Factors Driving Import Demand in Selected Central, Eastern and Southeastern European Countries

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This study presents estimates of both country-specific and panel long-run import elasticities for EU Member States from Central, Eastern and Southeastern Europe and for Croatia and Turkey. The results confirm (1) the existence of a strong export-import link in most of the countries, (2) the prominent role of fixed investment in determining imports in nearly all countries, and (3) with some exceptions, the relatively smaller role of private consumption for imports. Furthermore, we use import elasticities to test for economic interlinkages within the EU-27 and find that economic integration is advanced.

1 Introduction

Research on factors that influence import demand has always been an active area of both theoretical and empirical economic study. This interest has often been motivated by issues associated with external imbalances and their culmination into external debt problems. Against this background, appropriate estimates of import demand functions are generally of great interest for considering adequate policy responses.

This study focuses on the EU Member States of Central, Eastern and Southeastern Europe, here abbreviated as CESEE-MS (i.e. the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia, which entered the EU on May 1, 2004, as well as Bulgaria and Romania, which became EU Member States on January 1, 2007). To the extent that it is possible, this paper also includes Croatia and Turkey, the candidate countries negotiating accession to the EU.

Most of the countries under review had non-negligible levels of current account deficits in recent years. However, looking e.g. at the most recent three-year averages reveals quite important differences between them (see table 1). In most countries, the deficit in the goods and services balance, i.e. the main component of the current account, contributed substantially to the current account deficit (Slovakia, Estonia) or even exceeded it and was only to a minor extent offset by a surplus in the other sub-balances (Lithuania, Latvia, Bulgaria, Romania, Croatia). By contrast, in the Czech Republic, Hungary, Poland and Slovenia, a negative income balance was the main source of the current account deficit, while the goods and services balance posted a relatively small deficit (Hungary, Poland, Slovenia) or even a surplus, which was, however, not (yet) sufficiently high to finance the deficit in the income balance (Czech Republic).

In the study of import demand of these countries, which are all catching-up economies, it is of particular interest to examine the extent to which it is demand effects or price and exchange rate effects that drive import demand. Moreover, when we look at total demand effects, the relative importance of domestic demand versus that of foreign demand (exports) is another relevant aspect. This includes also the question of how strong is the export-import link. With respect

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Table 1

Development of the Current Account and the Goods and Services Balance in CESEE-MS as well as Croatia and Turkey

	Three-Year Averages			EU Commission Forecast	
	1998 to 2000	2001 to 2003	2004 to 2006	2007e	2008e
	Current account balance as a percentage of GDP				
Czech Republic	−3.1	−5.7	−4.1	−2.5	−2.1
Hungary	−7.5	−6.7	−6.6	−3.9	−1.5
Poland	−5.7	−2.5	−2.2	−3.3	−2.9
Slovenia	−2.2	−0.3	−2.8	−3.3	−2.6
Slovakia	−5.1	−7.0	−8.2	−4.2	−2.7
Estonia	−6.0	−8.6	−11.3	−13.6	−11.2
Lithuania	−9.5	−5.3	−7.3	−12.5	−12.9
Latvia	−7.4	−7.0	−14.4	−22.2	−18.9
Bulgaria	−3.5	−4.5	−10.6	−17.0	−16.0
Romania	−4.8	−4.6	−8.6	−12.8	−14.5
Croatia	−10.4	−4.3	−6.7	−8.5	−8.1
Turkey	−1.2	−0.5	−4.9	n.a.	n.a.
	Goods and services balance as a percentage of GDP				
Czech Republic	−1.8	−2.2	1.1	..	..
Hungary	−2.6	−2.5	−0.9	..	..
Poland	−6.5	−3.1	−1.0	..	..
Slovenia	−3.0	0.3	−0.9	..	..
Slovakia	−5.4	−5.3	−4.0	..	..
Estonia	−5.9	−5.5	−8.6	..	..
Lithuania	−9.3	−5.5	−8.2	..	..
Latvia	−9.7	−10.9	−17.3	..	..
Bulgaria	−3.6	−9.4	−15.5	..	..
Romania	−5.9	−7.0	−10.5	..	..
Croatia	−12.4	−7.1	−7.4	..	..
Turkey	−1.8	0.6	−3.9	..	..

Source: European Commission Forecast Autumn 2007, Eurostat, national central banks, author's calculations.

Note: The current account balances include the small surpluses on the capital account that stem primarily from EU transfers, except for the forecast values given for Croatia. Data for Turkey are based on the GDP figures as revised in 2008; thus, no consistent forecast values by the European Commission were available.

to total domestic demand, we can also distinguish between (private) consumption and investment. Finally, another question arises regarding foreign demand: To what extent is import demand driven by foreign demand that stems from a country's main trading partner – the EU-15 states, i.e. the EU Member States before the 2004 and 2007 enlargements, or those EU Member States that joined the euro area before 2007 (EA-12). In other words, how strong is the interlinkage between imports within the EU-27?

A more profound insight into the factors that drive import demand in the CESEE-MS may be helpful for understanding the ongoing process of European economic integration. It may also provide some hints for possible policy responses to address large external imbalances.

This study is structured as follows: Section 2 provides a brief survey of papers published on import demand functions and presents the main variables used to estimate import demand equations in practical terms. In section 3, the study gives some stylized facts on total final demand in the CESEE countries as background information for interpreting the ensuing estimation results. Section 4 highlights

the econometric issues involved in estimating import demand functions and outlines the econometric framework. Section 5 presents the estimation results, while section 6 briefly summarizes and concludes. The data used for the CESEE import equations, data availability and limitations as well as possible structural breaks in the time series are outlined in the appendix.

2 Literature Survey

Given the quite comprehensive literature dealing with import demand functions, we will only mention a few papers that are often considered milestones in the analysis of import demand. While there are many country-specific papers in which import demand functions are estimated for one particular country, this paper focuses on those that cover several countries, often grouped into developing versus developed countries.

Hoetthaker and Magee (1969) provided an early paper on income and price elasticities in world trade, in which they conclude that the import elasticity with respect to income is lower in developing countries than in developed economies.

Several years later, Goldstein and Khan (1985) of the IMF published a comprehensive overview on income and price effects in foreign trade, including estimates of price and income elasticities and related policy issues. Their overview includes both theoretical aspects and estimation methodologies. However, the approaches they describe for estimating import demand functions are rather traditional, which is in particular attributable to the fact that the paper was written before cointegration analysis was introduced.

Among the studies that were published after the development of cointegration analysis and thus apply an error correction model, the earliest papers were by Deyak et al. (1993) for Canada, and Clarida (1994) for the U.S.A. (covering the period from 1968 to 1990, based on seasonally adjusted quarterly data), followed by Carone (1996) for the U.S.A., and Amano and Wirjanto (1997) for Canada and the U.S.A. (covering the period from 1960 to 1993, based on quarterly data).

Reinhart (1995) and Senhadji (1997), both of the IMF, applied a similar approach to a larger number of countries. Reinhart used data on 12 developing countries for the period from 1970 to 1991, pooled into regional blocks (3 African, 4 Asian and 5 Latin American countries). In addition to estimating import demand functions, she estimated also the elasticity of these countries' exports with respect to income in developed countries. Comparing such specific import elasticity with respect to income of developed countries (specific in that it is confined to imports from these developing countries) with her estimates of import elasticity with respect to the income in developing countries, she confirmed the results obtained by Hoetthaker and Magee (1969), according to which this elasticity is higher in developed economies than in developing countries. Senhadji (1997) came to the same conclusion on the basis of a sample comprising 77 countries.

More recently, Harb (2005) estimated a heterogeneous panel of 40 countries with 28 annual observations for each country. The data series start in different years and range from the mid-1960s to the late 1990s. Splitting his panel into developed economies and developing countries, he could only partially confirm the results obtained by Hoetthaker and Magee (1969).

In a narrower country focus, Tsionas and Christopoulos (2004) applied cointegration analysis to four EU countries (UK, FR, IT, NL) and the U.S.A. for the period from 1960 to 1999.

With respect to the CESEE-MS, there are some advanced estimations of import demand functions for individual countries, e.g. by Benacek et al. (2003) who performed a detailed study on the factors determining the Czech foreign trade balance by looking at both import and export functions at a disaggregated (two-digit NACE) level. In both functions they included several explanatory variables, e.g. the stock of inward FDI, in addition to the main activity variable and relative prices. Moreover, they investigated these functions separately for trade with the EU and for trade with non-EU countries, highlighting the strong interdependence of imports from and exports to the EU.

