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Comparative Advantages in CEEC-5

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Abstract. The structure, geography, and organization of world trade have dramatically changed in the last decades with the emergence of new global competitors and the decline of old ones. Global Value Chains are probably the most prominent feature of this new landscape and the growth of these chains is posing new challenges to studies of international trade and countries' competitiveness. Some traditional measures may be of little use since they hinge on the assumption that all activities in the production of a good take place in the local economy, using domestic inputs only. Furthermore, export indexes based on gross flows become less meaningful as part of its value is made of imported inputs. Previous applied research uses a wide array of statistical tools to assess international specialization and trade performance but focuses is on Gross Exports. These analyses can be very misleading due to double counting of trade in intermediate inputs. This paper would like to shed light on the export structure and competitiveness in five Central and Eastern European Countries during 1995-2011. I assess which sectors enjoy a comparative advantage in 1995-2011 using Gross Exports and Value Added in Trade data. The sets of competitive industries are compared and discussed. There are some noticeable differences in these indicators in Hungary and Slovakia, while just a few in Romania and Bulgaria.

Keywords: international trade, comparative advantages, CEEC-5.

1 Introduction

This paper examines the export performance of some Central and Eastern European countries. It tries to shed light on their export competitiveness during the period 1995-2011 using the data provided by WIOD. Under free trade these countries should specialize in those goods and services they have a comparative advantage. From a theoretical point of view, this issue can be easily solved if we can observe the difference between autarkic and free trade relative prices (Deardorff 1980). Unfortunately, the former are usually unobservable and we must resort to ex post information. Indicators of competiveness should respect several criteria. First, they should address all the sectors exposed to international competition, i.e. the ones that produce the so-called "tradeables". Then, they should been based on data that are fully comparable at the international level. Due to lack of homogeneity, studies based on export prices are often confined to aggregate measures of manufacturing (Durand and Giorno 1987). Furthermore, for a quite large number of goods, such as commodities, prices tend to be determined at the world level rather than by local producers. To overcome these problems we adopt the customary Revealed Comparative Advantage approach initiated by Liesner (1958) and Balassa (1965), who adapted the location coefficient introduced by Hoover (1936) to international trade. We embrace several indicators for 35 sectors and deviate from standard analyses in two respects. First, we focus on sectors rather than goods reducing the dimensionality of the product space by far. Second, we take into account the profound changes in the geography of world trade with the emergence of the Global Value Chains. Hence, we move beyond standard measures based on Gross Exports to address indicators based on domestic value added generated by foreign final demand. This distinction is crucial, as within GVCs it is customary to offshore parts of production. Final goods may contain a large share of imported intermediate and competitiveness indicators based on Gross Exports may be completely misleading as they include output due to other producers. To bring these issues to the fore we embrace the Value Added in Trade approach. Only net flows can reveal actual international trade

as value added, not gross output, discloses domestic production. Another advantage of this approach is the straightforward extension to services. The latter are usually neglected, as these international flows are often unrecorded, even if it has been widely recognized the increasing importance of tertiary that has the largest share in GDP of all the most advanced countries. Excluding services from the analysis would fail to capture a fundamental contribution to export performance in these nations as domestically produced services are embodied even in foreign goods. Hence, it is interesting to check export competitiveness through the lens of domestic value added (Ceglowski 2015). The paper is organized as follows. Next section presents the dataset and the methodology. Then Section 3 shows which sectors are competitive in five Central and Eastern European countries: Bulgaria, the Czech Republic, Hungary, Romania, and Slovakia. Section 4 concludes.

2 Methodology and database

We adopt the world input–output model with N sectors and R countries. International IO tables follow the standard approach in multiregional analysis and can be represented by partitioned matrices and vectors (Miller and Blair 2006):

$$\boldsymbol{x} = \left(\mathbf{I} - \mathbf{A}\right)^{-1} \boldsymbol{y} = \mathbf{B}\sum_{i=1}^{R} \boldsymbol{f}^{i} \tag{1}$$

with:

