cumulative growth	57.9	11.5	46.4
Contributions:				Contributions:			
World demand	41.4	6.8	34.6	Domestic demand	52.1	10.6	41.5
FDI	14.6	4.1	10.5	Exports	25.1	6.7	18.4
Price competitiveness	0.5	8.5	-8.1	Price competitiveness	-2.3	-4.8	2.6
Trend	7.1	0.1	7.0	Trend	-12.1	-4.0	-8.1
Unexplained	-3.0	-2.0	-0.9	Unexplained	-4.0	4.0	-7.9

Slovakia	Exports				Imports		
	2002-07	2002-03	2004-07		2002-07	2002-03	2004-07
Cumulative growth	73.9	20.0	54.0	Cumulative growth	60.5	11.4	49.1
Contributions:				Contributions:			
World demand	110.6	16.6	94.0	Domestic demand	25.1	3.4	21.8
FDI	5.1	6.2	-1.1	Exports	24.6	7.6	17.0
Price competitiveness	-7.6	-1.2	-6.4	Price competitiveness	6.2	2.4	3.8
Trend	-38.3	-8.9	-29.5	Trend	7.6	0.4	7.2
Unexplained	3.6	6.6	-3.0	Unexplained	-2.1	-1.5	-0.6

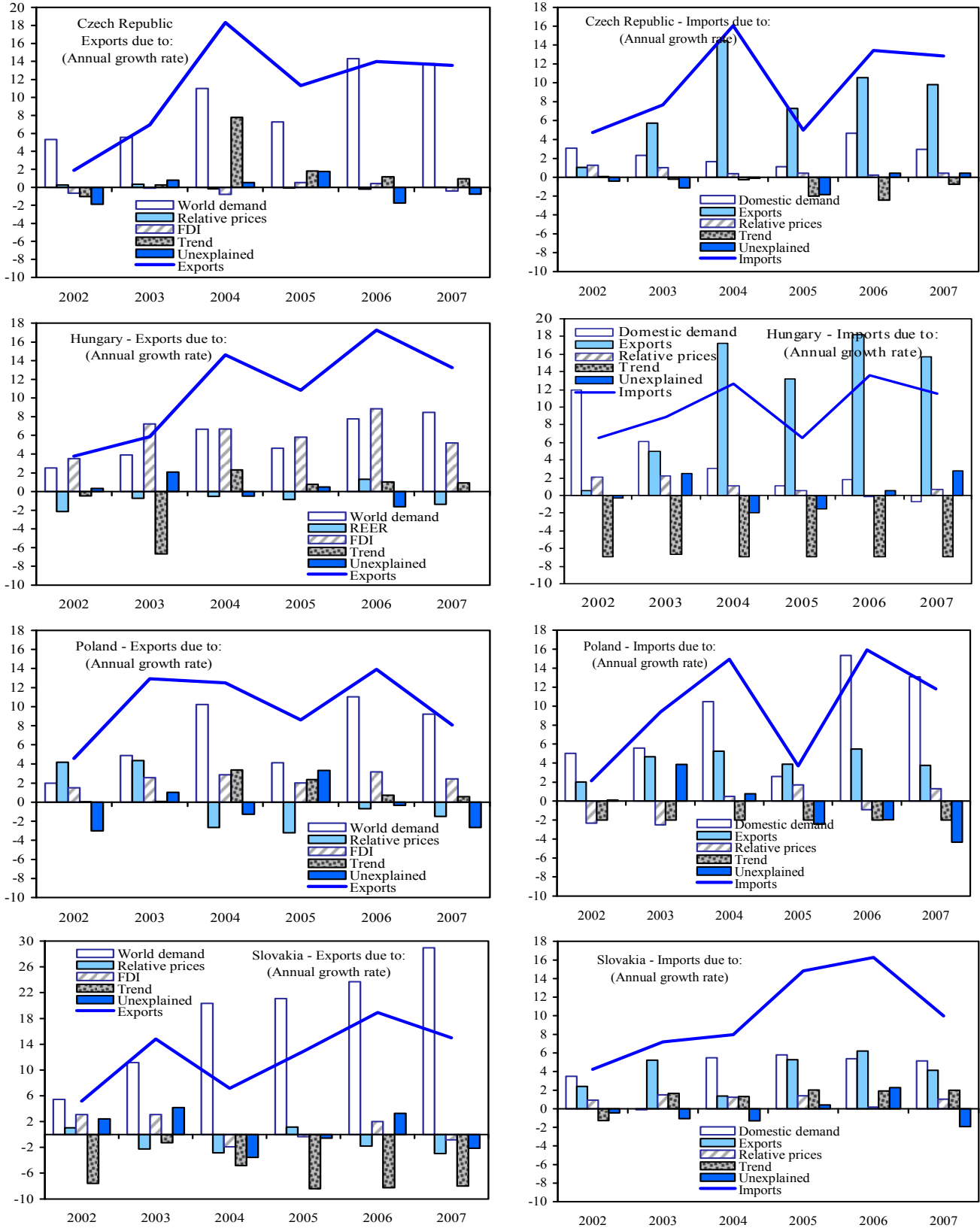
Source: IMF staff estimates.