Mroczek and Rubaszek (2004) estimated the volume of Poland's imports from the EU in the period from 1992 to 2002, taking weighted total final demand as the activity variable, while imposing a unity restriction on the income elasticity for the long-run relationship. Fic et al. (2005) present a multi-equation macroeconomic model of the Polish economy (ECMOD), which incorporates a module on the import volumes that includes a trend variable, potential GDP as activity variable (combined with a unity elasticity restriction) and relative import prices adjusted for oil price fluctuations and enhanced by the rate of customs duties in the cointegrating relationship. This model was estimated on the basis of quarterly data for the period from 1995 to 2004.

Benk et al. (2006) present the Hungarian Quarterly Projection Model (NEM), which incorporates an equation for import volumes that includes weighted total final demand (combined with a unity elasticity restriction) and the real effective exchange rate based on relative import prices in the cointegrating relationship.

The British National Institute of Economic and Social Research (NIESR, 2007) estimated import demand functions for CESEE-MS on the basis of quarterly data in the period from 1993 to 2003 by using a panel that included the Czech Republic, Estonia, Hungary, Poland and Slovenia, in order to build the respective country modules within the institute's General Equilibrium Model (NiGEM).

However, to the best of our knowledge, no systematic estimates of import demand functions have been made for individual CESEE-MS (as well as Croatia and Turkey) that follow the same methodological approach.

Usually, the import demand equation used for empirical estimation purposes takes the following general log-linear form:

$$\ln(m_t) = c + \alpha \ln(a_t) - \beta \ln\left(\frac{p_m}{p}\right)_t \qquad (1)$$

where a represents the real economic activity variable, m stands for imported goods, and p_m/p denotes the relative import price level.

Many authors, e.g. Reinhart (1995) or Tsionas and Christopoulos (2004), use GDP as the main activity variable when estimating import demand functions. By contrast, Senhadji (1997) takes GDP minus exports, while Amano and Wirjanto (1997) construct the sum of private real consumption and aggregate real investment as their activity variable, arguing in favor of excluding public consumption as

"aggregate private [domestic] demand is an appropriate index of market demand for imported goods" (Amano and Wirjanto, 1997, p. 467).

In his empirical estimates for the U.S.A., Clarida (1994) calculates a proxy for the consumption of domestically produced (nondurable) consumer goods as the explanatory variable. However, he estimates an import demand equation that he derived within a utility-maximizing framework which includes final consumption goods only. Consequently, he aims at explaining the consumption of imported nondurable goods, for which he uses imports of nondurable consumer goods as a proxy.

Harb (2005) uses both Senhadji's and Reinhart's specifications for the activity variable and concludes that GDP (as opposed to GDP minus exports) yields a superior performance. In building the CESEE country modules in NiGEM, NIESR used total final demand for performing its panel estimate of import demand functions.

In this study, too, we use real total final demand as the main activity variable. However, for the testing equation, we split real total final demand into its main components: real private consumption (C), real gross fixed capital formation (fixed investment, I), and real exports of goods and services (X). In doing so, we aim at gaining a deeper insight into the driving forces of imports of goods and services. In effect, we thus exclude public consumption from the estimation, following the line of Amano and Wirjanto (1997).

It has to be noted that quite often, import demand functions show imports as having (by assumption) unitary elasticities with respect to the activity variable and the relative price level (i.e. 1 and –1, respectively). However, according to Reinhart (1995) and Harb (2005), there are good reasons why these elasticities may deviate from unity, in particular when taking into account that imports do not consist of final goods only.

3 Structure of Total Final Demand in CESEE-MS as well as Croatia and Turkey: Some Stylized Facts

Table 2 shows the share of the main components of total final demand[2] in full-year 2006.

Exports have the largest weight in total final demand in most of the CESEE-MS that acceded to the EU on May 1, 2004, with the exception of Lithuania and Poland, where private consumption is the largest component. In Bulgaria, Romania, Croatia and Turkey, private consumption has the largest weight, too. The structure of total final demand is quite similar in Lithuania, Bulgaria and Croatia. Poland's structure resembles that of the EA-12, while Romania and Turkey show a particularly low weight of exports combined with a particularly high weight of private consumption in total final demand.

The share of fixed investment in total final demand is considerably lower than that of exports and private consumption, but it is larger than that of public consumption in all countries, with the notable exception of Hungary (where both are about equal in size).

[2] *Here, total final demand excludes the statistical discrepancy in all countries and the change of inventories in all countries except for Estonia and Croatia.*

Table 2

Total Final Demand of CESEE-MS as well as Croatia and Turkey in 2006

	Private Consumption	Public Consumption	Fixed Investment	Exports
	Shares in % (excluding change of inventories and statistical discrepancy)			
Czech Republic	28.2	12.5	14.7	44.6
Estonia[1]	28.8	8.7	20.3	42.2
Lithuania	39.7	10.5	13.9	35.9
Hungary	30.7	12.7	12.5	44.1
Poland	44.4	12.8	14.0	28.8
Slovenia	32.0	11.4	15.3	41.3
Slovakia	30.6	9.7	14.1	45.6
Latvia	27.7	10.4	21.3	40.6
Bulgaria	39.1	9.8	14.8	36.2
Romania	48.2	12.4	17.0	22.4
Croatia[1]	36.4	13.1	19.4	31.1
Turkey	51.6	10.2	16.3	21.9
EA 12	41.1	14.7	15.3	28.9

Source: Eurostat, author's calculations.

[1] *Fixed investment includes changes in inventories in the case of Estonia and Croatia.*

The lower share of exports in the EA-12 as well as in Poland, Romania and Turkey (partly) reflects the smaller degree of openness inherent in the larger size of the respective economic area (in terms of population and the economy). Conversely, comparatively smaller economies could be expected to have larger shares of exports in total final demand. However, the largest export shares are found not in the Baltic countries, but in the Czech Republic, Slovakia and Hungary. In case of the former two countries, this may be partly explained by the still remaining strong economic integration between the two. Moreover, in all three countries the sizeable stock of inward FDI has probably particularly enhanced the role of exports.

From another perspective, a relatively higher share of exports in total final demand can be expected for catching-up countries, as exports tend to be valued at world market prices (at least when assuming that the law of one price holds for tradables), while non-tradables are usually still valued lower in these economies than tradables that are integrated in the world market.

4 Econometric Approaches for Estimating Import Demand Functions

Since we are interested primarily in long-run import elasticities, we build an error correction model (ECM) which includes the long-run cointegration relationship (error correction term, ECT) between the dependent variable and the explanatory variables as non-stationary time series in levels. The estimations in this study are based on seasonally and working day-adjusted data. For more information on data sources and data availability, the interested reader is referred to the appendix.

4.1 Single-Country Time Series

In a first step, we use a single time series approach to estimate country-specific import demand functions. Under this approach, we first perform unit root tests

for all the variables chosen so as to determine which variables to include in the long-run relationship as nonstationary in levels.

In performing the unit root tests, we follow the testing strategy outlined by Mosconi (1998). This is a three-step strategy that starts with an augmented Dickey-Fuller (ADF) test on the basis of an autoregressive model that includes both a trend and a constant. If the null hypothesis of a unit root can be rejected at the MacKinnon 5%-level at this stage and the trend variable is significant, the time series is regarded as trend stationary. If the null hypothesis of a unit root cannot be rejected at the MacKinnon 5%-level, a Fischer test is conducted for the joint hypothesis that both a unit root and no trend exist. If this joint hypothesis can be rejected, the time series is regarded as nonstationary (usually as integrated of order one, I(1)) with a trend (and a constant).

In case that no significant trend can be established, the second step of this strategy consists in an ADF test on the basis of an autoregressive model that includes only a constant. Following the similar decision tree as before, the time series is considered to be stationary (I(0)) with a constant or nonstationary (usually I(1)) with a constant. Alternatively, in case that no significant constant has been found, the third step – an ADF test on the autoregressive model without a constant – leads to the time series regarded as stationary (I(0)) without a constant or nonstationary (usually I(1)) without a constant.