$$\text{c}\ \boldsymbol{x} = \begin{bmatrix} \boldsymbol{x}^{1} \\ \vdots \\ \boldsymbol{x}^{c} \\ \vdots \\ \boldsymbol{x}^{R} \end{bmatrix}, \quad \mathbf{A} = \begin{bmatrix} \mathbf{A}^{11} & \cdots & \mathbf{A}^{1c} & \cdots & \mathbf{A}^{1R} \\ \vdots & & & & \\ \mathbf{A}^{c1} & \cdots & \mathbf{A}^{cc} & \cdots & \mathbf{A}^{cR} \\ \vdots & & & & \\ \mathbf{A}^{R1} & \cdots & \mathbf{A}^{Rc} & \cdots & \mathbf{A}^{RR} \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} \mathbf{B}^{11} & \cdots & \mathbf{B}^{1c} & \cdots & \mathbf{B}^{1R} \\ \vdots & & & & \\ \mathbf{B}^{c1} & \cdots & \mathbf{B}^{cc} & \cdots & \mathbf{B}^{cR} \\ \vdots & & & & \\ \mathbf{B}^{R1} & \cdots & \mathbf{B}^{Rc} & \cdots & \mathbf{B}^{RR} \end{bmatrix},$$

$$\boldsymbol{y} = \begin{bmatrix} \boldsymbol{y}^{11} \\ \vdots \\ \boldsymbol{y}^{c1} \\ \vdots \\ \boldsymbol{y}^{R1} \end{bmatrix} + \cdots + \begin{bmatrix} \boldsymbol{y}^{1c} \\ \vdots \\ \boldsymbol{y}^{cc} \\ \vdots \\ \boldsymbol{y}^{Rc} \end{bmatrix} + \cdots + \begin{bmatrix} \boldsymbol{y}^{1R} \\ \vdots \\ \boldsymbol{y}^{cR} \\ \vdots \\ \boldsymbol{y}^{RR} \end{bmatrix} = \boldsymbol{f}^{1} + \cdots + \boldsymbol{f}^{c} + \cdots + \boldsymbol{f}^{R}$$

where $\boldsymbol{f}^{c}$ is final demand in country c. Country c Gross Exports to country s are:

$$\boldsymbol{e}_{G}^{cs} = \mathbf{A}^{cs}\boldsymbol{x}^{cs} + \boldsymbol{y}^{cs} \tag{2}$$

and bilateral gross trade balance is:

$$\boldsymbol{t}_{G}^{cs} = \boldsymbol{u}\left(\mathbf{A}^{cs}\boldsymbol{x}^{s} + \boldsymbol{y}^{cs}\right) - \boldsymbol{u}\left(\mathbf{A}^{sc}\boldsymbol{x}^{c} + \boldsymbol{y}^{sc}\right) \tag{3}$$

where $\boldsymbol{u}$ is a unit vector. Worldwide exports and imports are easily derived by aggregation. Following Koopman *et al.* (2014), we can arrange the Leontief model in a different way:

$$\begin{bmatrix} \boldsymbol{q}^{11} & \boldsymbol{q}^{12} & \cdots & \boldsymbol{q}^{1R} \\ \boldsymbol{q}^{21} & \boldsymbol{q}^{22} & \cdots & \boldsymbol{q}^{2R} \\ \vdots & \vdots & \cdots & \vdots \\ \boldsymbol{q}^{R1} & \boldsymbol{q}^{R2} & \cdots & \boldsymbol{q}^{RR} \end{bmatrix} = \begin{bmatrix} \mathbf{B}^{11} & \mathbf{B}^{12} & \cdots & \mathbf{B}^{1R} \\ \mathbf{B}^{21} & \mathbf{B}^{22} & \cdots & \mathbf{B}^{2R} \\ \vdots & \vdots & \cdots & \vdots \\ \mathbf{B}^{R1} & \mathbf{B}^{R2} & \cdots & \mathbf{B}^{RR} \end{bmatrix} \begin{bmatrix} \boldsymbol{y}^{11} & \boldsymbol{y}^{12} & \cdots & \boldsymbol{y}^{1R} \\ \boldsymbol{y}^{21} & \boldsymbol{y}^{22} & \cdots & \boldsymbol{y}^{2R} \\ \vdots & \vdots & \cdots & \vdots \\ \boldsymbol{y}^{R1} & \boldsymbol{y}^{R2} & \cdots & \boldsymbol{y}^{RR} \end{bmatrix} \tag{4}$$

or

$$\left[\boldsymbol{q}^{1} \cdots \boldsymbol{q}^{c} \cdots \boldsymbol{q}^{R}\right] = \left(\mathbf{I} - \mathbf{A}\right)^{-1} \left[\boldsymbol{f}^{1} \cdots \boldsymbol{f}^{c} \cdots \boldsymbol{f}^{R}\right] \tag{5}$$