<sup>8</sup> It is also possible that, with the investment efforts undertaken by these economies around the time of EU accession, domestic production is better equipped to fulfill domestic demand and substitute imported goods and services; this would be another sign of greater nonprice competitiveness on the import side.

#### IV. CONCLUSION

17. **The global and domestic upswings, along with rising market shares, go a long way toward accounting for trade developments in Central-Eastern European countries during the period spanning from EU accession to the onset of the financial crisis; this period was characterized by strong, albeit moderating, nonprice competitiveness gains.** The pickup in growth in the main trade partners' economies during 2004-07, especially in Western Europe, undeniably played the biggest role in supporting export growth in all four countries. Similarly, domestic absorption in the run-up to, and wake of, EU accession significantly boosted imports. Still, beyond these cyclical components, this study points to strong nonprice competitiveness gains over the period, as the region was able to take advantage of the global cycle to increase its export market share, partly thanks to strong FDI inflows. In addition, with lower trade barriers within the EU, these economies developed a network of production and exchange within the region and with mature markets that tapped into their comparative advantage, as exemplified by the growing amount of imports related to export-oriented production. These developments are not totally homogeneous across the region, though: the Czech Republic and Slovakia seem to have benefited the most and the earliest from these gains, while Poland lagged slightly behind.
18. **The trend exchange rate appreciation did not weigh excessively on trade developments over 2004-07; in this respect, the sharp reversal since the fall of 2008 is not warranted by fundamentals.** Despite rapid exchange rate appreciation, relative trade prices had remained more muted, as productivity gains in export-oriented sectors had proved strong enough to offset nascent domestic wage pressures. This feature likely highlights the fact that most of the real exchange rate appreciation over 2004-07 had followed an upward trend in its equilibrium value, without jeopardizing price competitiveness. Data for 2006-07, though, suggest that relative prices had started to weigh more negatively on trade flows in Poland and Slovakia, a signal that exchange rate developments might have been about to outpace what was sustainable in these countries. Still, this study suggests that the extent of the depreciations experienced since mid-2008 in Hungary, Poland and the Czech Republic does not reflect fundamentals; rather, external determinants related to the global financial turmoil have led to significant currency undervaluation.
19. **While the region entered the current period of global turmoil from a strong competitiveness position, the crisis also exposed the vulnerability of its heavy reliance on global demand to a sudden trade shock.** As foreshadowed by the relatively high elasticities of exports to foreign demand, the slowdown in trade partners drastically curtailed trade flows, especially for the smaller CEE countries. Meanwhile, Poland seems slightly more protected, being less sensitive to world demand. One mitigating factor, however, is that, in all countries, imports concomitantly slowed down, not only because domestic growth moderated but also because its export-related component was curbed.

Figure 6: Dynamic Contributions to Exports and Imports, 2002-07



Source: IMF staff calculations.

## Appendix I: Data Sources

### Domestic economies' data:

From **Eurostat** quarterly data (with base year 2000), from 1995 to 2007 (except for the Czech Republic, for which data start only in the first quarter of 1996, all seasonally adjusted and adjusted for working days:

- Exports, imports, and domestic demand volume, in national currency chain-linked volume; and
- Export, import, and domestic demand prices based on national currencies.

### From the **European Commission**

([http://ec.europa.eu/economy\\_finance/thematic\\_articles/article12306\\_en.htm](http://ec.europa.eu/economy_finance/thematic_articles/article12306_en.htm)):

- Unit labor cost-based real effective exchange rate: REER versus 36 main trade partners (EU-27, other Western European countries, Australia, Canada, Japan, Mexico, New Zealand, Turkey, and the United States), used in the short-term dynamics of the behavior equations, and as the price competitiveness variable in the long-term relationship for Hungary's exports.