Basically, only variables that are found to be nonstationary in levels (usually integrated of order one, I(1)) are then included in the testable cointegration relationship. However, if the null of the ADF test can be rejected at the MacKinnon 5%-level, but not at the MacKinnon 10%-level, we also examine the cointegration relationship including this variable. Moreover, given the economically ambiguous character of statistical trend stationarity, we also examine the cointegration relationship including the variable that was found to be trend stationary.

In designing the test for cointegration, we took account of the possible endogeneity among the variables in the form of a simultaneity bias. Therefore, we employ the dynamic ordinary least squares (DOLS) method (Stock and Watson, 1993) for estimating the cointegrating vector itself, by including lags and leads of the first differences of the explanatory variables. To the extent possible in view of the short country-specific time series, the optimal number of lags and leads is determined on the basis of the Schwarz criterion.

Thus, the employed econometric framework consists of the following DOLS model:

$$m_t = \beta_0 + \beta_1 a_t + \beta_2 (p_m / p)_t + \sum_{i=0}^{iopt} \eta_{1,i} da_{t+i} + \sum_{j=1}^{jopt} \theta_{1,j} da_{t-j} + \sum_{i=0}^{iopt} \eta_{2,i} d(p_m / p)_{t+i} + \\ + \sum_{j=1}^{jopt} \theta_{2,j} d(p_m / p)_{t-j} + e_t \qquad (2)$$

The residuals (i.e. the residuals proper plus the differenced terms in leads and lags) that result from estimating this model for the variables that have been found to be nonstationary are then tested for stationarity by means of an ADF test. For evaluating the t-statistic of this unit root test (with the null hypothesis of a unit root being equivalent to no cointegration), we take not only the asymptotical MacKinnon critical values, but also the critical values corrected for the small sam-

ple size according to MacKinnon (1991), which turns out to have a considerable upward effect on these thresholds.

Having established cointegration, we rebuild the DOLS regression in first differences by lagging the explanatory terms and by including the (lagged) error correction term (ECT) that was derived from the first DOLS regression. This leads to the following error correction representation of the DOLS regression:

$$dm_t = c_0 + \gamma ECT_{t-1} + \delta_1 da_{t-1} + \delta_2 d(p_m / p)_{t-1} + e_t \quad (3)$$

In this way, we estimate γ, i.e. the adjustment coefficient in the case of a disequilibrium in levels (as compared with the long-run relationship).

4.2 Panel Estimates

In a second step, we build three different types of panels to estimate import demand. From a methodological point of view, this constitutes an additional strategy to tackle the problem of short country-specific time series and to increase the reliability of results. Econometrically, more degrees of freedom and less collinearity among explanatory variables improve the efficiency of the estimates. Moreover, utilizing information on both the intertemporal dynamics and the individuality of the investigated countries allows controlling for the effects of missing or unobserved variables (Hsiao, 2003). From an economic viewpoint, we are also interested in the regional perspective. Therefore, we distinguish the following three panels: Panel 5 covers the five Central European EU Member States (Czech Republic, Hungary, Poland, Slovakia, Slovenia); panel 8 includes panel 5 plus the three Baltic countries; and panel 12 covers panel 8 plus Bulgaria and Romania, i.e. the Southeastern European EU Member States, as well as Croatia and Turkey.[3] In each panel we included country-specific fixed effects. Conducting a panel study allows us not only to examine a shorter time period (from 1995 up to 2003, before the EU accession of eight CESEE-MS on May 1, 2004) and a longer time period (from 1995 to mid-2007), but to examine the two subperiods (1995 to 2003 and 2004 to mid-2007) separately from the full time period.

In econometric terms, we first perform panel unit root tests for each panel on all the variables, testing the null hypothesis of a unit root by using the Levin, Lin & Chu (LLC) t*-statistic, which is based on the assumption of a common unit root process, and the Im, Pesaran & Shin (IPS) W-statistic, which is based on the assumption of individual unit root processes. In both cases, we apply the test with individual intercepts and – partly as a robustness check – with individual intercepts and individual (deterministic) trends.

Next, we applied the Pedroni panel cointegration test, an Engle-Granger-based residual test of the null hypothesis of no cointegration (unit root in the residuals), against the alternative hypothesis with common autoregressive coeffi-

[3] *Actually, we build nine different panels, of which only three are shown in the tables due to space constraints and in the interest of focusing the presentation. Three of the remaining panels are variants of the ones mentioned above (Panel 6 covers panel 5 plus Croatia, panel 9 includes panel 8 plus Croatia, and panel 11 is panel 12 minus Turkey), while the other three are subpanels for the Baltic countries (panel 3ba) and for the Southeastern European countries (panel 3se excludes and panel 4se includes Turkey). Their results broadly confirm the results presented, which may be considered as some sort of robustness check. Occasionally, we will make reference to these estimates when interpreting the results.*

cients (within-dimension) or individual autoregressive coefficients (between-dimension, see group statistics). Pedroni (1999) provides seven statistics, four within-dimension and three between-dimension statistics for evaluation. We focus on the ADF statistics (both within-dimension and between-dimension) for two reasons. First, in a methodologically similar study, Canning and Pedroni (2004) opt for the same type of statistics. Second, in a comprehensive simulation study on the performance of panel cointegration methods, Wagner and Hlouskova (2007) conclude that these statistics show a superior performance, in particular in the case of a relatively short cross-section specific length of time series (T). Additionally, we take into account the other test statistics, even though they are not presented in the tables due to space constraints and in the interest of focusing the presentation. Here again, we apply the test with individual intercepts and – partly as a robustness check – with individual intercepts and individual trends.

The relationship between the cointegrated nonstationary variables is then recovered from a DOLS regression, with the numbers of leads and lags of the differenced terms determined by the Schwarz criterion. In order to control for heteroscedasticity across the panel, we performed standard error corrections (across cross-sections, the time dimension and both) to derive White-consistent t-statistics. While we report the values without heteroscedasticity corrections, the values resulting after these corrections are referred to as results of robustness checks.

Next, we build the ECM by rebuilding the DOLS regression in first differences, including the lagged ECT that was derived from the initial DOLS regression. Again, we determine the numbers of leads and lags of the differenced terms by the Schwarz criterion.[4] From the ECM estimation, we obtain the adjustment parameter for the disequilibrium in levels. We test for the homogeneity of the long-run adjustment parameter across countries by applying the Wald test, an F-test of the null hypothesis that all the cross-section-specific (i.e. country-specific) long-run adjustment parameters are equal to the average (across countries) long-run adjustment parameter.

5 Results

5.1 Single-Country Time Series

Under the country-specific single time series approach, the **unit root tests** on the stationarity of the time series involved show that all GDP components (M, C, I, X) can be considered nonstationary in the form of I(1).

However, with respect to the relative import price level, the results are not entirely clear cut (see appendix, table A.1). The relative import price level was found to be stationary in several cases (Estonia, Hungary, Poland and Romania as well as Bulgaria for the shorter and Lithuania for the longer period). Given the large swings in the exchange rate in both directions in Hungary, Poland and Romania, and the particularly high pass-through of import prices in very small

[4] *We also set up an ECM that was restricted to include only the first-order lag of the differenced terms. (The results of this variant were roughly in line with those of the Schwarz-determined ECM.) Moreover, we set up an ECM that included lags of the first differences of the dependent variable (in addition to the leads and lags of the differenced explanatory variables), with the number of lags again determined by the Schwarz criterion. Finally, we repeated the whole exercise on the basis of the Akaike information criterion.*

and open economies, this result is economically plausible for the time periods considered.

Moreover, the relative import price level was found to be trend stationary in the Czech Republic and Latvia, as well as in Bulgaria for the longer period. Finally, in Lithuania for the shorter period, the null of a unit root could not be rejected at the MacKinnon 5%-level of statistical significance, but at the 5.5%-level. For the cases of trend-stationary time series and for the borderline case of Lithuania in the shorter period, we examine both possible cointegration relationships, including and excluding the relative import price level.

Where the MacKinnon critical value (increased in absolute terms by correcting for the small sample size) is surpassed (in absolute terms), a significant **cointegration** relationship is established. In the longer period (up to mid-2007), significant cointegration is found in all countries except the Czech Republic, Croatia[5] and Turkey (see appendix, table A.2).

