Are the transition economies balance-of-payments constrained? An aggregate and multi-sector approach applied to Central and Eastern Europe.

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Abstract

The balance of payments can act as a constraint on the output growth rate, since it puts a limit on the growth of demand. This paper focuses on verifying whether the Balance-of-Payments-constrained growth hypothesis is suitable for explaining the growth performance in several transition economies of the Central and Eastern Europe that joined the European Union in 2004. According to Thirlwall´s Law, we determine the balance of payments equilibrium growth rate of an economy by the ratio of the income elasticities of the demand for exports and imports and the growth of foreign demand. The obtained results are compared with the multi-sector version of Thirlwall´s Law as an alternative approach that considers the structure of the economy and how specific specialization affects the Balance-of-Payments-constrained growth. Our results show that almost all transition countries in the sample grew and a higher rate that the one consistent with the Balance-of-Payments equilibrium and that the multi-sector version of this approach makes a suitable prediction of the actual growth in these countries.

Key words: Balance-of-Payments-constrained growth, aggregate and multi-sector Thirlwall´s Law, Structural change.

***JEL classification*:** C13, E12, F41, F43

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1. Introduction

The global external imbalances are always the long-term main concern for open economies, especially for small countries. The issue of whether the balance of payments can be an impediment to economic growth is very crucial for the transition economies that implemented the market economy since the beginning of the1990´s and compete within a free EU market. Some of the transition countries became members of the Eurozone losing their freedom of using a competitive exchange rate policy that could alleviate the balance of payments pressure on external payments. The relatively higher economic growth shown in these countries is also accompanied (in most cases) by the accumulation of balance of payments deficits, especially on current account.

The supply-side economics view postulates that the balance of payments is self-adjusting under a flexible exchange rate regime and it is not an impediment to the long-term economic growth. Economic growth is determined by the supply of factor inputs exogenously given, including technical progress. Long-term economic growth depends on the optimal allocation of production factors and the existing technological progress that is freely available. No special importance is given to the balance of payments problems since growth is supply constrained by the availability of factor inputs and a flexible price-wage regime will always bring the economy into equilibrium.

Against this automatic adjustment mechanism is the demand orientated approach arguing that growth is demand determined and that balance of payments issues matter for the long-term growth. Productive factors and technology are endogenous in the growth process, depending on the strength of demand. Unsustainable external deficits (on current account) can restrict aggregate demand and therefore growth, unless a country benefits from capital inflows that can finance external imbalances. This is the essence of Thirlwall´s Law (1979) stating that no country can grow above its balance of payments equilibrium growth rate, the latter determined by the ratio of the export growth to the income elasticity of the demand for imports or alternatively by the ratio of the income elasticity of exports to that of imports, multiplied by the growth of foreign demand. If a country does not respect this rule, soon or later will face unsustainable external deficits that only can be controlled for by contracting demand and therefore growth. Income is the variable that adjusts to bring the economy into

equilibrium and international relative prices play no significant role in the long-term pace of economic growth[1].

Recently, Araújo and Lima (2007) made a significant contribution in this strain of economic thought by developing a multi-sector version of Thirlwall´s Law taking into account the productive structure of the economy. This alternative approach shows that sectoral income elasticities of the demand for imports and exports are important for determining the balance of payments equilibrium growth rate (in contrast to the aggregate income elasticities of the Thirlwall´s model). If a country specializes in exporting goods with high income elasticity of demand and importing goods with low income elasticity, then a higher growth can be achieved without facing external imbalances. Therefore, the type of product specialization matters for the long-term growth.

The aim of this paper is to analyze whether these two versions (aggregate and multi-sectoral) of the Balance-of-Payments constrained growth are suitable for explaining the actual growth of eleven transition countries (Central and Eastern Europe), over the period 1995–2014. This demand orientated approach which sets a limit on the path of economic growth when the balance of payments equilibrium growth rate requirement is not fulfilled, has not been applied before on this set of countries, especially the multi-sector version of Thirlwall´s Law. These countries have experienced a significant economic growth in recent years, catching-up towards the Western European countries but most of them at the cost of accumulating external deficits, especially in the current account. Therefore, Thirlwall´s model (aggregate and multi-sector) is the appropriate approach to predict actual growth in these countries and to detect the limitations on this growth due to balance-of-payments constraints.

Beside the Introduction this paper has the following sections: section 2 explains the aggregate version of the Balance-of-Payments constrained growth known as Thirlwall´s Law; section 3 analyses the historical tendencies on growth rates and current account performance between the EU(28) average and the 11 transition economies considered in this study; section 4, estimates the import and export demand functions to obtain the trade elasticities which are necessary in order to test the validity of Thirlwall´s Law; section 5 tests the Balance-of-Payments constrained growth hypothesis for the 11 transition economies;

[1] For the history and new developments on the balance of payments constrained growth models see SOUKIAZIS, E. - CERQUEIRA, P. (2012).

section 6 describes the multi-sector version of Thirlwall´s Law; section 7 explains the structural changes on imports and exports in the transition economies; section 8 computes the Balance-of-Payments equilibrium growth rates based on the multi-sector analysis. The final section 9, summarizes the main conclusions found in the empirical approach, pointing out some policy recommendations.

2. The Balance-of-Payments constrained growth model

There is both theoretical and empirical support for the view that aggregate demand plays an important role in determining economic growth in the long-term analysis. In this vein of thought, productive factors are endogenous to the growth process depending on the strength of demand. The accumulation of productive capacity in terms of capital and labor is influenced by demand so that potential output is mostly demand determined (Setterfield, 2003).

The demand-led growth approach has been heavily influenced by the export-led hypothesis where exports is the engine of growth. This comes from the early work of Harrod (1933) who developed the foreign trade multiplier arguing that exports govern the long-term growth of output and employment. Borrowing this concept, Thirlwall (1979) established the Balance-of-Payments Constrained Growth (henceforth BPCG) hypothesis based on the proposition that no country can grow faster than that rate consistent with the balance of payments equilibrium (on current account), unless it can finance ever-growing deficits (normally by capital inflows) which in general it cannot. Thirlwall showed that the balance of payments equilibrium growth rate of a country can be determined (or actual growth can be predicted) by the ratio of the growth of real exports to the income elasticity of the demand for imports and this is the dynamic version of the Harrod´s foreign trade multiplier. To achieve this result Thirlwall uses the following relations:

$$P_d X = P_f E M \qquad current\ account\ equilibrium \qquad (1)$$

$$X = a\left(\frac{P_d}{P_f E}\right)^{\eta} Z^{\varepsilon} \qquad \eta < 0, \varepsilon > 0\ \ export\ demand\ function \qquad (2)$$

$$M = b\left(\frac{P_f E}{P_d}\right)^{\psi} Y^{\pi} \qquad \psi < 0, \pi > 0\ \ import\ demand\ function \qquad (3)$$

where X and M are real exports and imports, P_d is the domestic price of exports and P_f the foreign price of imports, E the exchange rate measured as the domestic price of foreign currency, Z is foreign income and Y the domestic income, η and ψ are the price elasticities of the demand for exports and imports, and ε and π are the income elasticities of demand for exports and imports, respectively.