From **Dx data** and (for earlier years when not available in Dx data) **Haver Analytics**:

- FDI stocks in national currency in current prices. GDP deflators for the IMF's WEO database were used to construct FDI stocks in constant prices.

### External environment data:

From the **IMF WEO database**:

- World demand faced by the Czech Republic, Hungary, Poland, and Slovakia: weighted GDP at constant prices of trade partners, with, for each of the four countries, weights defined as the share of exports to the trade partners (for trade partners whose share is greater than 1 percent of total exports). Detailed export data are derived from the **IMF's Direction of Trade statistics**. World demand is available only on an annual basis, and, for the sake of the econometric analysis, the quarterly series is derived by applying the quarterly pattern of OECD GDP to distribute global demand on a quarterly basis.
- Foreign competitors' prices for the Czech Republic, Hungary, Poland, and Slovakia: weighted GDP deflators converted into national currency, with weights similar to the ones used for foreign demand. As with foreign demand, the data are available only on an annual basis.
- Relative export prices (for export equations) are defined as the ratio of foreign competitors' prices, expressed in euros, to domestic exporters' prices. Import relative prices (for import equations) are defined as the ratio of importers' prices to overall domestic demand prices (as a proxy of the ratio of importers' prices to the prices of domestic production sold nationally). Hence, in both cases, an increase in the ratio signals an increase in price competitiveness.



## Appendix II: Error-Correction Model for Trade Equations and Cointegration Tests<sup>9</sup>

### CZECH REPUBLIC

#### Exports

$$\begin{aligned} \Delta \text{Log}(Ex) = & -0.009 + 0.50 \Delta \text{Log}(Ex)_{-1} + 0.13 \Delta \text{Log}(Ex)_{-3} + 1.90 \Delta \text{Log}(World\_Demand) \\ & \quad \quad \quad (-1.02) \quad (4.56) \quad (1.27) \quad (2.10) \\ & + 0.26 \Delta \text{Log}(Price\_Compet)_{-3} + 0.28 \Delta \text{Log}(Price\_Compet)_{-4} + 0.54 \Delta \text{Log}(FDI)_{-1} \\ & \quad \quad \quad (2.40) \quad (2.48) \quad (2.32) \\ & - 0.78 \Delta \text{Log}(FDI)_{-2} + 0.48 \Delta \text{Log}(FDI)_{-4} - 0.87 ECM_{-1} \\ & \quad \quad \quad (-2.84) \quad (2.51) \quad (-5.97) \end{aligned}$$

where

$$ECM = \text{Log}(Ex) - 3.63 \text{Log}(World\_Demand) - 8.15 + 0.0026 \text{trend}20041 - 0.05 \text{dummy}19981\_20003$$

Estimation: 1997:Q2-2007:Q4, Durbin Watson statistics=1.80, standard error of estimate=0.018

#### Imports:

$$\begin{aligned} \Delta \text{Log}(Im) = & -0.0027 + 1.20 \Delta \text{Log}(Domestic\_Demand) - 0.14 \Delta \text{Log}(Domestic\_Demand)_{-2} \\ & \quad \quad \quad (-1.31) \quad (17.24) \quad (-2.22) \\ & - 0.20 \Delta \text{Log}(Domestic\_Demand)_{-3} - 0.17 \Delta \text{Log}(Domestic\_Demand)_{-4} + 0.90 \Delta \text{Log}(Ex) \\ & \quad \quad \quad (-2.98) \quad (-2.41) \quad (24.92) \\ & - 0.07 \Delta \text{Log}(Ex)_{-3} - 0.32 ECM_{-1} \\ & \quad \quad \quad (-2.13) \quad (-2.27) \end{aligned}$$

where

$$ECM = \text{Log}(Im) - 0.57 \text{Log}(Domestic\_Demand) - 0.73 \text{Log}(Ex) + 0.15 \text{Log}(Price\_Compet) - 4.09 + 0.041 \text{dummy}20003\_20043$$

Estimation: 1997:Q2-2007:Q4, Durbin Watson statistics=1.04, standard error of estimate=0.030

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<sup>9</sup> Figures in parentheses below the estimated coefficients are *t*-statistics. Significance at 5 percent level is reached for *t*-statistics over 1.96.