At the same time, significant cointegration relationships can be established more often in the period up to mid-2007 than in the period up to 2003. While extending the time series alone might have produced this result (given that the increase of the critical value as a result of the small-sample correction declines with the number of observations), the effect of this change in the size of the critical value is in fact rather small.

In the cases in which we examine both possible cointegration relationships (including and excluding the relative import price level), in particular the cases of trend-stationary relative import prices, the cointegration relation without the relative import prices is mostly found to be superior and significant (with the Czech Republic being the main exception). Thus, only one significant cointegration relationship remains in each country (or none in case of the Czech Republic, Croatia and Turkey).

The estimated **adjustment coefficient** is found to be negative in all cases in which a significant cointegration relationship can be established. Thus, any disequilibrium in the lagged long-run level relationship, i.e. ECT (–1), induces corrective changes in aggregate imports toward the long-run equilibrium ("ECT acts as attractor"). In fact, this is what is required for the stability of the long-run equilibrium.

The **long-run import elasticities** that are recovered from the significant cointegration relationships are summarized in table 3.

Exports are found to be highly significant in explaining imports in all countries. In six out of nine countries with significant cointegrating relationship, the import elasticity with respect to exports is highest among the import elasticities with respect to the main final demand components. It is considerably higher than the others in Estonia, Lithuania and Slovenia, and roughly equal to the elasticities with respect to fixed investment in Hungary, Bulgaria and Poland, thereby exceeding (Hungary, Bulgaria) or equaling (Poland) the elasticity with respect to private consumption. The significant large impact of exports confirms the hypothesis of a strong export-import link in these countries. Apart from the fact that the rela-

[5] *For Croatia, however, cointegration is found to be highly significant if we exclude the relative import price level from the long-run relationship. In this case, private consumption is highly significant (with a large coefficient) in explaining imports, and fixed investment is significant at the 10%-level, while exports are not significant.*

Table 3

Long-Run Elasticity of Imports with Respect to the Main Components of Total Final Demand (and, for A, with Respect to the Relative Import Price Level)

		swa 2003			swa 2007		
		1995q1 to 2003q4			1995q1 to 2007q2		
		C	I	X	C	I	X
		Coefficients significant at the 5%-level in bold print (with the corresponding p-values in italics below)					
		Dependent variable: M (logarithm of M)					
Estonia	B	−0.11	**0.26**	**0.84**	0.06	**0.19**	**0.81**
		0.640	*0.040*	*0.000*	*0.665*	*0.020*	*0.000*
Latvia	B	..	..	..	**0.59**	**0.19**	**0.42**
		..	..	..	*0.000*	*0.007*	*0.016*
Lithuania	B	0.02	**0.36**	**0.69**	**0.18**	**0.37**	**0.64**
		0.834	*0.000*	*0.000*	*0.017*	*0.000*	*0.000*
Hungary	B	..	..	..	−0.21	**0.72**	**0.71**
		..	..	..	*0.054*	*0.000*	*0.000*
Poland	B	0.27	**0.57**	**0.61**	**0.54**	**0.48**	**0.46**
		0.360	*0.000*	*0.000*	*0.017*	*0.000*	*0.000*
Slovenia	A	−0.37	**0.29**	**0.65**	0.14	**0.25**	**0.70**
		0.511	*0.036*	*0.005*	*0.542*	*0.000*	*0.000*
Slovakia	A	..	..	..	**1.06**	**0.10**	**0.51**
		..	..	..	*0.000*	*0.117*	*0.000*
Bulgaria	B	**−1.71**	**0.86**	**0.77**	**−1.30**	**0.74**	**0.86**
		0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Bulgaria 97[1]	A	..	..	..	−0.26	**0.51**	**0.67**
		..	..	..	*0.340*	*0.000*	*0.000*
Romania[2]	B	..	..	..	**0.89**	**0.32**	**0.41**
		..	..	..	*0.000*	*0.086*	*0.000*

Source: Author's calculations.

[1] *Based on time series starting in 1997q3.*

[2] *Time series starts only in 2000q1.*

Note: A stands for cointegration relationships that include relative import price levels; B denotes cointegration relationships that exclude relative import price levels; swa stands for seasonally and working day-adjusted data. Values in bold print indicate rejection of the null hypothesis at the 5% significance level. This table shows the relationship between the cointegrated nonstationary variables that was recovered from a DOLS regression (equation (2)), with the number of leads and lags of the differenced terms determined by the Schwarz criterion for each country.

tively high share of exports in total final demand supports this result, it is consistent with the observation that each of these countries can be considered a small and open economy that participates flexibly in international trade and the division of labor. More specifically, a strong export-import link may be explained, inter alia, by the high stock of export-oriented inward FDI in these countries. It may even partly consist of intra-company trade within transnational corporations. In some cases, the export-import link may reflect a country's role as transit country between the EU-15 and Russia.

Even in those three countries where the import elasticity with respect to exports is not highest among the import elasticities with respect to the main final demand components (Latvia, Slovakia and Romania), it is clearly significant and high, too: It is higher than the import elasticity with respect to fixed investment, but considerably smaller than that with respect to private consumption.

Gross fixed capital formation is found to be highly significant in explaining imports in nearly all countries, with its significance at about the 10%-level in the remaining two countries (Slovakia and Romania). The import elasticity with re-

spect to fixed investment is generally the second-highest or highest among the elasticities with respect to the main components of total final demand, even though the share of fixed investment in total final demand usually ranks only third. The notable exceptions to this pattern are Latvia, Slovakia and Romania, where import elasticity with respect to investment ranks only third, after private consumption and exports.

Private consumption offers the most heterogeneous picture, as it is found to be significant in explaining imports in only six of the nine countries with significant cointegration relationships, despite its generally relatively large share in total final demand. In four of these six countries, the import elasticity with respect to private consumption is even higher than (Latvia, Slovakia, Romania) or equal to (Poland) the import elasticity with respect to exports. In Bulgaria, the coefficient of private consumption has a negative sign. This rather unexpected result may be explained by the severe financial and economic crisis the country went through in 1995 and 1997: In a period of hyperinflation, private consumption slumped, while imports increased at the same time. This pronounced divergent development is reflected not only in the first-period results, but also translates into the full-period results. By contrast, the estimates for Bulgaria excluding the period of hyperinflation (i.e. from the establishment of the currency board in mid-1997 onward) do not yield private consumption as significantly related to imports.

Another perspective focuses on import elasticities with respect to the main components of total final demand in particular for countries with larger external imbalances, e.g. Estonia, Lithuania, Latvia, Slovakia, Bulgaria, Romania and Croatia. For those countries that show also a high import elasticity with respect to exports (as Estonia, Lithuania and Bulgaria do), it may be quite difficult to overcome the gap in the goods and services balance only by increasing exports. However, export-capacity-enhancing (foreign direct) investments in these countries that use also domestically produced goods as a considerable share of their input in the production process may change the picture. At the same time, if countries with large external imbalances display a (positive) import elasticity with respect to private consumption that is significant (as our results suggest for four of the seven countries listed above), this may provide, to some extent, a possible channel for diminishing the gap in the trade balance, even though this elasticity may be smaller than that of other demand components. In fact, in some of these countries (Latvia, Slovakia, Romania), this elasticity is found to be even relatively high.

5.2 Panel Estimates

Turning to the results of the panel estimates, the panel **unit root tests** (like those for the single-country time series) confirm the nonstationarity of the time series of the GDP components in levels.

Concerning the relative import price level, the results are more heterogeneous, as in the case of the single time series analysis. Over time, there is a tendency toward rejection of the null hypothesis of a unit root (see appendix, table A.3). In the following, we examine both possible cointegration relationships, including and excluding the relative import price level, whenever the results of the panel unit root tests on the relative import price level are somewhat ambiguous.

The time series of both the GDP components and the relative import price are stationary in first differences. Thus, all the GDP components time series are I(1), as expected.

The panel **cointegration test** clearly establishes significant cointegration relationships for all three panels both in the full period and in the two subperiods on the basis of the ADF statistics, which are the most relevant ones in the given context (see appendix, table A.4).

Moreover, the existence of cointegration (or, more precisely, the rejection of the null of no cointegration) is confirmed even by the two types of rho-statistics (within and between) for the first subperiod and the full period for panels 5 and 8 as well as for the subpanel covering the Baltic countries only. This is certainly reassuring, given that Pedroni (2004) concludes in his simulation study that "for example, in very small panels, if the group-rho statistic rejects the null of no cointegration, one can be relatively confident of the conclusion because it is slightly undersized and empirically the most conservative of the tests."