Taking logarithms and time derivatives we can define the dynamic version of the model (small letters are growth rates of variables):

$$p_{d,t} + x_t = p_{f,t} + e_t + m_t \tag{4}$$

$$x_t = \eta\left(p_{d,t} - p_{f,t}e_t\right) + \varepsilon(z_t) \tag{5}$$

$$m_t = \psi\left(p_{f,t}e_t - p_{d,t}\right) + \pi(y_t) \tag{6}$$

Finally, plugging equations (5) and (6) into (4), we obtain the growth rate of domestic income consistent with the balance of payments equilibrium, given as

$$y_{BP,t} = \frac{[(1 + \eta + \psi)(p_{d,t} - p_{f,t} - e_t) + \varepsilon(z_t)]}{\pi} \tag{7}$$

Thirlwall further assumes that relative prices remain constant in the long-term, i.e. $(p_{d,t} - p_{f,t} - e_t = 0)$, since the exchange rate role is to equalize the domestic and foreign prices (the one price hypothesis). Assuming this hypothesis, the above equation collapses to:

$$y^*_{BP,t} = \frac{\varepsilon\,(z_t)}{\pi} \tag{8}$$

or alternatively to

$$y^{**}_{BP,t} = \frac{x_t}{\pi} \tag{9}$$

Equation (8) shows that the long-term balance of payments equilibrium growth rate of a country depends on the growth of foreign income z_t multiplied by the ratio of the export to import income elasticity, ε/π. Another interpretation of equation (8) is that a country can grow faster than the rest of the world, i.e., $y^*_{BP,t} > z_t$ only if its income elasticity of the demand for exports is higher than its income elasticity of the demand for imports, that is, $\varepsilon > \pi$ and this is a kind of a catching-up tendency to occur. The ratio ε/π captures the non-price

competiveness of the economy associated with the supply characteristics of the produced goods, such as quality, design, liability, variety, among others. Finally, equation (9) is the simplest Thirlwall´s rule that became known as Thirlwall´s Law, stating that a country´s actual growth rate y_t can be simply predicted by dividing its exports growth to its income elasticity of the demand for imports. $1/\pi$ is equivalent to the dynamic Harrod´s foreign trade multiplier. The message from this simple rule is that, if a country grows faster than its balance of payments equilibrium rate, that is, $y_t > y^{**}_{BP,t}$ then sooner or later will be forced to adjust its income downward due to the accumulation of external deficits. Therefore, external imbalances can be an impediment to growth due to the pressure on demand when external deficits (on current account) are becoming unsustainable.

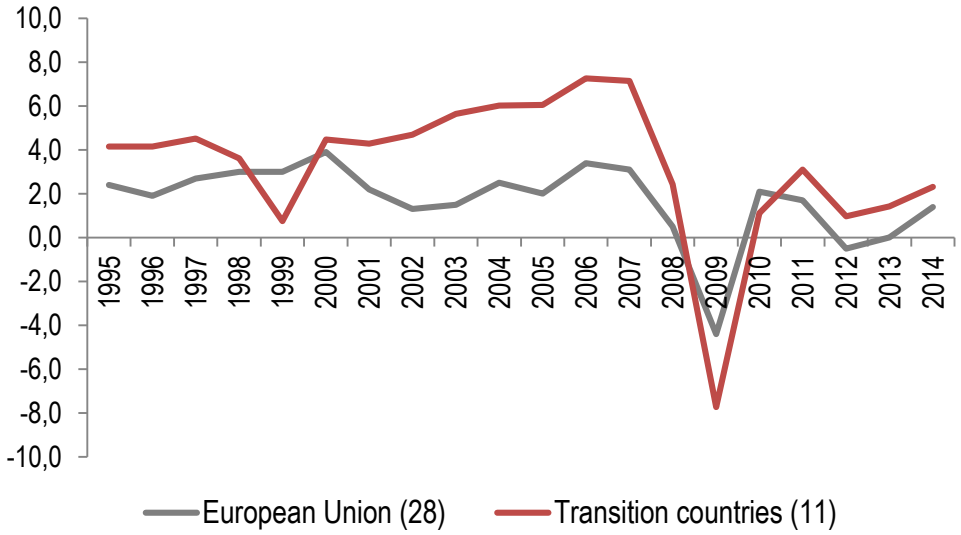
3. Data source and Historical tendencies

Thirwall´s Law can be tested for a set of eleven transition economies of the Central and Eastern Europe, namely: Bulgaria, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia. The data covers the period 1995 – 2014 and the main source is AMECO (annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs). Some additional statistical information has been collected from the Eurostat, OECD Statistics and World Bank Data. The appendix A provides the details on the variables definition. The period of analysis uses 20 annual observations for each country, except for Bulgaria, Croatia, Lithuania, Latvia, where the data are available only from 1996 onwards. We consider that the span of time is long enough to accommodate the assumptions of the model.

We can start our empirical analysis by just looking at some basic data trying to detect important tendencies that describe differences between the 11 transition economies and the EU(28) countries. Most of all our interest falls on the relation between the growth performance and the current account position of these two groups of countries. This relation or historical tendencies can shed light on the basic idea of Thirlwall´s Law that a country can fall into the balance of payments constrained growth trap when it grows at a higher rates at the cost of accumulating external imbalances, mostly on current account deficits.

Figure 1, plots the annual data on the average GDP growth of the 28 European Union countries and the 11 transition economies of our sample, from 1995 to 2014. The first observation to make is that the transition economies, on average, grew at a higher rate than the EU(28), and this is an expected result. This higher growth rate is mostly explained by the catching-up effect, since all these countries started from a much lower GDP per capita level in comparison with the more advanced EU countries. Another explanation is the structural funds these countries benefited as members of the EU group, that helped them to improve their economic performance and implement structural changes in infrastructure networks. Foreign direct investment attracted by lower labor cost and well trained labor force, as well as, corporate tax facilities contributed significantly to this higher growth (Soukiazis, Muchova, 2012). Another remark to make is that the international financial crisis started in the end of 2007 deeply hit the transition economies more than the EU(28), but the former countries managed to recover quickly and follow a moderate growth path in the post crisis period, but still higher than the EU(28) countries.

Figure 1. Average Real GDP growth of the EU(28) and the Transition(11) countries

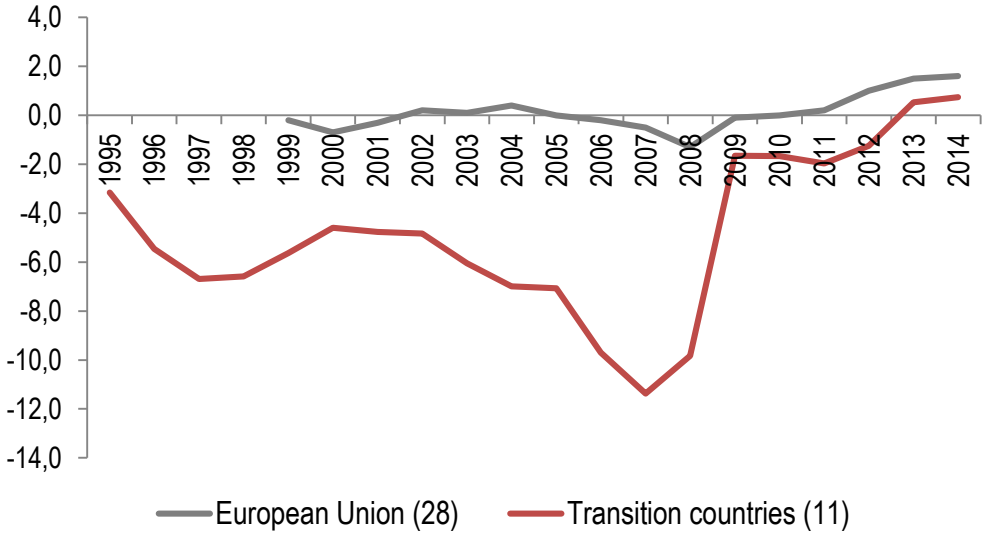


Source: AMECO
Transition countries: Bulgaria, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia, Slovakia.