**HUNGARY***Exports:*

$$\Delta \text{Log}(Ex) = \underset{(-1.46)}{-0.011} + \underset{(4.27)}{0.43} \Delta \text{Log}(Ex)_{-1} + \underset{(2.21)}{0.20} \Delta \text{Log}(Ex)_{-3} + \underset{(2.70)}{1.66} \Delta \text{Log}(World\_Demand)_{-4}$$

$$+ \underset{(3.16)}{0.34} \Delta \text{Log}(FDI) - \underset{(-5.95)}{1.04} ECM_{-1}$$

where

$$ECM = \text{Log}(Ex) - 1.92 \text{Log}(World\_Demand) - 0.56 \text{Log}(FDI) + 0.15 \text{Log}(REER\_ULC)$$

$$- 0.13 + 0.0024 \text{trend}20001 - 0.07 \text{dummy}20003\_20023$$

Estimation: 1996:Q2-2007:Q4, Durbin Watson statistics=1.96, standard error of estimate=0.016

*Imports:*

$$\Delta \text{Log}(Im) = \underset{(-3.99)}{-0.020} + \underset{(3.95)}{0.31} \Delta \text{Log}(Im)_{-4} + \underset{(7.91)}{1.97} \Delta \text{Log}(Domestic\_Demand) - \underset{(-4.06)}{0.86} \Delta \text{Log}(Domestic\_Demand)_{-4}$$

$$+ \underset{(10.47)}{0.99} \Delta \text{Log}(Ex) - \underset{(-3.48)}{0.47} ECM_{-1}$$

where

$$ECM = \text{Log}(Im) - 1.18 \text{Log}(Domestic\_Demand) - 1.10 \text{Log}(Ex) + 0.23 \text{Log}(Price\_Compet)$$

$$- 18.74 + 0.016 \text{trend} + 0.0017 \text{trend}2000\_1$$

Estimation: 1996:Q2-2007:Q4, Durbin Watson statistics=1.85, standard error of estimate=0.034

**POLAND***Exports:*

$$\Delta \text{Log}(Ex) = \underset{(-1.73)}{-0.031} + \underset{(2.54)}{0.19} \Delta \text{Log}(Ex)_{-1} - \underset{(-1.97)}{0.11} \Delta \text{Log}(Ex)_{-4} + \underset{(2.67)}{3.39} \Delta \text{Log}(World\_Demand)_{-1}$$

$$+ \underset{(1.76)}{2.44} \Delta \text{Log}(World\_Demand)_{-3} + \underset{(12.24)}{0.88} \Delta \text{Log}(Price\_Compet) + \underset{(1.74)}{0.37} \Delta \text{Log}(FDI)_{-1} - \underset{(-5.95)}{1.04} ECM_{-1}$$

where

$$ECM = \text{Log}(Ex) - 2.40 \text{Log}(World\_Demand) - 0.19 \text{Log}(FDI) + 0.74 \text{Log}(Price\_Compet)$$

$$- 5.74 - 0.0014 \text{trend}20041 + 0.068 \text{dummy}19991\_20001$$

Estimation: 1996:Q2-2007:Q4, Durbin Watson statistics=1.94, standard error of estimate=0.032

*Imports:*

$$\Delta \text{Log}(Im) = 0.00089 + 2.45 \Delta \text{Log}(Domestic\_Demand) - 0.87 \Delta \text{Log}(Domestic\_Demand)_{-4} \\ + 0.27 \Delta \text{Log}(Ex) - 0.77 \Delta \text{Log}(Price\_Compet) + 0.16 \Delta \text{Log}(Price\_Compet)_{-2} - 0.27 ECM_{-1}$$

where

$$ECM = \text{Log}(Im) - 1.81 \text{Log}(Domestic\_Demand) - 0.41 \text{Log}(Ex) + 0.52 \text{Log}(Price\_Compet) \\ - 15.47 - 0.005 trend$$

Estimation: 1996:Q2-2007:Q4, Durbin Watson statistics=1.71, standard error of estimate=0.024