$$\mathbf{Q} = \left(\mathbf{I} - \mathbf{A}\right)^{-1} \mathbf{F} \tag{5bis}$$

where both the gross output and final demand matrices are ($NR \times R$). If we premultiply (5) with a diagonal matrix of direct value-added coefficients along the main diagonal we obtain the value-added production matrix:

$$\hat{\boldsymbol{v}}\mathbf{B}\mathbf{F} = \begin{bmatrix} \hat{\boldsymbol{v}}^{1} & 0 & \cdots & 0 \\ 0 & \hat{\boldsymbol{v}}^{2} & \cdots & 0 \\ \vdots & \vdots & \cdots & \vdots \\ 0 & 0 & \cdots & \hat{\boldsymbol{v}}^{R} \end{bmatrix} \begin{bmatrix} \boldsymbol{q}^{11} & \boldsymbol{q}^{12} & \cdots & \boldsymbol{q}^{1R} \\ \boldsymbol{q}^{21} & \boldsymbol{q}^{22} & \cdots & \boldsymbol{q}^{2R} \\ \vdots & \vdots & \cdots & \vdots \\ \boldsymbol{q}^{R1} & \boldsymbol{q}^{R2} & \cdots & \boldsymbol{q}^{RR} \end{bmatrix} = \begin{bmatrix} \hat{\boldsymbol{v}}^{1}\sum_{g=1}^{R}\mathbf{B}^{1g}\boldsymbol{y}^{g1} & \cdots & \hat{\boldsymbol{v}}^{1}\sum_{g=1}^{R}\mathbf{B}^{1g}\boldsymbol{y}^{g} \\ \hat{\boldsymbol{v}}^{2}\sum_{g=1}^{R}\mathbf{B}^{2g}\boldsymbol{y}^{g1} & \cdots & \hat{\boldsymbol{v}}^{2}\sum_{g=1}^{R}\mathbf{B}^{2g}\boldsymbol{y}^{g} \\ \vdots & & \vdots \\ \hat{\boldsymbol{v}}^{R}\sum_{g=1}^{R}\mathbf{B}^{Rg}\boldsymbol{y}^{g1} & \cdots & \hat{\boldsymbol{v}}^{R}\sum_{g=1}^{R}\mathbf{B}^{Rg}\boldsymbol{y}^{gR} \end{bmatrix}_{R} \tag{6}$$

whose block elements in the diagonal give each country's production of value added absorbed at home, while off diagonal block elements show value added produced in country and absorbed abroad. Value added exports from country *c* to *s* and worldwide are:

$$\boldsymbol{e}_{VA}^{cs} = \hat{\boldsymbol{v}}^{c}\sum_{g=1}^{R}\mathbf{B}^{cg}\boldsymbol{y}^{gs} \tag{7}$$

$$\boldsymbol{e}_{VA}^{c} = \hat{\boldsymbol{v}}^{c}\sum_{s\neq c}^{R}\sum_{g=1}^{R}\mathbf{B}^{cg}\boldsymbol{y}^{gs}\,. \tag{8}$$

Similarly, country *c* imports value added produced in country *s* and worldwide:

$$\boldsymbol{e}_{VA}^{sc} = \hat{\boldsymbol{v}}^{s}\sum_{g=1}^{R}\mathbf{B}^{sg}\boldsymbol{y}^{gc} \tag{9}$$

$$\boldsymbol{m}_{VA}^{c} = \hat{\boldsymbol{v}}^{s}\sum_{s\neq c}^{R}\sum_{g=1}^{R}\mathbf{B}^{sg}\boldsymbol{y}^{gs}\,. \tag{10}$$

This approach is applied to the well-known WIOD dataset that contains annual time-series of world input–output tables covering the period from 1995 to 2011 for 40 nations (Timmer *et al.* 2015). All together they cover about 85% of world GDP in 2008. In addition, the remaining non-covered part is estimated too, so that these 40 countries and the "Rest of the World" region form a complete world IO model. They have an industry-by-industry format and provide details for 35 industries mostly at the two-digit level. Data are based on officially published supply and make matrices merged with national accounts and international trade statistics, even if it is claimed it relies more on IO tables then international trade (Weidman *et al.* 2011, Rojas-Romagosa 2015). Moreover, the calibration procedure

employed in WIOD implies the usual data discrepancies cannot be fully calibrated, and the Rest of the World is implicitly absorbing these differences.