Figure 2 presents the current account data as a percentage of GDP for the two groups of countries, the EU(28) and the 11 transition economies. As it can be seen the latter experienced higher current account deficits especially up to 2008, but after the international financial crisis and the implementation of austerity measures in all Europe the current

account deficit reduced drastically and turned into a surplus in the last two years of our analysis. If we compare the data on the growth performance of Figure 1 and the current account tendency of Figure 2, at least up to the financial crisis in 2008, we can observe that the higher economic growth of the transition economies is accompanied by higher deficits in current account, but in the post crisis period the moderate economic growth is accompanied by a positive performance in external deficits due mostly to a weak economic growth in all Europe. This is to say that the adjustment of current account is made at the cost of lower growth and this can put into question the catching-up process started in the 90´s. Calculating the coefficient of correlation between the growth rate of GDP and the current account (as percentage of GDP) for the 11 transition countries (Slovakia -0.44, Czech Republic -0.19, Poland -0.10, Hungary -0.47, Lithuania -0.50, Latvia -0.71, Estonia -0.53, Slovenia -0.51, Bulgaria -0.46, Romania -0.33, Croatia -0.31) in all cases the relation is negative confirming therefore the idea that on average, a higher economic expansion in the transition countries is achieved at the expense of higher external deficits that in the long-term could constrain demand and thus economic growth.

Figure 2. Average current account as percentage of GDP for the EU(28) and Transition(11) countries



Source: AMECO
Transition countries: Bulgaria, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia, Slovakia.

4. Estimation of the import and export demand functions

To compute Thirlwall´s model given by equations (8) or (9), we need to estimate the export and import demand functions that are specified as follows:

$$x_t = \beta + \varepsilon(z_t) + \eta(rp_t) + v_t \quad (10)$$

The growth of real exports is a function of the growth of real foreign income z_t (the average GDP growth of the EU(28)) and the growth of relative prices rp_t, defined as the difference between the growth of export and import prices. It is expected that a higher growth of foreign income stimulates the growth of domestic exports and that relative prices have a negative impact on exports, therefore $\varepsilon > 0$ and $\eta < 0$.

Analogously, the import demand function is defined as:

$$m_t = a + \pi(y_t) + \psi(rp_t) + \omega_t \quad (11)$$

The growth of real imports is a function of the growth of domestic income y_t and the growth of relative prices rp_t. It is expected that the growth of imports is positively related to both, the growth of domestic income and the growth of relative prices, therefore $\pi > 0$ and $\psi > 0$.

The exports demand functions can be estimated by OLS since foreign income and relative prices are assumed to be exogenous, and the regression results are shown in Table 1 for each of the 11 transition economies. As it can be seen all foreign income elasticities are statistically significant at the highest probability level (99%) and all carry their expected positive sign with a value higher than 2. It must be noticed that according to Thirlwall´s Law these elasticities capture the non-price competitiveness of the exported goods associated with quality, design, product differentiation, among other supply characteristics of the produced goods. Although the majority of the price elasticities carry the expected negative sign, their statistical significance is weak. Only two out of eleven of these elasticities are statistically significant at the conventional probability level. This is in line with the original proposition of Thirlwall´s Law that international relative prices are neutral in the long-term, and that what matters in international trade is the non-price competitiveness.

The imports demand functions are estimated by 2SLS to obtain consistent estimates[2], since as it is shown by the Hausman test in Table 2, domestic income cannot be treated as exogenous explanatory variable in these equations. Through the Sargan test the instruments used (the growth of consumption, investment and exports) are valid at the 5% significance level and they are not weak as it shown by the F-test. As it can be seen, the income elasticities of the demand for imports are all highly significant at the 1% level and all carry their expected positive sign with value greater than 2. As in the case of imports, the price elasticities are not statistically significant in almost all cases, and this is in line with Thirlwall´s proposition that in the long-term is income that adjusts to bring the economy into equilibrium and not relative prices.

[2] Bairam (1988), Atesoglu (1993; 1995), Léon-Ledesma (1999) and Soukiazis and P.A. Cerqueira (2012) also applied this estimation approach in previous studies, and the latter showed that the income elasticity of the demand for imports in Portugal is underestimated if OLS is used.

Table 1. OLS regression results from the export demand functions , 1995 - 2014

	BG	CZ	EE	HR	HU	LT	LV	PL	RO	SI	SK
z_t	3.2805***	2.9409***	4.8264***	2.5763***	4.9069***	3.9861***	3.6074***	2.2946***	2.3776***	2.9244***	3.0656***
	(3.575)	(3.779)	(4.332)	(3.854)	(4.479)	(2.993)	(5.129)	(2.910)	(3.116)	(6.490)	(3.261)
rp_t	-0.1733**	-0.8686	-1.2538	0.0039	2.2648	-0.2043	-0.5899	-0.5875	-0.0667	-0.9240**	0.4191
	(-2.316)	(-1.411)	(-1.161)	(0.004)	(1.401)	(-0.2336)	(-1.137)	(-1.012)	(-1.539)	(-2.232)	(0.467)
Observations	18	20	20	19	20	19	19	20	20	20	20
R-squared	0.817	0.526	0.525	0.484	0.543	0.415	0.617	0.437	0.399	0.796	0.409
F	20.88	9.42	9.38	7.50	10.11	3.79	13.71	6.58	5.65	33.14	5.88
p-value	[0.000]	[0.001]	[0.002]	[0.005]	[0.001]	[0.032]	[0.000]	[0.008]	[0.013]	[0.000]	[0.011]
Autocorrelation	$\chi^2 = 1.295$	$\chi^2 = 0.559$	$\chi^2 = 0.200$	$\chi^2 = 0.990$	$\chi^2 = 0.005$	$\chi^2 = 2.121$	$\chi^2 = 0.973$	$\chi^2 = 2.674$	$\chi^2 = 0.000$	$\chi^2 = 1.735$	$\chi^2 = 3.508$
p-value	[0.255]	[0.455]	[0.655]	[0.320]	[0.941]	[0.145]	[0.324]	[0.102]	[0.990]	[0.188]	[0.061]

Table 2. 2SLS regression results from the import demand functions, 1995 - 2014

	BG	CZ	EE	HR	HU	LT	LV	PL	RO	SI	SK
y_t	3.252***	2.3946***	2.6780***	2.9078***	3.6050***	2.3340***	2.6997***	5.3409***	2.5811***	2.1688***	2.9165***
	(2.870)	(2.622)	(7.402)	(5.542)	(5.288)	(3.200)	(7.493)	(6.128)	(4.101)	(10.230)	(6.019)
rp_t	-0.0103	-2.2174	-4.5077**	-0.6000	1.2789	-2.4363	1.3619	-0.7975	0.0536	-0.3632	-0.0281
	(-0.047)	(-0.875)	(-2.450)	(-0.449)	(0.963)	(-0.958)	(2.723)	(-1.356)	(0.694)	(-1.035)	(-0.035)
Observations	19	20	20	19	18	19	19	20	20	20	20
R-squared	0.283	0.431	0.782	0.668	0.634	0.311	0.796	0.678	0.396	0.862	0.676
F	3.81	4.82	31.18	19.48	13.98	5.87	20.43	20.52	8.42	56.48	12.23
p-value	[0.033]	[0.015]	[0.000]	[0.000]	[0.000]	[0.012]	[0.000]	[0.000]	[0.003]	[0.000]	[0.000]
Endogeneity test[a]	$\chi^2 = 213.1$	$\chi^2 = 72.88$	$\chi^2 = 43.59$	$\chi^2 = 69.08$	$\chi^2 = 18.09$	$\chi^2 = 10.81$	$\chi^2 = 13.07$	$\chi^2 = 22.31$	$\chi^2 = 27.64$	$\chi^2 = 33.09$	$\chi^2 = 36.54$
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.004]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sargan statistic	$\chi^2 = 0.904$	$\chi^2 = 0.523$	$\chi^2 = 0.185$	$\chi^2 = 1.768$	$\chi^2 = 5.447$	$\chi^2 = 3.655$	$\chi^2 = 5.867$	$\chi^2 = 5.191$	$\chi^2 = 5.521$	$\chi^2 = 0.995$	$\chi^2 = 1.950$
p-value	[0.9043]	[0.4695]	[0.6673]	[0.4131]	[0.0656]	[0.0558]	[0.0532]	[0.0746]	[0.0632]	[0.6081]	[0.3772]
Weak instruments	$F_{(3,15)} = 3.24$	$F_{(3,14)} = 11.22$	$F_{(3,14)} = 27.33$	$F_{(3,14)} = 39.07$	$F_{(3,13)} = 11.22$	$F_{(3,14)} = 11.35$	$F_{(3,15)} = 30.30$	$F_{(3,15)} = 28.28$	$F_{(3,15)} = 20.20$	$F_{(3,15)} = 147.2$	$F_{(4,15)} = 28.60$