For panels 12 and 11 as well as the two Southeastern European (SEE) subpanels, the ADF statistics generally allow rejecting the null of no cointegration (with only one exception for both subpanels in the first subperiod), but the rho-statistics generally do not allow rejecting the null (with some exceptions for both full panels in the full period).

In all three panels (and in all others not shown explicitly), the **error correction model** (ECM) has a reasonable goodness of fit, with the adjusted R^2 being roughly in the range of 65% to 80% for panel 5, 60% to 70% for panel 8 and 50% to 65% for panel 12. Besides, also the Durbin-Watson statistic is generally at a satisfactory level for all the panels investigated.

In all three panels (and in all others not shown explicitly), the **adjustment coefficient** for the disequilibrium in levels lagged by one period is highly significant (see table 4) and has a negative sign. This indicates that precedent changes (innovations, shocks) which bring the difference (in levels) between imports and final demand components (or the relative import price) out of line with its long-run equilibrium will induce such corrective changes that the long-run equilibrium between imports and the activity variables (or the relative import price) will remain stable over time. In particular, a shock that raised the level of final demand in the previous period will imply an added factor to import growth in the current period. These results do not change when applying robustness checks, in particular when using the Akaike information criterion instead of the Schwarz criterion or when the ECM includes lags of the differenced dependent variable.[6]

The size of the adjustment coefficient is higher in panels 5 and 8 than in panel 12 in the second subperiod (i.e. after EU accession) and in the full period. Moreover, in panels 5 and 8 (as well as in the Baltic subpanel), its size increases over time, or else becomes larger after EU accession. The quicker import responsiveness probably reflects a higher degree of integration and openness and perhaps also, more generally, a higher degree of flexibility in these economies. Again,

[6] *With the exception of the two SEE subpanels in the second subperiod for which the adjustment coefficient becomes insignificant if the ECM includes lags of the differenced dependent variable.*

Table 4

Error Correction Model: Goodness of Fit and Adjustment Parameter to Disequilibrium in Levels

		swa 2003		swa 2004		swa 2007	
		1995q1 to 2003q4		2004q1 to 2007q2		1995q1 to 2007q2	
		coefficient	p-value	coefficient	p-value	coefficient	p-value
	Adjustment parameter significant at the 5%-level in bold print (with the corresponding p-values in italics)						
	Dependent variable: dM (first difference of the logarithm of M)						
	Variable						
Panel 5							
A	ECT (−1)	**−0.407**	*0.000*	**−0.738**	*0.000*	**−0.396**	*0.000*
A	number of observations	..	*165*	..	*65*	..	*235*
A	adjusted R2	..	*0.727*	..	*0.806*	..	*0.718*
A	Durbin-Watson statistic	..	*2.190*	..	*1.865*	..	*2.251*
A	F-statistic (Wald test)	..	*0.181*	..	*0.107*	..	*0.234*
B	ECT (−1)	..	..	**−0.789**	*0.000*	**−0.314**	*0.000*
B	number of observations	..	..	..	*65*	..	*240*
B	adjusted R2	..	..	..	*0.811*	..	*0.655*
B	Durbin-Watson statistic	..	..	..	*1.884*	..	*2.180*
B	F-statistic (Wald test)	..	..	..	*0.094*	..	*0.063*
Panel 8							
A	ECT (−1)	**−0.368**	*0.000*	**−0.634**	*0.000*	..	..
A	number of observations	..	*280*	..	*104*	..	..
A	adjusted R2	..	*0.684*	..	*0.624*	..	..
A	Durbin-Watson statistic	..	*2.125*	..	*1.561*	..	..
A	F-statistic (Wald test)	..	*0.125*	..	*0.927*	..	..
B	ECT (−1)	**−0.392**	*0.000*	**−0.672**	*0.000*	**−0.334**	*0.000*
B	number of observations	..	*272*	..	*104*	..	*384*
B	adjusted R2	..	*0.708*	..	*0.597*	..	*0.655*
B	Durbin-Watson statistic	..	*2.132*	..	*1.546*	..	*2.098*
B	F-statistic (Wald test)	..	***0.049***	..	*0.958*	..	***0.018***
Panel 12							
A	ECT (−1)	**−0.382**	*0.000*	..	..	..	..
A	number of observations	..	*344*	..	..	..	..
A	adjusted R2	..	*0.633*	..	..	..	..
A	Durbin-Watson statistic	..	*2.080*	..	..	..	..
A	F-statistic (Wald test)	..	*0.963*	..	..	..	..
B	ECT (−1)	..	..	**−0.492**	*0.000*	**−0.246**	*0.000*
B	number of observations	..	..	..	*156*	..	*512*
B	adjusted R2	..	..	..	*0.453*	..	*0.581*
B	Durbin-Watson statistic	..	..	..	*1.836*	..	*2.169*
B	F-statistic (Wald test)	..	..	..	*0.531*	..	***0.001***

Source: Author's calculations.

Note: Panel 5 includes the Czech Republic, Hungary, Poland, Slovenia and Slovakia. Panel 8 includes the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia and Slovakia. Panel 12 covers Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, Slovakia, Croatia, and Turkey. A denotes cointegration relationships that include relative import prices (assuming the relative import price level to be nonstationary). B stands for cointegration relationships that exclude relative import prices (assuming the relative import price level to be stationary). All panels are estimated with the inclusion of country-specific fixed effects. ECT denotes the error correction term. The Wald test is an F-test of the null hypothesis of homogeneity of the long-run adjustment parameter across countries. Under the null, all the cross-section-specific (i.e. country-specific) long-run adjustment parameters are equal to the average (across countries) long-run adjustment parameter, which is shown in this table. Values in bold print indicate rejection of the null hypothesis at the 5% (or lower) significance level. Underlined values indicate rejection of the null hypothesis at the 10% (i.e. 5% to 10%) significance level.

these results are robust to changes in the lag selection criterion or to the inclusion of lags of the differenced dependent variable.

Concerning the homogeneity of the adjustment coefficient across countries in the respective panels, the results for panel 5 do not allow rejecting the null of homogeneity in both subperiods and in the full period.[7]

While for the Baltic subpanel the presence of homogeneity is confirmed even more strongly than for panel 5, the two panels combined (i.e. panel 8) yield a less clear picture concerning the homogeneity of the adjustment coefficient. In the second subperiod, the null of homogeneity cannot be rejected – a result that is robust.[8] Even if homogeneity cannot be taken for granted for the full period, the results of the baseline ECM for panel 8 suggest at least an increase in homogeneity over time, or else upon EU accession.

While for both SEE subpanels the results indicate the presence of homogeneity for both subperiods and the full period, adding these panels to obtain panel 12 (or 11) weakens homogeneity again, as the null of homogeneity has to be rejected for the full period. However, for each subperiod it cannot be rejected.

It is not too surprising that extending the set of countries erodes the homogeneity of the adjustment coefficient – even more so if this leads to the inclusion of structurally more heterogeneous countries. Notwithstanding this fact, the results supporting homogeneity are sufficiently strong even for the large panels to warrant a closer look at the long-run relationship embodied in the error correction term.

Looking at the panel results for the **long-run elasticity of imports** with respect to the main components of total final demand (see table 5), the high significance of *exports* and *gross fixed capital formation* in explaining imports is confirmed for all panels in all periods, with the only exception being the second subperiod for the SEE subpanels (concerning exports and partly also investment) and the Baltic subpanel (concerning investment). In spite of these rather exceptional deviations from the general pattern, in both panels 8 and 12 (and 11) exports and gross fixed capital formation are highly significant in this period, too. These findings are robust to the various standard error corrections performed to control for heteroscedasticity as well as to changes in the lag/lead selection criterion of the DOLS model. At the same time, the size of import elasticity with respect to exports is clearly higher than that with respect to fixed investment (wherever both elasticities were significant) (see table 5).