The literature aimed at investigating international competitiveness and trade performance is huge. We follow the standard Revealed Comparative Advantage approach and address ex post trade data. Balassa (1965) introduced the first and the most popular measure of comparative advantage. It may track either exports or imports, even if only the former is usually figured out. Balassa defines comparative advantage in terms of markets shares:

$$\mathrm{BRCA}_i^c = \frac{e_i^c / e^c}{e_i^w / e^w} \tag{11}$$

Where e_i^c and e_i^w are exports of the *i*-th product in country *c* and the reference area, say the world. $e^s = \sum_i e_i^c$ is total exports in country c and, similarly, e^w is the grand total. The critical value is one. A country *c* has a comparative advantage in the production of the *i*-th good if its export share is larger than the reference area and BRCA > 1. This index suffers several shortcomings. First, it is a single flow index and results about exports and imports may differ. Then, the BRCA index has neither an ordinal nor a cardinal property that facilitate comparisons between countries and sectors: "*the traditional RCA approach does not produce a strict ordinal index and, in cases, may not even provide a statistically significant ranking of industries according to revealed comparative advantage. Concerning this problem, it is evident that the potential for bias is greatest when comparisons are made between industries which have the widest differences in their underlying (country) RCA distributions*" (Yeats 1985, 67). Moreover, it is not additive and it tends to give a stronger advantage to small countries with high specialization (Hoen and Oosterhaven 2006). Finally, it is asymmetric in that is bounded by zero on one end and does not have an upper bound on the other end (De Benedictis and Tamberi, 2004). The asymmetry causes problems when the Balassa index is included in standard econometric models. In order to fix this issue an easy alternative has been suggested by Laursen (1998) and Dalum *et al.* (1998):

$$\mathrm{SRCA}_i^c = \frac{\mathrm{BRCA}_i^c - 1}{\mathrm{BRCA}_i^c + 1} \ . \tag{12}$$

This index is symmetric and ranges from -1 to +1 with a critical value equal to zero. Moreover, it is an approximation of the log transformation of BRCA suggested by Vollrath (1991) and should provide the same rankings, since it is an almost positive monotonic transformation. It shares other shortcomings yet. It does not have a stable mean over space and time, which gives suspicious on its comparability between and within countries.

Some researchers argue the multiplicative form of BRCA and SRCA causes their problematic features. Hoen and Oosterhaven (2006) suggest to adopt an additive form:

$$\mathrm{ARCA}_i^c = \frac{e_i^c}{e^c} - \frac{e_i^w}{e^w} \tag{13}$$

where all the variables have been defined previously. The cut-off is zero again. Positive values indicate a comparative advantage and negative ones the opposite. The index is symmetric and it is not affected by the level of sectoral aggregation, but comparability in cross country analysis is questionable, as the sum of the ARCAs with respect to a given sector is not stable (Sanidas and Shin

2010). A final recent alternative is mixing both additive and multiplicative features with the Normalized Revealed Comparative Advantage index introduced by Yu *et al.* (2009):

$$\mathrm{NRCA}_i^c = \frac{e_i^c}{e^w} - \frac{e_i^w e^c}{e^w e^w} \tag{14}$$

The reference value is still zero, while values ranges from -0.25 to 0.25. Since world trade is used to normalize, figures tend to be very small. One unquestionable advantage is comparability over time and across space, since the sum of NRCAs is equal to zero across both dimensions. "*This explains well the notion of zero sum imbedded in comparative advantage: if a country gains comparative advantage in one sector, then the country loses comparative advantage in other sectors; and if one country gains comparative advantage in a sector, then other countries lose comparative advantage in the sector*" (Sanidas and Shin 2010, 18).

3 Competitiveness in CEEC5

In this section I present results for the five CEEC countries under investigation, i.e. Bulgaria, the Czech Republic, Hungary, Romania, and Slovakia. This preliminary study addresses the dichotomous choice about competitiveness without matching values between and within countries, as comparability over time and sectors is questionable but NRCA. Is not difficult to prove that if an industry has a competitive advantage according to the Balassa index then the other indicators confirm it. Hence, we can restrict the analysis to the differences between Gross Export and Value Added in Trade. For reason of clarity, results are not given for each year, but for selected ones. We divided the sample into three periods and pick: 1995 and 2001 as the initial observation and the year before the creation of the Monetary Union, 2006 as the last year of tranquility before the subprime crisis and the Lehman bankruptcy, and 2011, i.e. the last year available before the complete eruption of the Euro-crisis. Sector classification is provided in the Appendix.