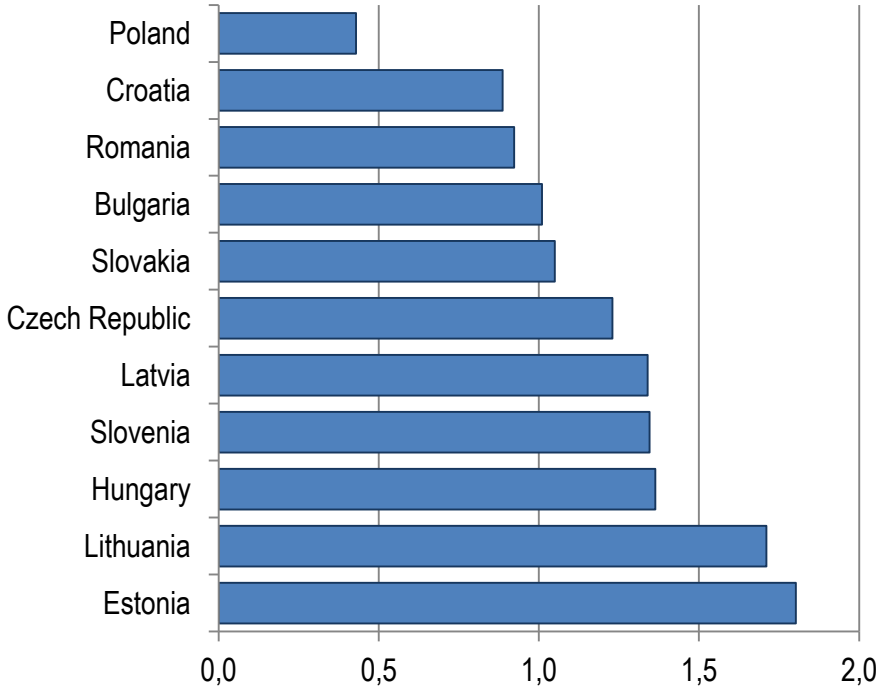
Source: AMECO

Notes: BG – Bulgaria, CZ – Czech Republic, EE – Estonia, HR – Croatia, HU – Hungary, LT – Lithuania, LV – Latvia, PL – Poland, RO – Romania, SI – Slovenia, SK – Slovakia
Numbers in parenthesis are t-ratio and in square brackets are p-values.
(***),(**),(*) Coefficient significant at the 1 %, 5% and 10% level, respectively

[a] y_t is the endogenous regressor and the growth of consumption, investment and exports are used as instruments in the 2SLS estimation approach.

In international trade, it is important that the income elasticity of the demand of exports exceeds that for imports for an economy to grow faster without disturbing the balance of payments equilibrium. Chart 1 shows the ratio of these two elasticities ε/π for each of the 11 transition economies and the EU(12) average. In most cases this ratio exceeds 1 except for Poland, Croatia and Romania, as a result of the income elasticity of the demand for imports being higher than that of exports. This can be taken as evidence of low non-price competiveness in these three countries, that in the long-term can induce external deficits and lower economic growth. Latvia, Lithuania and Estonia on the other hand are the transition economies with the highest ratio of the trade elasticities, being therefore in a privilege position to grow faster without harming the balance of payments position.

Chart 1. The ε/π ratio in Central and Eastern European countries

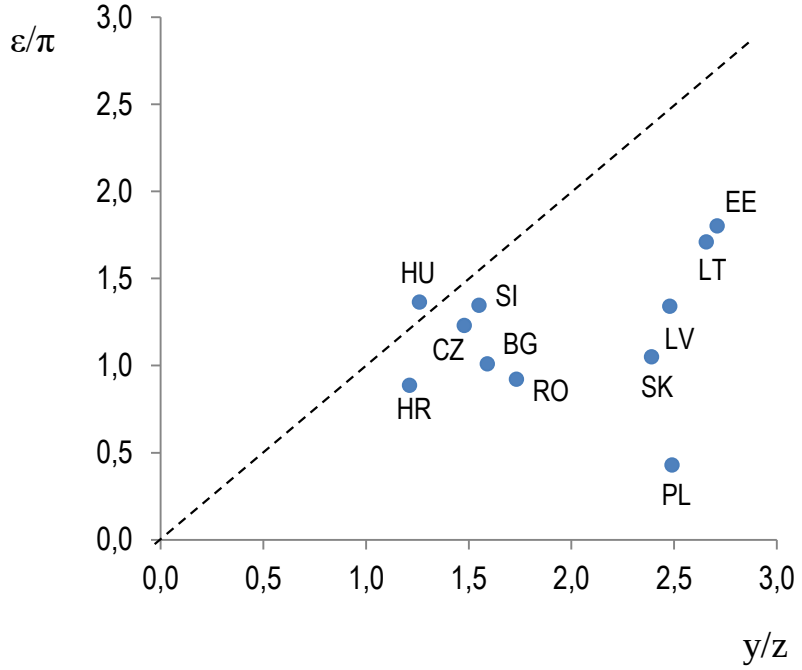


Source: own calculations

Some empirical studies in the relevant literature have found a positive relationship between the growth rates and the income elasticity ratio ε/π (Caporale and Chui, 1999; Krugman, 1989). According to Krugman, the country growing relatively faster should have a relatively higher income elasticity of exports than for imports, and this became known as the ”45-degree rule”. As we explained before, equation (8) has an alternative interpretation determining the relative growth rate between a country and the rest of the world, that is,

$y^*_{BP,t}/z_t = \varepsilon/\pi$. According to this, a country will grow faster than its partners when its income elasticity of the demand of exports is exceeding its income elasticity of the demand for imports, $\varepsilon > \pi$. This relationship is illustrated in Chart 2 (with the 45-degree line), where the income elasticities ratio of the 11 transition economies is plotted against the growth ratio of each country relatively to the EU(28) average. The positive relation is confirmed in this special case, the exception being Poland, Croatia and Bulgaria behaving as outliers. The Baltic countries managed to grow at a higher rate than the EU countries since they report a higher non-price competitiveness ratio. The average growth ratio of the 11 transition economies relatively to the EU(28) or relatively to the EU(12) is 1.69 and 1.44, respectively.

Chart 2. The relationship between the non-price competiveness, ratio ε/π and the relative growth ratio y/z, in transition economies.



Source: AMECO, own calculations
Note: BG – Bulgaria, CZ – Czech Republic, EE – Estonia, HR – Croatia, HU – Hungary, LT – Lithuania, LV – Latvia, PL – Poland, RO – Romania, SI – Slovenia, SK – Slovakia

5. The computation of the Balance-of-Payments equilibrium growth rate

After estimating the export and import demand functions, obtaining the trade elasticities which reflect the non-price competitiveness, we are able to compute the growth rate consistent with the Balance-of-Payments equilibrium and compare it with the actual growth

rate over the period 1995-2014. The expressions (8) and (9) can be used to compute Thirlwall´s Law, and check how close this Law predicts the actual growth achieved in the transition economies considered in our sample.