## **SLOVAKIA**

*Exports:*

$$\Delta \text{Log}(Ex) = 0.0095 + 0.23 \Delta \text{Log}(Ex)_{-3} + 2.99 \Delta \text{Log}(World\_Demand)_{-3} + 0.36 \Delta \text{Log}(Price\_Compet) \\ + 0.43 \Delta \text{Log}(FDI)_{-2} - 0.56 \Delta \text{Log}(FDI)_{-3} - 0.41 ECM_{-1}$$

where

$$ECM = \text{Log}(Ex) - 7.03 \text{Log}(World\_Demand) - 0.072 \text{Log}(FDI\_before2004) - 0.068 \text{Log}(FDI\_after2004) \\ + 0.63 \text{Log}(Price\_Compet) - 31.47 + 0.02 trend + 0.094 dummy19993\_20023$$

Estimation: 1996:Q2-2007:Q4, Durbin Watson statistics=1.66, standard error of estimate=0.027

*Imports:*

$$\Delta \text{Log}(Im) = 0.0067 - 0.27 \Delta \text{Log}(Im)_{-4} + 0.80 \Delta \text{Log}(Domestic\_Demand) + 0.49 \Delta \text{Log}(Ex) \\ - 0.59 \Delta \text{Log}(Price\_Compet) - 0.39 ECM_{-1}$$

where

$$ECM = \text{Log}(Im) - 0.85 \text{Log}(Domestic\_Demand) - 0.32 \text{Log}(Ex) + 0.38 \text{Log}(Price\_Compet) \\ - 2.51 - 0.005 trend - 0.67 dummy20004\_20013$$

Estimation: 1996:Q2-2007:Q4, Durbin Watson statistics=1.74, standard error of estimate=0.020

Testing for Cointegration Relationship and Estimation of the Long-term Trade Equations 1/

	Czech Republic		Hungary		Poland		Slovakia	
	(Est. over 1996:Q1-2007:Q4)		(Est. over 1995:Q1-2007:Q4)		(Est. over 1995:Q1-2007:Q4)		(Est. over 1995:Q1-2007:Q4)	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
World demand	3.63 (50.47)		1.92 (9.75)		2.40 (6.47)		7.03 (9.88)	
Domestic demand		0.57 (11.48)		1.18 (13.27)		1.81 (13.71)		0.85 (12.95)
Exports		0.73 (42.84)		1.10 (15.59)		0.42 (4.93)		0.32 (5.35)
FDI stock			0.56 (21.61)		0.19 (5.13)			
FDI stock before 2004							0.072 (1.63)	
FDI stock after 2004							0.068 (1.56)	
Price competitiveness 2/		-0.15 (-4.08)		-0.23 (-1.99)	0.73 (8.85)	-0.52 (-4.55)	0.63 (6.16)	-0.38 (-3.41)
REER based on ULCs			-0.15 (-3.49)					
Trend starting in ...	2004_1 0.0026 (7.91)		2000_1 0.0024 (3.62)	1995_1 -0.016 (-4.94)	2004_1 0.0014 (2.28)	1995_1 -0.0050 (-2.17)	1995_1 -0.020 (-3.56)	1995_1 0.0050 (3.23)
Break in trend 3/				2000_1 -0.0017 (-2.90)				
Dummy over the period of	1998:Q3-2003:Q3 -0.046 (-5.03)	2000:Q3-2004:Q4 0.041 (12.61)	2000:Q3-2002:Q3 0.067 (8.63)		1999:Q1-2000:Q1 -0.068 (-3.36)		1999:Q3-2002:Q3 -0.094 (-5.66)	2000:Q4-2001:Q3 0.067 (5.10)
Statistical tests for cointegration relationship 4/								
Z(rho)	-35.34***	-45.04***	-35.31**	-29.50*	-22.69	-33.43**	-24.76	-26.28
Z(t)	-5.85***	-7.37***	-6.93***	5.25***	-4.29**	-4.87***	-5.54***	-4.85***

1/ All variables, except the trends, are in logarithms. Figures in parentheses below the coefficient estimates are *t*-statistics. Estimation also includes a constant.

2/ The price competitiveness variable for exports is the ratio of foreign GDP prices (expressed in euros) to exporter prices, and for imports the ratio of import prices to domestic demand prices.

3/ The coefficient for the period after the break in trend is the sum of both this coefficient and the one for the trend starting at the beginning of the sampling period

4/ Phillips-Ouliaris-Hansen tests, with critical values derived from Hamilton (1994).

A \*\*\* signals significance of the cointegration relationship at the 1 percent level, \*\* at the 5 percent level, and \* at the 10 percent level.