Private consumption is not found to be significant in explaining imports for panel 5 – a fully robust result again. The corresponding findings regarding the role of private consumption in the other panels are also robust to the various checks applied. The significance of private consumption changes over time both in the Baltic subpanel and in panel 8. In the first subperiod its coefficient is insignificant, but in the second subperiod it is highly significant and relatively large. Moreover, private consumption shows up as significant in both panels also in the full-period

[7] *This result is even more pronounced when including lags of the differenced dependent variable in the ECM.*

[8] *In the first subperiod the result is rather ambivalent and in the full period the null of homogeneity has to be rejected. However, this result is not robust to the inclusion of lags of the differenced dependent variable, as including these lags in the ECM leads to support of homogeneity in both cases.*

Table 5

Long-Run Elasticity of Imports with Respect to the Main Components of Total Final Demand (and, for A, with Respect to the Relative Import Price Level)

			swa 2003		swa 2004		swa 2007	
			1995q1 to 2003q4		2004q1 to 2007q2		1995q1 to 2007q2	
			coefficient	p-value	coefficient	p-value	coefficient	p-value
Coefficients significant at the 5%-level in bold print (with the corresponding p-values in italics on the right-hand side)								
Dependent variable: M (logarithm of M)								
		Variable						
Panel 5								
	A	Private consumption	−0.043	*0.639*	0.018	*0.938*	−0.099	*0.173*
	A	Gross fixed capital formation	**0.305**	*0.000*	**0.288**	*0.000*	**0.266**	*0.000*
	A	Exports of goods and services	**0.826**	*0.000*	**0.712**	*0.000*	**0.792**	*0.000*
	A	Relative import price level	**−0.233**	*0.000*	−0.026	*0.763*	**−0.269**	*0.000*
	B	Private consumption	..	..	0.016	*0.948*	0.033	*0.673*
	B	Gross fixed capital formation	..	..	**0.278**	*0.000*	**0.275**	*0.000*
	B	Exports of goods and services	..	..	**0.722**	*0.000*	**0.808**	*0.000*
Panel 8								
	A	Private consumption	−0.115	*0.081*	**0.391**	*0.000*	..	..
	A	Gross fixed capital formation	**0.219**	*0.000*	**0.174**	*0.003*	..	..
	A	Exports of goods and services	**0.850**	*0.000*	**0.631**	*0.000*	..	..
	A	Relative import price level	**−0.176**	*0.000*	−0.124	*0.189*	..	..
	B	Private consumption	−0.099	*0.152*	**0.397**	*0.000*	**0.098**	*0.035*
	B	Gross fixed capital formation	**0.227**	*0.000*	**0.180**	*0.002*	**0.205**	*0.000*
	B	Exports of goods and services	**0.883**	*0.000*	**0.635**	*0.000*	**0.799**	*0.000*
Panel 12								
	A	Private consumption	**−0.157**	*0.018*	..	..	..	..
	A	Gross fixed capital formation	**0.314**	*0.000*	..	..	..	..
	A	Exports of goods and services	**0.777**	*0.000*	..	..	..	..
	A	Relative import price level	**−0.311**	*0.000*	..	..	..	..
	B	Private consumption	..	..	**0.598**	*0.000*	−0.031	*0.492*
	B	Gross fixed capital formation	..	..	**0.138**	*0.004*	**0.321**	*0.000*
	B	Exports of goods and services	..	..	**0.571**	*0.000*	**0.803**	*0.000*

Source: Author's calculations.

Note: Panel 5 includes the Czech Republic, Hungary, Poland, Slovenia and Slovakia. Panel 8 includes the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia and Slovakia. Panel 12 covers Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, Slovakia, Croatia, and Turkey. A denotes cointegration relationships that include relative import prices (assuming the relative import price level to be nonstationary). B stands for cointegration relationships that exclude relative import prices (assuming the relative import price level to be stationary). All panels are estimated with the inclusion of country-specific fixed effects. Values in bold print indicate rejection of the null hypothesis at the 5% significance level. This table shows the relationship between the cointegrated nonstationary variables that was recovered from a DOLS regression (equation (2)), with the number of leads and lags of the differenced terms determined by the Schwarz criterion for each panel.

estimate, albeit with the size of the corresponding import elasticity being comparatively lower than in the second subperiod. This development between these two subperiods probably reflects the strong acceleration of quarterly private consumption growth in the Baltic countries to a level considerably above that of quarterly GDP growth.

Also in the SEE subpanels and in panel 12 (and 11), private consumption is highly significant in the second subperiod, with the size of import elasticity even being equal to that with respect to exports in panel 12 (and 11). However, in the first subperiod, private consumption is significant, too, but has a negative sign. This rather unexpected result is very probably influenced decisively by the corre-

sponding large negative coefficient in Bulgaria that is explained in the context of the single-country time series results above. In most countries, private consumption is not significantly related to imports in the first subperiod, so that the significant and large negative coefficient for Bulgaria (that reflects the country's idiosyncratic development) dominates the panel results in this period. In the full period, private consumption is not significant, which may be interpreted as the significantly negative relation in the first subperiod offsetting the significantly positive relation in the second subperiod.

On a more general note, the fact that private consumption is often insignificant and mostly plays a less prominent role in explaining import demand than exports or fixed investment (as reflected e.g. in the mostly smaller size of import elasticity with respect to private consumption) is certainly not unexpected, given that most people have low income levels that do not allow them to buy large quantities of imported goods or goods with a high import content. The combination of a relatively large share in total demand and a relatively small import elasticity suggests that the marginal import content of private consumption, i.e. the import content of one additional unit of private consumption, is generally far below that of one additional unit of fixed investment or exports. Against the background that private consumption generally plays a subordinate role in driving imports, those cases in which private consumption is found to have a significant (and large) impact on imports deserve even more attention.

As the above-mentioned import elasticities express the extent to which changes in the explanatory variables translate into changes of imports, one should bear in mind when interpreting these results that the various components of total final demand usually have different levels of growth rates on average across time and across the countries concerned. Typically, export growth rates, which are on average roughly equal in size to import growth rates, are higher than the growth rates of gross fixed capital formation, which in turn are higher than those of private consumption. Thus, taking e.g. the import elasticities with respect to the main components of total final demand in panel 8 in the second subperiod (see table 5), the average quarterly import growth rate of 3.0% may be decomposed into: first, the 0.7 percentage points (or 22%) contribution to the average import growth rate by average private consumption growth of 1.7%; second, the 0.4 percentage points (or 14%) contribution by average gross fixed capital formation growth of 2.4%; and third, the 1.9 percentage points (or 61%) contribution by average export growth of 2.9%, which, in turn, is close to the average import growth rate.

Regarding the *relative import price level*, it has the expected sign where it enters the cointegration relation. It acquires high significance in the first subperiod in all panels as well as in the full period in panel 5 and in the Baltic and SEE subpanels.

In a final step, we tested for the strength of the economic interlinkages within the EU-27(+)[9] as measured by CESEE countries' import elasticities. The basic idea of this approach is to take into account the asymmetric size relations between the EA-12 on the one hand and the CESEE countries on the other. While the

[9] *In this study, EU-27(+) denotes the EU-27 plus Croatia and Turkey.*

Table 6

Long-Run Elasticity of Imports with Respect to Exports and Euro Area Imports in Comparison

			swa 2003		swa 2004		swa 2007	
			1995q1 to 2003q4		2004q1 to 2007q2		1995q1 to 2007q2	
			coefficient	p-value	coefficient	p-value	coefficient	p-value
Coefficients significant at the 5%-level in bold print (with the corresponding p-values in italics on the right-hand side)								
Dependent variable: M (logarithm of M)								
		Variable						
Panel 5								
	A	Exports of goods and services	**0.826**	*0.000*	**0.712**	*0.000*	**0.792**	*0.000*
	A	Euro area imports of goods and services	**1.097**	*0.000*	**0.669**	*0.000*	**1.054**	*0.000*
	B	Exports of goods and services	..	..	**0.722**	*0.000*	**0.808**	*0.000*
	B	Euro area imports of goods and services	..	..	**0.688**	*0.000*	**1.042**	*0.000*
Panel 8								
	A	Exports of goods and services	**0.850**	*0.000*	**0.631**	*0.000*	..	..
	A	Euro area imports of goods and services	**1.131**	*0.000*	**1.491**	*0.000*	..	..
	B	Exports of goods and services	**0.883**	*0.000*	**0.635**	*0.000*	**0.799**	*0.000*
	B	Euro area imports of goods and services	**1.050**	*0.000*	**1.508**	*0.000*	**1.149**	*0.000*
Panel 12								
	A	Exports of goods and services	**0.777**	*0.000*	..	..	..	..
	A	Euro area imports of goods and services	**0.766**	*0.000*	..	..	..	..
	B	Exports of goods and services	..	..	**0.571**	*0.000*	**0.803**	*0.000*
	B	Euro area imports of goods and services	..	..	**1.111**	*0.000*	**1.024**	*0.000*

Source: Author's calculations.