Table 3, shows these results where *y* is actual growth, *x* the growth of real exports, π and ε the income elasticities of the demand for imports and exports taken from Table 1 and 2, y_{BP}^{*} is the growth rate computed by expression (8), as the ratio of the export growth to the income elasticity of the demand for imports (x/π), y_{BP}^{**} is the growth rate computed by the alternative version of Thirlwall´s Law, given by the ratio of the trade elasticities multiplied by foreign demand $(\varepsilon.z)/\pi$. Column (7) of Table 3 also reports the difference between the balance of payments equilibrium growth rate and actual growth, y_{BP}-y, and the last column (8) presents the average rate of the current account for each country.

As it can been seen from Table 3, the average annual growth rates of domestic income in many countries for the whole period, column (1), is higher than the average growth rate consistent with the Balance-of-Payments equilibrium, columns (5) and (6), obtained by using the expressions (8) and (9), respectively. Expression (9) is our preferable one since it uses structural parameters, that is, the trade elasticities taken from the estimation of the import and export demand functions (see Tables 1 and 2). Considering this case, the difference between the growth rate computed by Thirlwall´s Law and actual growth is negative except for Hungary (see column (7)). This reveals that the majority of the transition economies grew at a faster rate than that allowed by the balance-of-payments equilibrium, at the expense of having external trade deficits on current account (see last column of Table 3). According to the balance of payments constraint hypothesis, soon or later these countries will face difficulties in financing the external imbalances, which would imply a contraction on demand and therefore on growth. In order to avoid these implications, countries must increase the income elasticity of the demand of exports by turning their exports more competitive in international markets, but most importantly should reduce the import elasticity of the demand for imports by turning domestic products most attractive in the domestic market and reduce the appetite for imports.

Finally, it can been seen from Table 3, that the simple Thirlwall´s model given by equation (9) predicts better actual growth in these countries since the average error of the difference

between the balance of payments equilibrium growth rate and actual growth rate is smaller (-0.387) that that obtained by using equation (8), (-1.302).

Table 3. The Balance-of-Payments equilibrium growth rate for the transition economies, 1995 – 2014.

Countries	(1) y	(2) x	(3) π	(4) ε	(5) $y_{BP}^* = x/\pi$	(6) $y_{BP}^{**} = (\varepsilon.z)/\pi$	(7) $y_{BP} - y$	(8) ca
Bulgaria	***2.69***	4.95	3.25		*1.52*		-1.17	-7.10
				3.28		***1.70***	-0.99	
Czech Republic	***2.50***	9.14	2.39		*3.82*		1.32	-3.71
				2.94		***2.08***	-0.42	
Estonia	***4.58***	9.63	2.68		***3.59***		-0.99	-6.81
				4.83		*3.05*	-1.53	
Croatia	***2.05***	4.87	2.91		***1.67***		-0.38	-3.82
				2.58		*1.50*	-0.55	
Hungary	***2.13***	12.4	3.60		*3.43*		1.30	-4.12
				4.91		***2.30***	0.17	
Lithuania	***4.49***	9.67	2.33		*4.15*		-0.34	-6.29
				3.99		*2.89*	-1.60	
Latvia	***4.19***	7.85	2.70		***2.91***		-1.28	-7.40
				3.61		*2.26*	-1.93	
Poland	***4.21***	9.02	5.34		***1.69***		-2.52	-3.40
				2.29		*0.72*	-3.49	
Romania	***2.93***	9.52	2.58		***3.69***		0.76	-5.81
				2.38		*1.56*	-1.37	
Slovenia	***2.62***	6.12	2.17		***2.82***		0.20	-0.92
				2.92		*2.27*	-0.35	
Slovakia	***4.04***	8.41	2.92		***2.88***		-1.16	-4.82
				3.07		*1.78*	-2.26	
						Average Error (y_{BP}^*-y) = ***-0.387***; *Average Error* (y_{BP}^{**}-y) = ***-1.302***		

Note: y - growth of real GDP, *x* - growth of real exports, *z* - growth of real GDP of the EU(28), *ca* – current account, ε - income elasticity of demand of exports (taken from Table 1), and π - income elasticity of demand for imports (taken from Table 2).
Source: AMECO and own calculations

6. The Multi-sector version of Balance-of-Payments constrained growth.

This part of the study shows how changes in the sectoral composition of exports and imports affect the balance of payments equilibrium growth rate. Therefore, Thirlwall´s aggregate

model can be modified to take into account the sectoral product specialization of the economy that affects the non-price competitiveness of the produced goods. This idea is associated with earlier studies by Pasinetti (1981; 1993) on Structural Economic Dynamics, that changes in the production structure systematically affect the pace of economic growth. Moving from the production of low elasticity of demand to high elasticity of demand is the way of boosting economic growth due to differences in sectoral income elasticities (Gouvea, Lima, 2010). In the same line of thought, Araújo and Lima (2007) developed a multi-sector version of the balance-of-payments equilibrium growth rate, in contrast to the aggregate Thirlwall´s model (henceforth ATL) where no importance is given to the sectoral decomposition of the traded products. The latter approach is known as the multi-sector version of Thirlwall´s Law (henceforth MSTL).

The MSTL model is disaggregated to allow for the existence of different sectors that have different income elasticities of demand for exports and imports. The main advantage of this approach is that it allows for the identification of key strategic sectors of the economy that could influence positively the pace of economic growth (Araújo, Lima, 2007).

In a multi-sector economy, the import and export functions (equations (3) and (2) of the ATL model) can be written as follows:

$$M_j = b_j \left(\frac{P_{fj} E}{P_{dj}} \right)^{\psi_j} Y^{\pi_j} \tag{12}$$

$$X_i = a_i \left(\frac{P_{di}}{P_{fi} E} \right)^{\eta_i} Z^{\varepsilon_i} \tag{13}$$

In this economy we assume *j* sectors in imports and *i* sectors in exports, and that each sector has its own income and price elasticity of the demand for imports and exports, respectively. Assuming that relative prices are constant in the long-term (the standard proposition of Thirlwall´s Law) and taking growth rates in variables, the above equations take the following simple form:

$$m_j = \pi_j y \tag{14}$$

$$x_i = \varepsilon_i z \tag{15}$$

Aggregate imports and exports in growth rates can be defined as:

$$m = \sum_{j=1}^{k} \omega_{mj}\, m_j \tag{16}$$

$$x = \sum_{i=1}^{l} \omega_{xi}\, x_i \tag{17}$$

where ω_{mj} and ω_{xi} denote the share of the j^{th} and i^{th} sector in total imports and exports, respectively. Substituting equations (14) and (15) into the expressions for aggregate real imports and exports (equations (16) and (17)) we get:

$$m = y \sum_{j=1}^{k} \omega_{mj}\, \pi_j \tag{18}$$

$$x = z \sum_{i=1}^{l} \omega_{xi}\, \varepsilon_i \tag{19}$$

Based on the assumption that the balance of payments (on current account) is in equilibrium, that is

$$x = m \tag{20}$$

and substituting expressions (18) and (19) into (20), we get

$$y \sum_{j=1}^{k} \omega_{mj}\, \pi_j = z \sum_{i=1}^{l} \omega_{xi}\, \varepsilon_i \tag{21}$$

Finally, solving for *y* yields:

$$y = \frac{\sum_{i=1}^{l} \omega_{xi}\ \varepsilon_i}{\sum_{j=1}^{k} \omega_{mj}\, \pi_j}\ z \tag{22}$$

Equation (22) is the multi-sector version of Thirlwall´s Law where *z* is the growth of foreign income, ε_i is the income elasticity of demand for exports of sector *i*, π_j is the income elasticity of the demand for imports of sector *j*, ω_{xi} is the share of sector *i* in total exports, and ω_{mj} is the share of sector *j* in total imports. Equation (22), which is based on the MSTL model, will be tested for the 11 transition economies in the following sections.