In table 1-5 I provide the lists of the industries with comparative advantages in each country. I do not assess changes over time and diversities between nations, but focus on differences in the dichotomous classification using gross and net data. These dissimilarities are highlighted in bold. For instance, in Bulgaria (table 1) according to Value Added in Trade the 4-th sector (Textile) has a competitive advantage in 1995 that is not signaled by the Gross Export index. However, the former is rather questionable as BRCA is 1.03 only and NRCA is slightly positive (6.8×10^{-7}). Anyway, figures are much larger in the following years suggesting an increasing competitiveness. The picture is somehow different if we deem VAiT in financial intermediation (sector 28). This industry is in the second position in the ARCA/NRCA ranking, while it holds a lower place in the BRCA/SRCA list (only 15th), but still on the competitive side of the economy. In contrast, its performance is rather modest according to Gross Export. This is reasonable as financial services may be embodied in other goods and direct sales abroad are often small. Quite interestingly, it is no longer competitive between 1997 and 2003, when all the indicators shift below the critical cutoff. On the opposite side, sectors 9 (Chemical Products), 11 (Other Non-Metallic Mineral), and 12 (Basic Metals and Fabricated Metal) are competitive in gross terms only. The very same situation refers to 21 (Retail Trade) and 27 (Post and telecommunication).

The picture is slightly different in 2001 with 5 (Leather) that is competitive according to VAiT only and vice versa 6 (Wood) for Gross Exports. The identical situation applies to 13 (Machinery, nec) and 12 (Basic Metals and Fabricated Metal). The retail sector (21) is interesting too. Its performance is concordant in the first years only. Thereafter, there is a decline in value added figures. For instance, BRCA is about 1.28 in 1996 and merely 0.52 two years later. In the following period, it is close to

unity (0.98) in 2006 alone. In the last part of the sample there are just a few differences between VAiT and Gross Exports, as the right hand columns show.

Table 1: Competitive sectors in Bulgaria

1995		2001		2006		2011	
VA	GE	VA	GE	VA	GE	VA	GE
1	1	1	1	1	1	1	1
3	3	4	4	4	4	3	3
4	5	**5**	**6**	6	6	4	4
5	6	8	8	8	8	6	6
6	8	11	11	11	11	8	8
8	**9**	**13**	**12**	12	12	11	11
17	**11**	17	17	16	16	12	12
18	**12**	18	18	17	17	17	17
19	17	19	19	18	18	18	18
20	18	23	**20**	19	19	19	19
23	19	24	**21**	21	**20**	21	**20**
24	20	25	23	23	21	23	21
25	**21**	26	24	24	23	24	23
26	23	27	25	25	24	25	24
28	24	29	26	26	25	26	25
29	25	31	27	27	26	27	26
	26		29	**28**	27	**28**	27
	27		31	29	29	29	29
	29			31	31	31	31

Table 2: Competitive sectors in the Czech Republic

1995		2001		2006		2011	
VA	GE	VA	GE	VA	GE	VA	GE
1	4	**3**	6	6	6	6	6
3	5	**4**	**7**	7	7	7	7
4	6	6	10	10	10	10	10
5	8	10	11	11	11	11	11
6	**10**	11	12	12	12	12	12
8	11	12	13	13	13	13	13
11	12	13	15	14	14	14	14
12	16	15	16	15	15	15	15
16	17	16	17	16	16	16	16
17	18	17	18	17	17	17	17
18	19	18	19	18	18	18	18
19	21	19	22	19	19	19	19
22	22	**21**	23	**20**	22	**21**	22
23	23	22	26	**21**	23	22	23
26	26	23	32	22	33	23	33
27	27	26	33	**23**	**34**	**26**	**34**
29	29	**27**	**34**	**27**		**32**	
31	**30**	32		33		33	
32	31	33					
33	32						
	33						
	34						

Let's now turn to the Czech Republic. We can notice the number of competitive sectors is more or less the same as in Bulgaria. At the beginning, there are some diversities between Gross Exports and VAiT indexes in primary and secondary such as 1 (Agriculture), 3 (Food), 4 (Textile), and 10 (Rubber and plastic). On the opposite, differences mostly pertain to the tertiary in the last decade. Service sectors that deliver exports mainly via other products are 20 (Wholesale trade), 21(Retail trade), 23 (Inland transport), 26 (Other Supporting and Auxiliary Transport Activities), 27 (Post and

telecommunication), and 32 (Education). However, their occurrence is scattered through time, but the 27-th sector, that has always a competitive advantage as stated by the VAiT indicators and only in 1995 for Gross Exports.