Note: Panel 5 includes the Czech Republic, Hungary, Poland, Slovenia and Slovakia. Panel 8 includes the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia and Slovakia. Panel 12 covers Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, Slovakia, Croatia, and Turkey. A denotes cointegration relationships that include relative import prices (assuming the relative import price level to be nonstationary). B stands for cointegration relationships that exclude relative import prices (assuming the relative import price level to be stationary). Values in bold print indicate rejection of the null hypothesis at the 5% significance level. This table shows the relationship between the cointegrated nonstationary variables that was recovered from a DOLS regression (equation (2)), with the number of leads and lags of the differenced terms determined by the Schwarz criterion for each panel.

former have a large share in the CESEE countries' total external demand and exports, the reverse is not true. It follows that the total imports of the EA-12 probably have a decisive impact on the total exports of the CESEE countries. Hence, we may hypothesize that the total imports of the EA-12 also have a significant indirect influence on the CESEE countries' total imports, taking into account the generally strong export-import link that we documented above. Moreover, foreign demand from the euro area may induce fixed investment and thus imports. To examine this hypothesis, we substitute CESEE countries' total exports in the import demand equations of these CESEE countries by total imports of the EA-12 to yield testable relationships.

In general, the panel results show significant cointegration, with the adjustment coefficient having the appropriate sign in all panels. As before, the size of the adjustment coefficient increases over time in panels 5 and 8. Its homogeneity is roughly similar to that of the adjustment coefficient in the previous specification.

While the adjustment coefficient is less homogeneous in panel 12 (rejection of the null of homogeneity in the full period and in the first subperiod), it is more homogeneous in panel 8 (no rejection of the null in the full period and in each subperiod). Moreover, we found a strong impact of total EA-12 imports on CESEE countries' imports in terms of a high elasticity of CESEE countries' imports with respect to EA-12 imports (see table 6).[10] Also, these results are robust to the various robustness checks applied as outlined above. Hence, indirectly, euro area import growth helps explain a large part of the import growth observed in the countries under study. This certainly reflects important economic interlinkages between these country groups within the EU-27(+) and is indicative of advanced economic integration.

6 Conclusions

In this study we made systematic estimates of long-run import elasticities with respect to the main final demand components for both individual CESEE countries and different panels composed of these countries, following the same methodological approach on the basis of quarterly seasonally and working day-adjusted data for the periods from 1995 to 2003 and from 1995 to mid-2007 and, in the case of panel analysis, also for a second subperiod from 2004 to mid-2007.

The estimation results confirm the existence of a strong export-import link in most individual countries and nearly all panels and periods (except for the SEE panels in the second subperiod). The import elasticity with respect to exports is both highly significant and large. This appears to reflect a number of factors: the relatively high share of exports in total final demand, the flexible participation of these small and open economies in international trade and in the international division of labor, their high stock of export-oriented inward FDI, intra-company trade by transnational corporations and, in some cases, the countries' role as transit countries between the EU-15 and Russia.

Second, our findings confirm the prominent role of fixed investment in determining imports in most individual countries and nearly all panels and periods (except for the Baltic panel in the second subperiod), despite the relatively small share of gross fixed capital formation in these countries' total final demand. However, the size of import elasticity with respect to fixed investment is generally considerably smaller than that with respect to exports.

Third, the results show that private consumption plays a significant role in determining import developments in only about one-half of the countries under study. However, in most of the countries in which private consumption acquires a significant role, import elasticity with respect to this demand component is even higher than (Latvia, Slovakia, Romania) or equal to (Poland) that with respect to exports. On the basis of the panel estimates, we found that private consumption was highly significant with a relatively large coefficient not in the Central European panel but in the larger panels that include the Baltic and/or the SEE countries (as well as in the respective subpanels), in particular in the second subperiod.

[10] *The fact that the import elasticity with respect to EA-12 imports is mostly larger than that with respect to exports has to be seen against the background that the growth rate of EA-12 imports is generally lower than that of the CESEE countries' exports.*

In countries with larger external imbalances, a strong export-import link (e.g. Estonia, Lithuania and Bulgaria) renders it more difficult to overcome the gap in the goods and services balance by only increasing exports. Still, export capacity-enhancing (foreign direct) investments that use also domestically produced goods as a considerable share of their input in the production process may change the picture in these countries. At the same time, however, in most of the countries or country groups with larger external imbalances, import elasticity with respect to private consumption was found to be significant, which may provide a possible (additional) channel for diminishing the gap in the trade balance. This is true in particular for countries or country groups where this elasticity was found to be relatively high (e.g. Latvia, Slovakia, Romania; Baltic and SEE panels).

Finally, we tested for economic interlinkages between the euro area (EA-12) and the CESEE countries by using total imports of the EA-12 (instead of CESEE countries' total exports) in the estimated import demand equations of the CESEE countries. The estimation results show a significant and sizeable impact of total euro area imports on the CESEE countries' imports, which confirms a high degree of economic integration within the EU-27 (and within the EU-27 plus Croatia and Turkey). These economic interlinkages offer a field of further research.

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Appendix

Estimating Import Demand Functions for CESEE-MS, Croatia and Turkey: Data Issues

For most CESEE-MS and also for Croatia, annual time series are not available for a period that is sufficiently long to perform country-specific single time series regressions. Moreover, if they are available, the fundamental structural break due to the systemic transformation recession in the early 1990s renders any regression across this break very questionable.

Therefore, to work with a sufficient number of observations, we have to use quarterly data. For most CESEE-MS, both types of data are available – quarterly time series that are not seasonally adjusted (and not working day-adjusted, either) as well as seasonally and working day-adjusted quarterly time series.

More precisely, quarterly data that are not seasonally adjusted (nsa) are available from Eurostat in level form (as chain-linked volumes with the reference year 2000) for

- Estonia (EE), Slovakia (SK) and Turkey (TR) for the period from 1993q1 to 2007q2;
- Bulgaria (BG), the Czech Republic (CZ), Latvia (LV), Lithuania (LT), Hungary (HU), Poland (PL) and Slovenia (SI) for the period from 1995q1 to 2007q2;
- Croatia (HR) for the period from 1997q1 to 2007q2;
- and Romania (RO) for the period from 2000q1 to 2007q2.

Seasonally and working day-adjusted (swa) quarterly data are available from Eurostat in level form (as chain-linked volumes with the reference year 2000) for

- Estonia (EE), Lithuania (LT), Hungary (HU), Poland (PL), Slovenia (SI) and Slovakia (SK) for the period from 1995q1 to 2007q2;
- the Czech Republic (CZ) for the period from 1996q1 to 2007q2;
- and Latvia (LV) for the period from 1999q1 to 2007q2.

For Bulgaria (BG), Romania (RO) and Croatia (HR) swa data were not available yet.

However, with the help of Eurostat's DEMETRA tool for seasonal (and working day) adjustment, we could derive swa time series on the basis of nsa data from 1995q1 to 2007q2 for all countries except Croatia (starting in 1997q1) and Romania (starting in 2000q1).

In the case of Bulgaria, we made an additional estimate based on a sample ranging from 1997q3 to 2007q2, given the severe financial crisis in 1996/1997 and the setup of the currency board regime on July 1, 1997.

In addition, we performed the estimations on the basis of a shorter sample ranging from 1995q1 up to 2003q4, as one might suspect a potential structural break in the countries' external trade relations in the run-up to EU accession for the CESEE-MS that joined the EU on May 1, 2004. Given sufficient data availability, we included Bulgaria in these estimations, too.

While in most cases the quarterly time series are hence long enough to run least squares regressions, a small sample correction for deriving fully appropriate critical values was required in all cases when testing for cointegration.