7. The sectoral structure of exports and imports

The close relationship between technological capabilities and international competitiveness is generally accepted in world trade, where products are classified by their technological intensity (Lall, 2000). To analyze this relationship we use the product classification of the World Bank, originally created by Lall (2000). This indicator gives a percentage breakdown of a country's exports (imports) according to five broad technological categories embodied in the final products. These categories are: high tech, medium tech, low tech, resource-based, and primary products. The product classification is made by the following formula:

$$100 * \sum_{k \in \Omega_{tec}} \frac{x_{ijk}}{X_{ij}}, \quad \forall\, tec \in [HT, MT, LT, PP, RB] \qquad (23)$$

where *x* is the value of exports of sector *k* from country *i* to partner *j*, and X is the total value of all exports of *i* to *j*. Ω_{tec} is the set of all products in mutually exclusive categories: High-Tech (*HT*), Medium-Tech (*MT*), Low-Tech (*LT*), Primary Products (*PP*), and Resource-based (*RB*). The same formula is used for imports (World Bank, 2013).

Trade data of this nature come from the United Nations, Commodity Trade Statistics Database (COMTRADE), and are classified on the basis of the most commonly classification used, known as the Standard International Trade Classification - SITC Revision 3, defined according to their technological intensity. Using the SITC classification, Tables 4 and 5 report the shares of these five large categories in total exports and imports, respectively, for the 11 transition economies as a whole, considering the first and last years of the time span used in our sample. Individual country data of the same nature are given in Table 9 (Appendix B) and Table 10 (Appendix C) in order to better understand differences between countries on trade specialization.

In general terms, as it can been seen from Table 4, the exports share of primary goods, resource-based goods and low technology goods has been reduced substantially, from 1994 to 2014, while the share of Medium and High technology exports has increased at a greater extent. Interestingly, the share of High technology exports has more than doubled over the considered period. Trade liberalization and higher integration in the EU endorsed these countries to allocate productive resources from the low-tech to high-tech sectors. As Cimoli et al., (2010) argue, it is reasonable to expect that an economy with a higher participation of

technology-intensive sectors would be more able to react and exploit trade opportunities arising from changes in world demand.

Table 4. Technological content in total exports for 11 countries

Products	1995 (mil. $)	2014 (mil. $)	**1995**	**2014**
All products	85 176	719 948	100%	100%
Primary products	9 223	61 812	11%	9%
Resource based	19 191	126 402	23%	18%
Low technology	28 558	142 084	34%	20%
Medium technology	22 294	275 265	26%	38%
High technology	5 909	114 386	7%	16%

Source: COMTRADE, own calculations

On the other hand, from Table 5 it can be seen that the sectoral structure of imports has not changed substancialy as in the case of exports. The expected reduction in primary, resource -based and low technology imported products is modest (only 2 percentual points in each case), and the share of Medium technology imported goods didn´t change at all. As expected the share of High technology imported goods increased substancialy (5 percentual points). Therefore, the most significant change in the structure of imports and exports occurred in the high technology products.

Table 5. Technological content in total imports for 11 countries

Products	1995 (mil. $)	2014 (mil. $)	**1995**	**2014**
All products	102 994	681 775	100%	100%
Primary products	17 246	99 901	17%	15%
Resource based	17 436	105 658	17%	15%
Low technology	21 747	132 774	21%	19%
Medium technology	34 068	225 810	33%	33%
High technology	12 498	117 631	12%	17%

Source: COMTRADE, own calculations

At the country level (see Appendix B and C), the most significant changes on high-tech products observed in Slovakia, Czech Republic and Hungary, both in import and export shares. These three transition countries managed to reallocate resources from the low-tech to the high-tech sectors and trade on these kind of products.

8. The multi-sector Balance-of-Payments equilibrium growth rate

In order to compute the balance of payments equilibrium growth rate at a sectoral level, equation (22), we need to estimate the income elasticities of the demand for exports and imports of the above explained five basic sectors. The exports and imports equations by each category are estimated by OLS and the results are given in Tables 6 and 7, respectively. In these tables, ω_{xi} is the average share of sector *i* in total exports, ε_i is the income elasticity of demand for exports of sector *i*, ω_{mj} is the average share of sector *j* in total imports, and π_j is the income elasticity of demand for imports of sector *j*.

As it is shown, all sectoral income elasticities are statistically significant at least at the 10% level, and as expected their values are much smaller than the aggregate elasticities of Tables 1 and 2. One generalization that can be made, is that the income elasticity of the demand for exports for the high-tech products is higher in the majority of countries, and the resource-based products register a lower elasticity of demand in export markets. This can be taken as evidence that the transition economies are specializing mostly in the production of tradable goods with high elasticity of demand in international markets and products with higher technology content. This is an encouraging evidence that could boost economic growth in the long-term horizon. Regarding imports, we are not able to find any perceptible regularity.

Table 6. Estimated income elasticities of exports for each sector and sector shares, 1995 - 2014

	BG		CZ		EE		HR		HU		LT		LV		PL		RO		SI		SK	
	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i	w_{xi}	ε_i
HT	*0.06*	.063***	*0.17*	.106***	*0.17*	.087*	*0.09*	.025*	*0.27*	.084*	*0.06*	.040*	*0.07*	.061**	*0.10*	.061***	*0.07*	.076**	*0.10*	.036**	*0.13*	.115***
		(2.933)		(3.518)		(1.823)		(1.857)		(2.019)		(2.088)		(2.628)		(3.567)		(2.182)		(2.295)		(-3.762)
LT	*0.28*	.048**	*0.25*	0.048**	*0.23*	.039**	*0.25*	.045**	*0.15*	.039***	*0.21*	.046***	*0.27*	.054**	*0.28*	.044**	*0.38*	.054***	*0.27*	.055***	*0.25*	.047*
		(2.665)		(2.356)		(2.395)		(2.366)		(3.653)		(3.578)		(2.657)		(2.726)		(3.391)		(3.860)		(2.055)
MT	*0.17*	.058***	*0.39*	.057**	*0.20*	.047*	*0.29*	.107***	*0.37*	.069**	*0.25*	.054*	*0.13*	.056**	*0.35*	.060***	*0.27*	.054**	*0.39*	.052***	*0.39*	.090***
		(2.953)		(2.728)		(1.971)		(2.963)		(2.256)		(2.084)		(2.739)		(3.307)		(2.554)		(3.276)		(3.724)
PP	*0.22*	.061**	*0.05*	.053***	*0.10*	.058**	*0.08*	.038***	*0.07*	.052**	*0.12*	.056**	*0.12*	.027*	*0.10*	.045**	*0.08*	.054*	*0.08*	.069***	*0.05*	.043*
		(2.175)		(3.101)		(2.671)		(2.907)		(2.256)		(2.757)		(2.021)		(2.812)		(1.865)		(2.965)		(1.772)
RB	*0.27*	.062*	*0.13*	.047**	*0.31*	.047*	*0.29*	.044**	*0.14*	.039*	*0.36*	.049*	*0.41*	.035**	*0.18*	.039**	*0.20*	.060**	*0.16*	.039**	*0.18*	.039**
		(2.049)		(2.306)		(1.827)		(2.156)		(2.082)		(2.007)		(2.607)		(2.435)		(2.672)		(2.582)		(-2.438)

Table 7. Estimated income elasticities of imports for each sector and sector shares, 1995 - 2014