### Appendix III: Principle of Dynamic Contributions

The computation of dynamic contributions allows one to visualize, for each period, either the role of each explanatory variable estimated in a univariate mode or the respective role of the short- and long-term dynamic form of the error-correcting model (ECM). Because these contributions are derived directly from the econometric relationship, they explicitly take into account the structure and delays with which the explanatory variables influence the variable, as opposed to breakdowns on an accounting basis.

Let  $Y_t$  be the endogenous variable,  $X_i$  the explanatory variables, and  $\varepsilon_t$  the econometric residual.

$$\text{The ECM can be written as } \Delta \text{Log} Y_t = c_0 + \sum_{j=1}^p c_j \text{Log} Y_{t-j} + \sum_{i=1}^n \sum_{j=1}^p b_{i,j} \Delta \text{Log} X_{i,t-j} - \lambda \text{ECM}_{-1} + \varepsilon_t, \quad (1)$$

where  $\text{ECM} = \text{Log} Y_t - \sum_{i=1}^n \alpha_i \text{Log} X_{i,t}$  is determined by the cointegration relationship.

#### Breakdown by explanatory variables

The estimated full dynamic can be summarized as  $A(L) \text{Log} Y_t = c_0 + \sum_{i=1}^p B_i(L) \text{Log} X_{it} + \varepsilon_t$ ,

where  $L$  is the lag operator, and  $A(L)$  and  $B_i(L)$  polynomials of this lag operator.

From (1),  $A(L) = 1 - L - \sum_{j=1}^p c_j (1-L)L^j - \lambda L$  and  $B_i(L) = \sum_{j=0}^p b_j (1-L)L^j - \lambda \alpha_i L$ .

By inverting  $A(L)$ , one gets:  $\text{Log} Y_t = \frac{c_0}{A(L)} + \sum_{i=1}^p \frac{B_i(L)}{A(L)} \text{Log} X_{it} + \frac{\varepsilon_t}{A(L)}$ .

The **dynamic contributions of variables  $X_i$  to the growth rate of variable  $Y$**  are then derived (additively) from the differentiation of (1):

$$\Delta \text{Log} Y_t = \sum_{i=1}^p \frac{B_i(L)}{A(L)} \Delta \text{Log} X_{it} + \frac{\Delta \varepsilon_t}{A(L)}. \quad (2)$$

This breakdown also allows one to visualize what remains unexplained in the econometric relationship, through the contributions of the residuals.

#### Breakdown between short- and long-term dynamics

Another presentation consists in distinguishing between the contribution of the short-term dynamic, through all the variables in growth rate in equation (1), and the long-term dynamic, through the impulse from the error-correcting term:

$$A^*(L) \text{Log} Y_t = c_0 + \sum_{i=1}^n \sum_{j=1}^p b_{i,j} \Delta \text{Log} X_{i,t-j} - \lambda \text{ECM}_{-1} + \varepsilon_t,$$

$$\text{where } A^*(L) = (1-L) \left( 1 - \sum_{j=1}^p c_j L^j \right).$$

$$\text{By inverting } A^*(L), \text{ one gets: } \Delta \text{Log} Y_t = \frac{c_0}{A^*(L)} + \sum_{i=1}^p \frac{B_i(L)}{A^*(L)} \Delta \text{Log} X_{it} - \frac{\lambda L}{A^*(L)} \text{ECM} + \frac{\varepsilon_t}{A^*(L)}. \quad (3)$$

The first two elements on the right side of (3)—the constant and the terms with the growth rate of  $X_i$  variables—correspond to the **contribution of the short-term dynamic**, whereas the term with the error-correcting factor shows the **contribution of the long-term dynamic** namely, by how much the gap from the steady state equilibrium contributes to the growth rate of variable  $Y$ . Here again, the breakdown also allows one to visualize what remains unexplained in the econometric relationship, through the contributions of the residuals.

### References

- Allard, C., M. Catalan, L. Everaert, and S. Sgherri, 2008, *France, Germany, Italy and Spain: Explaining Differences in External Sector Performances Among Large Euro Area Countries*, in “Exchange Rate Analysis in Support of IMF Surveillance”, ed. By C. Cottarelli, A. Ghosh, G.M. Milesi-Ferretti and C. Tsangarides (Washington: International Monetary Fund).
- Hamilton, J, 1994, *Time Series Analysis* (Princeton University Press).
- Igan, D., S. Fabrizio, and A. Mody, 2007, *The Dynamics of Product Quality and International Competitiveness*, IMF Working Paper 07/97, (Washington: International Monetary Fund).