Table A.1

Relative Import Price Level

	swa 2003		swa 2007	
	1995q1 to 2003q4		1995q1 to 2007q2	
	p-value	type	p-value	type
	Results of ADF Tests for Unit Roots in the Time Series in Levels			
Czech Republic	**0.025**	trend stationary	**0.012**	trend stationary
Estonia	**0.040**	I(0)	**0.020**	I(0)
Latvia	**0.001**	trend stationary	**0.006**	trend stationary
Lithuania	0.055	I(1) + trend	**0.000**	I(0) + constant
Hungary	**0.034**	I(0)	**0.028**	I(0)
Poland	**0.006**	I(0) + constant	**0.003**	I(0) + constant
Slovenia	0.205	I(1)	0.389	I(1)
Slovakia	0.309	I(1)	0.216	I(1)
Bulgaria	**0.044**	I(0)	**0.000**	trend stationary
Bulgaria 97[1]	..	..	0.595	I(1)
Romania[2]	..	..	**0.001**	I(0)
Croatia[3]	..	..	0.281	I(1)
Turkey	0.329	I(1)	0.341	I(1)

Source: Author's calculations.

[1] *Based on time series starting in 1997q3.*
[2] *Time series starts only in 2000q1.*
[3] *Time series starts only in 1997q1.*

Note: *Relative import prices are defined as the ratio between the import price deflator and the GDP price deflator; swa stands for seasonally and working day-adjusted data; p-value refers to the MacKinnon p-value. The type column presents the resulting type of time series that the relative import prices are found to be on the basis of the ADF test at the 5% (Mac Kinnon) significance level and the Fischer test with respect to constant (and trend). I(0) means integrated of order 0, I(1) integrated of order 1; t stands for trend; c means constant. Values in bold print indicate rejection of the null hypothesis (of a unit root) at the 5% (or lower) significance level. Underlined values indicate rejection of the null hypothesis at the 10% (i.e. 5% to 10%) significance level.*

Table A.2

Cointegration of Imports and the Main Components of Total Final Demand (and, for A, the Relative Import Price Level)

		swa 2003			swa 2007		
		1995q1 to 2003q4			1995q1 to 2007q2		
		t-stat	crit 5%	crit 10%	t-stat	crit 5%	crit 10%
		Results of ADF tests for unit roots in the "residuals" of the DOLS regression					
Czech Republic	A	−3.87	*−4.88*	*−4.48*	−3.85	*−4.71*	*−4.35*
	B	−2.97	*−4.47*	*−4.08*	−3.45	*−4.33*	*−3.98*
Estonia	B	**−4.87**	*−4.42*	*−4.05*	**−5.29**	*−4.32*	*−3.98*
Latvia	A	−0.52	*−4.85*	*−4.46*	−2.76	*−4.71*	*−4.36*
	B	−1.00	*−4.46*	*−4.08*	**−4.03**	*−4.33*	*−3.99*
Lithuania	A	−1.22	*−4.87*	*−4.47*	..	..	..
	B	**−4.88**	*−4.42*	*−4.05*	**−4.54**	*−4.33*	*−3.98*
Hungary	B	−3.31	*−4.43*	*−4.06*	**−5.00**	*−4.33*	*−3.98*
Poland	B	**−5.16**	*−4.46*	*−4.08*	**−7.04**	*−4.33*	*−3.98*
Slovenia	A	**−6.20**	*−4.88*	*−4.48*	**−5.22**	*−4.71*	*−4.35*
Slovakia	A	−2.69	*−4.84*	*−4.45*	**−6.65**	*−4.70*	*−4.35*
Bulgaria	A	..	..	..	−1.52	*−4.73*	*−4.37*
	B	**−5.35**	*−4.46*	*−4.08*	**−5.34**	*−4.34*	*−3.99*
Bulgaria 97[1]	A	..	..	..	**−5.89**	*−4.77*	*−4.40*
Romania[2]	B	..	..	..	**−9.09**	*−4.50*	*−4.10*
Croatia[3]	A	..	..	..	−2.00	*−4.76*	*−4.40*
Turkey	A	−2.40	*−4.87*	*−4.47*	−3.63	*−4.73*	*−4.37*

Source: Author's calculations.

[1] *Based on time series starting in 1997q3.*
[2] *Time series starts only in 2000q1.*
[3] *Time series starts only in 1997q1.*

Note: A denotes cointegration relationships that include relative import prices, B stands for cointegration relationships that exclude relative import prices; swa stands for seasonally and working day-adjusted data, crit 5% and crit 10% refer to critical values corrected for the small sample size according to MacKinnon (1991). Values in bold print indicate rejection of the null hypothesis of no cointegration.

Table A.3

Relative Import Price Level

	swa 2003		swa 2004		swa 2007	
	1995q1 to 2003q4		2004q1 to 2007q2		1995q1 to 2007q2	
	with indvidual **constant and trend**	with indvidual **constant**	with indvidual **constant and trend**	with indvidual **constant**	with indvidual **constant and trend**	with individual **constant**
	p-value	p-value	p-value	p-value	p-value	p-value
Results of panel tests for unit roots in the time series in levels						
Test type						
Panel 5						
LLC	0.316	0.897	0.224	**0.032**	**0.012**	0.543
IPS	0.145	0.857	0.061	0.263	**0.006**	0.535
Panel 8						
LLC	**0.003**	**0.045**	0.129	**0.047**	**0.000**	**0.004**
IPS	0.222	0.268	**0.038**	0.254	0.078	**0.028**
Panel 12						
LLC	0.547	0.486	**0.005**	**0.010**	**0.000**	**0.007**
IPS	0.303	0.558	**0.035**	0.087	**0.015**	**0.003**

Source: Author's calculations.

Note: Panel 5 includes the Czech Republic, Hungary, Poland, Slovenia and Slovakia. Panel 8 includes the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia and Slovakia. Panel 12 covers Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, Slovakia, Croatia, and Turkey. LLC refers to the Levin, Lin & Chu t-statistic, which is based on the assumption of a common unit root process and tests the null hypothesis of a unit root. IPS denotes the Im, Pesaran & Shin W-statistic, which is based on the assumption of individual unit root processes and tests the null of a unit root. Values in bold print indicate rejection of the null hypothesis at the 5% (or lower) significance level. Underlined values indicate rejection of the null hypothesis at the 10% (i.e. 5% to 10%) significance level.*

Table A.4

Cointegration of Imports and the Main Components of Total Final Demand (and, for A, the Relative Import Price Level)

			swa 2003		swa 2004		swa 2007	
			1995q1 to 2003q4		2004q1 to 2007q2		1995q1 to 2007q2	
			with individual constant and trend	with individual constant	with individual constant and trend	with individual constant	with individual constant and trend	with individual constant
			p-value	p-value	p-value	p-value	p-value	p-value
	Results of panel cointegration tests							
		Type of test statistic						
Panel 5								
	A	Panel ADF statistic	0.000	0.000	0.000	0.012	0.000	0.000
	A	Group ADF statistic	0.000	0.000	0.000	0.000	0.000	0.000
	B	Panel ADF statistic	..	..	0.000	0.001	0.000	0.000
	B	Group ADF statistic	..	..	0.000	0.000	0.000	0.000
Panel 8								
	A	Panel ADF statistic	0.000	0.000	0.000	0.000	..	..
	A	Group ADF statistic	0.000	0.000	0.000	0.000	..	..
	B	Panel ADF statistic	0.000	0.000	0.000	0.000	0.000	0.000
	B	Group ADF statistic	0.000	0.000	0.000	0.000	0.000	0.000
Panel 12								
	A	Panel ADF statistic	0.000	0.000	..	..	..	..
	A	Group ADF statistic	0.000	0.000	..	..	..	..
	B	Panel ADF statistic	..	..	0.000	0.000	0.000	0.000
	B	Group ADF statistic	..	..	0.000	0.000	0.000	0.000

Source: Author's calculations.

Note: Panel 5 includes the Czech Republic, Hungary, Poland, Slovenia and Slovakia. Panel 8 includes the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia and Slovakia. Panel 12 covers Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, Slovakia, Croatia, and Turkey. A denotes cointegration relationships that include relative import prices (assuming the relative import price level to be nonstationary), B stands for cointegration relationships that exclude relative import prices (assuming the relative import price level to be stationary). The Pedroni panel cointegration test is an Engle-Granger-based residual test of the null hypothesis of no cointegration (unit root in the residuals), against the alternative with common autoregressive coefficients (within-dimension) or individual autoregressive coefficients (between-dimension, group statistics). Values below 5% indicate the rejection of the null hypothesis (of no cointegration) at the 5% (or lower) significance level.