	BG		CZ		EE		HR		HU		LT		LV		PL		RO		SI		SK	
	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j	w_{mj}	π_j
HT	*0.11*	.027**	*0.20*	.049***	*0.16*	.020*	*0.10*	.034***	*0.26*	.043*	*0.09*	.029***	*0.11*	.016**	*0.14*	.073***	*0.13*	.017*	*0.10*	.032***	*0.17*	.051***
		(2.318)		(3.836)		(1.979)		(3.956)		(1.984)		(3.918)		(2.687)		(4.971)		(1.914)		(4.034)		(3.553)
LT	*0.21*	.034***	*0.22*	.052***	*0.19*	.020***	*0.22*	.034***	*0.18*	.033***	*0.16*	.029***	*0.21*	.021***	*0.20*	.062***	*0.24*	.028***	*0.22*	.030***	*0.20*	.038***
		(4.462)		(3.108)		(4.598)		(4.951)		(3.685)		(7.577)		(4.227)		(3.359)		(4.388)		(3.839)		(4.480)
MT	*0.32*	.030**	*0.33*	.046***	*0.30*	.029***	*0.32*	.044***	*0.35*	.043***	*0.32*	.034***	*0.31*	.029***	*0.36*	.064***	*0.34*	.042***	*0.34*	.037***	*0.36*	.042***
		(2.502)		(3.798)		(5.242)		(6.484)		(4.127)		(4978)		(3.692)		(3.005)		(5.281)		(4.251)		(5.648)
PP	*0.18*	.077*	*0.11*	.052***	*0.08*	.009**	*0.19*	.019*	*0.10*	.046**	*0.28*	.033*	*0.10*	.016**	*0.16*	.076***	*0.14*	.038***	*0.10*	.025**	*0.13*	0.026*
		(2.056)		(4.949)		(2.474)		(1.947)		(2.597)		(1.905)		(2.450)		(3.272)		(5.578)		(2.132)		(2.106)
RB	*0.18*	.045***	*0.13*	.036**	*0.27*	.025***	*0.17*	.031***	*0.12*	.033***	*0.15*	.022***	*0.27*	.014***	*0.14*	.072***	*0.15*	.038***	*0.23*	.025**	*0.14*	.032***
		(5.737)		(2.157)		(3.524)		(3.693)		(3.814)		(3.599)		(3.648)		(3.751)		(4.714)		(2.306)		(4.262)

Source: AMECO

Notes: BG – Bulgaria, CZ – Czech Republic, EE – Estonia, HR – Croatia, HU – Hungary, LT – Lithuania, LV – Latvia, PL – Poland, RO – Romania, SI – Slovenia, SK – Slovakia
HT – high-tech, LT – low-tech, MT – medium-tech, PP – primary products, RB – resource-based
Numbers in parenthesis are t-ratio.
(***),(**),(*) Coefficient significant at the 1 %, 5% and 10% level, respectively

Having estimated the income elasticities of exports and imports at a multi-sector level, the multi-sector balance of payments equilibrium growth rate can be determined, and the results are shown in Table 8. For comparison, the results of Table 3, where the aggregate Thirlwall´s model is estimated, are also replicated in Table 8. As it is shown, the multi-sector Thirlwall´s model better predicts actual growth in these transition economies, since the absolute error (-0.559) is smaller than that found when equation (8) is used (-1.302) and it is closer to that found (-0.387) when equation (9) is used to calculate the difference between the balance of payments equilibrium growth and actual growth. It is shown again, that almost all countries (except Hungary and Slovenia) grew at a higher rate than that allowed by the multi-sector Balance-of-Payments growth rate, and this is consistent with the current account deficits registered over the considered period. Therefore, structural changes at the production level make difference in the growth process, since they have different demand elasticities in international markets, and must be taken into account in the long-term growth analysis.

Table 8. The Balance-of-Payments equilibrium growth rate at the aggregate and multi-sector levels, 1995 – 2014.

Countries		Aggregate Thirlwall´s Model		Multi-sector Thirlwall´s Model	Absolute Error	
	y	y_{BP}*	y_{BP}**	$y_{BP}^{\#} = (\sum w_{xi}.\varepsilon_i / \sum w_{mi}.\pi_i)$. z	$y_{BP}^{\#}$ - y	ca
Bulgaria	2.69	1.52	1.70	***2.33***	-0.36	-7.10
Czech Republic	2.50	3.82	2.08	***2.21***	-0.29	-3.71
Estonia	4.58	3.59	3.05	***3.86***	-0.72	-6.81
Croatia	2.05	1.67	1.50	***3.02***	0.97	-3.82
Hungary	2.13	3.43	2.30	***2.66***	0.53	-4.12
Lithuania	4.49	4.15	2.89	***2.76***	-1.73	-6.29
Latvia	4.19	2.91	2.26	***3.60***	-0.59	-7.40
Poland	4.21	1.69	0.72	***1.25***	-2.96	-3.40
Romania	2.93	3.69	1.56	***2.79***	-0.14	-5.81
Slovenia	2.62	2.82	2.27	***2.76***	0.14	-0.92
Slovakia	4.04	2.88	1.78	***3.04***	-1.00	-4.82
Average Error	*(y_{BP}*-y)=-0.387*		*(y_{BP}**-y)=-1.302*		($y_{BP}^{\#}$-y) = ***-0.559***	

Source: AMECO and own calculations

Notes: y - growth of real GDP, *x* - growth of real exports, *z* – average growth of EU28, *ca* – current account, ε - income elasticity of total exports, π - income elasticity of total imports, ω_{xi} - the share of sector *i* in total exports, ε_i - the income elasticity of demand for exports of sector *i*, ω_{mj} - the share of sector *j* in total imports, and π_j - the income elasticity of demand for imports of sectors *j*.

In sum, the present study shows that the demand-orientated approach based on the Balance-of-Payments constraint hypothesis is suitable for explaining actual economic growth in the transition economies of the Central and Eastern Europe, over the period 1995 – 2014.

9. Concluding remarks

In this study a demand-led approach is used to explain economic growth in 11 transition economies of the Central and Eastern Europe for the period 1995-2014. The empirical analysis uses two main approaches based on the Balance-of-Payments constraint hypothesis: The aggregate and the multi-sector versions of the well-known Thirlwall´s Law. There is few empirical evidence in the literature on this issue considering the transition economies, and to our knowledge there is no evidence on predicting actual growth rates through the multi-sector analysis of the Balance-of-Payments constrained growth hypothesis. This study aims to fill this gap in the literature focusing on the special case of the transition economies.

Our empirical analysis shows that both versions of the Balance-of-Payments constrained growth hypothesis are suitable for explaining actual growth in the transition economies. In general terms it is shown that almost all countries grew at a higher actual growth rate than that allowed by the Balance-of-Payments equilibrium and this is consistent with the current account deficits observed during the period considered. The exception is Hungary and Slovenia. The interpretation of this result is that in the long-term the majority of the transition economies can fall into the Balance-of-Payments constrained growth trap if they continue to accumulate external deficits. As Bajo-Rubio and Diaz-Roldan (2009) argue, the sustainability of the external deficit appears to be a potential constraint on further output growth. The encouraging evidence is that data on current account shows a reduction in external imbalances (see Figure 2) after the international financial crisis in 2008, but this is due to the austerity measures in Europe which cannot last forever.

The multi-sectoral analysis provides evidence that different product categories have different income elasticities in imports and exports and that the income elasticity of the demand for exports of the high-tech products is higher in comparison to the products with lower embodied technology content. On the other hand, the structure of exports is changing in the transition economies, transferring resources from the low-tech to high-tech exported products and this structural change is more evident in the Baltic countries (Slovakia, Czech

Republic and Hungary). This is also an encouraging result for these countries, that could benefit a higher growth without falling into the Balance-of-Payments constrained growth trap, since these economies are specializing in products with high elasticity of demand in international trade. The empirical evidence in the literature according to Gouvea and Lima (2010) and Cimoli et al, (2010) suggests that high-tech products are more likely to display a higher income elasticity of demand in competitive markets.

The general policy recommendation for the transition economies to achieve higher growth rates without disturbing the Balance-of-Payments equilibrium (in current account) is to develop policies that would increase the income elasticity of the demand for exports both at the aggregate and the sectoral levels, by improving the supply characteristics of the produced goods (quality, design, product differentiation, high-tech content, etc.). At the same time they should develop policies able to reduce the import elasticity of the demand for imports by turning domestic production more attractive in the national market. Both policies are necessary to improve the non-price competitiveness of the economies, reflected in the ε/π ratio.

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Appendix A. List of variables

x – Annual growth rate of real exports
Exports of goods and services at 2010 prices (national currency; annual percentage change).

m – Annual growth rate of real imports
Imports of goods and services at 2010 prices (national currency; annual percentage change).

y – Annual growth rate of real GDP
GDP at 2010 market prices (national currency; annual percentage change).

c – Annual growth rate of real private consumption
Private final consumption expenditure at 2010 prices (national currency; annual percentage change).

i – Annual growth rate of real investment
Gross fixed capital formation at 2010 prices (national currency; annual percentage change).

px – Annual growth rate of export prices
Price deflator exports of goods and services (national currency; annual percentage change).

pm – Annual growth rate of import prices
Price deflator imports of goods and services (national currency; annual percentage change).

rp – Annual growth rate of the relative price of exports (*px* - *pm*).

ca – Balance on current transactions with the rest of the world (% of GDP at market prices).

z – Average annual growth rate of real GDP of EU28.

Appendix B. Table 9. The evolution of technological content in total exports

		HT	*LT*	*MT*	*PP*	*RB*
Slovakia	*1995 -1999*	0.06	0.31	0.34	0.07	0.22
	2000 - 2004	0.08	0.27	0.41	0.05	0.19
	2005 - 2009	0.18	0.22	0.40	0.05	0.16
	2010 - 2014	0.21	0.19	0.41	0.05	0.14
Czech Republic	*1995 -1999*	0.10	0.31	0.36	0.06	0.17
	2000 - 2004	0.17	0.25	0.39	0.04	0.14
	2005 - 2009	0.20	0.22	0.41	0.05	0.11
	2010 - 2014	0.22	0.21	0.41	0.05	0.11
Poland	*1995 -1999*	0.07	0.35	0.27	0.12	0.18
	2000 - 2004	0.09	0.29	0.37	0.09	0.17
	2005 - 2009	0.11	0.24	0.39	0.09	0.17
	2010 - 2014	0.12	0.22	0.36	0.10	0.19
Hungary	*1995 -1999*	0.17	0.21	0.32	0.10	0.19
	2000 - 2004	0.30	0.15	0.38	0.06	0.11
	2005 - 2009	0.33	0.11	0.39	0.06	0.11
	2010 - 2014	0.28	0.11	0.39	0.07	0.14
Lithuania	*1995 -1999*	0.06	0.23	0.24	0.14	0.32
	2000 - 2004	0.07	0.23	0.25	0.10	0.34
	2005 - 2009	0.07	0.19	0.25	0.12	0.37
	2010 - 2014	0.05	0.18	0.24	0.13	0.40
Latvia	*1995 -1999*	0.06	0.32	0.09	0.07	0.46
	2000 - 2004	0.04	0.32	0.09	0.10	0.46
	2005 - 2009	0.07	0.26	0.17	0.13	0.37
	2010 - 2014	0.10	0.20	0.17	0.17	0.36
Estonia	*1995 -1999*	0.13	0.26	0.17	0.11	0.33
	2000 - 2004	0.22	0.25	0.17	0.10	0.26
	2005 - 2009	0.15	0.21	0.23	0.08	0.33
	2010 - 2014	0.17	0.18	0.22	0.10	0.33
Slovenia	*1995 -1999*	0.09	0.32	0.36	0.06	0.17
	2000 - 2004	0.10	0.30	0.39	0.06	0.15
	2005 - 2009	0.10	0.25	0.42	0.09	0.14
	2010 - 2014	0.12	0.22	0.38	0.10	0.18
Bulgaria	*1995 -1999*	0.05	0.30	0.18	0.18	0.29
	2000 - 2004	0.05	0.37	0.16	0.18	0.24
	2005 - 2009	0.06	0.27	0.15	0.24	0.27
	2010 - 2014	0.07	0.19	0.17	0.28	0.29
Romania	*1995 -1999*	0.04	0.50	0.18	0.09	0.20
	2000 - 2004	0.07	0.47	0.19	0.07	0.20
	2005 - 2009	0.08	0.33	0.32	0.07	0.20
	2010 - 2014	0.10	0.23	0.39	0.09	0.19
Croatia	*1995 -1999*	0.07	0.29	0.29	0.07	0.28
	2000 - 2004	0.10	0.26	0.29	0.07	0.28
	2005 - 2009	0.10	0.22	0.30	0.08	0.30
	2010 - 2014	0.09	0.21	0.28	0.11	0.32

Source: World Bank, own calculations

Appendix C. Table 10. The evolution of technological content in total imports

		HT	*LT*	*MT*	*PP*	*RB*
Slovakia	*1995 -1999*	0.13	0.19	0.37	0.17	0.15
	2000 - 2004	0.13	0.21	0.39	0.13	0.14
	2005 - 2009	0.20	0.20	0.36	0.11	0.14
	2010 - 2014	0.22	0.19	0.34	0.11	0.14
Czech Republic	*1995 -1999*	0.16	0.22	0.36	0.12	0.14
	2000 - 2004	0.20	0.22	0.34	0.10	0.14
	2005 - 2009	0.21	0.22	0.32	0.11	0.13
	2010 - 2014	0.24	0.20	0.31	0.12	0.13
Poland	*1995 -1999*	0.13	0.20	0.37	0.15	0.14
	2000 - 2004	0.14	0.20	0.38	0.14	0.13
	2005 - 2009	0.15	0.20	0.36	0.16	0.14
	2010 - 2014	0.15	0.19	0.32	0.19	0.14
Hungary	*1995 -1999*	0.19	0.22	0.35	0.12	0.12
	2000 - 2004	0.29	0.18	0.36	0.07	0.10
	2005 - 2009	0.30	0.16	0.35	0.08	0.12
	2010 - 2014	0.26	0.14	0.33	0.13	0.13
Lithuania	*1995 -1999*	0.10	0.19	0.33	0.22	0.17
	2000 - 2004	0.10	0.17	0.35	0.25	0.12
	2005 - 2009	0.09	0.16	0.32	0.29	0.14
	2010 - 2014	0.07	0.13	0.27	0.36	0.16
Latvia	*1995 -1999*	0.11	0.21	0.30	0.11	0.27
	2000 - 2004	0.11	0.23	0.33	0.09	0.24
	2005 - 2009	0.10	0.20	0.32	0.09	0.28
	2010 - 2014	0.12	0.19	0.27	0.11	0.31
Estonia	*1995 -1999*	0.15	0.21	0.30	0.10	0.24
	2000 - 2004	0.19	0.20	0.32	0.09	0.20
	2005 - 2009	0.13	0.19	0.30	0.07	0.31
	2010 - 2014	0.17	0.16	0.27	0.08	0.32
Slovenia	*1995 -1999*	0.10	0.23	0.37	0.10	0.20
	2000 - 2004	0.11	0.24	0.35	0.09	0.21
	2005 - 2009	0.10	0.21	0.35	0.10	0.23
	2010 - 2014	0.10	0.19	0.31	0.12	0.29
Bulgaria	*1995 -1999*	0.10	0.20	0.27	0.26	0.17
	2000 - 2004	0.13	0.27	0.38	0.07	0.16
	2005 - 2009	0.10	0.21	0.35	0.17	0.17
	2010 - 2014	0.11	0.18	0.27	0.24	0.21
Romania	*1995 -1999*	0.11	0.24	0.33	0.15	0.16
	2000 - 2004	0.13	0.28	0.33	0.12	0.14
	2005 - 2009	0.12	0.23	0.37	0.14	0.14
	2010 - 2014	0.15	0.22	0.33	0.14	0.15
Croatia	*1995 -1999*	0.11	0.22	0.35	0.18	0.15
	2000 - 2004	0.11	0.22	0.35	0.17	0.15
	2005 - 2009	0.10	0.23	0.32	0.18	0.17
	2010 - 2014	0.10	0.22	0.25	0.22	0.21

Source: World Bank, own calculations