Table 3: Competitive sectors in Hungary

1995		2001		2006		2011	
VA	GE	VA	GE	VA	GE	VA	GE
1	1	1	1	**8**	**1**	1	1
3	3	**4**	10	**9**	10	**8**	10
5	8	**5**	14	10	14	10	11
6	11	**8**	15	**11**	15	11	13
8	**12**	10	17	14	**17**	13	14
11	17	**11**	18	15	18	14	15
17	18	14	19	18	**19**	15	17
18	19	15	**20**	19	20	17	18
19	**20**	17	21	21	21	18	19
21	21	18	23	23	23	19	**20**
23	23	19	26	26	26	21	21
27	**25**	21	30	**27**	34	23	23
30	**26**	23	31	**29**		26	26
31	27	26	34	**30**		**27**	34
32	**28**	**27**		**31**		**29**	
33	**29**	**29**		**32**		**30**	
34	30	30		34		**31**	
	31	31				**32**	
		32				34	
		33					
		34					

Table 4: Competitive sectors in Romania

1995		2001		2006		2011	
VA	GE	VA	GE	VA	GE	VA	GE
1	1	**1**	4	**1**	4	1	1
4	4	**3**	5	4	5	**3**	4
5	5	4	6	5	6	4	5
6	6	5	8	6	8	5	6
8	8	6	11	8	12	6	10
9	9	8	12	**10**	16	10	**12**
11	11	11	16	12	18	**11**	16
12	12	12	17	16	**19**	**15**	17
16	16	16	18	**17**	20	16	18
17	17	17	20	18	21	17	**19**
18	18	18	21	20	22	18	20
21	20	20	23	21	23	20	21
22	21	21	27	22	26	21	22
23	22	23		23	27	22	23
27	23	27		26	**30**	23	26
28	**24**			27		26	27
	27					27	**30**

Hungary and Romania look very different. Sometimes they do not seem very competitive in international markets, at least when we use Gross Export. The former country exhibits only 12 figures larger than critical cut offs in 2006, while the latter just 13 in 2001. There are a few more before and thereafter, but cardinality of the sets is often smaller than in the previous economies. Concordance between the VAiT and Gross Exports is almost perfect in the first part of the sample in Romania, because only a couple of values diverge. In the last years, there are several differences mostly in

manufacturing. On the contrary, several service sectors in Hungary enjoy a competitive advantage that is revealed only when we adopt the value added content. These range from 26 (Other Supporting and Auxiliary Transport Activities) to 32 (Education), while 33 (Health and Social Work) drops out after 2001. Finally, let's deem Slovakia in table 5. This country summarize several features discussed above. There are a few differences concerning mainly 16 (Manufacturing, nec), 17 (Electricity, Gas and Water Supply), 19 (Sale), 20 (Wholesale Trade), and 29 (Real Estate Activities). Nevertheless, we must acknowledge there is an overall concordance between gross and net measures.

Table 5: Competitive sectors in Slovakia

1995		2001		2006		2011	
VA	GE	VA	GE	VA	GE	VA	GE
5	5	**3**	5	5	5	5	5
6	6	**4**	6	6	6	6	6
7	7	5	7	7	7	7	7
8	8	6	8	8	8	10	10
9	9	7	10	10	10	11	11
10	10	8	11	11	11	12	12
11	11	10	12	12	12	14	14
12	12	11	15	14	14	15	15
16	18	12	16	15	15	16	16
17	**19**	**13**	17	**16**	17	**17**	18
18	21	15	18	17	18	18	21
21	22	16	21	18	19	**19**	22
22	23	17	**22**	19	21	**20**	23
23	26	18	23	**20**	22	21	33
26	27	**19**	31	21	23	22	34
27	28	21	33	22	29	23	
28	29	23	34	23	33	**29**	
29	**34**	**29**		29	34	**32**	
		31		33		33	
		33		34		34	
		34					

4 Conclusions

This paper examines competitiveness in five CEEC countries, i.e. Bulgaria, the Czech Republic, Hungary, Romania, and Slovakia. We embrace four indicators of competitive advantages ranging from the most popular due to Balassa (1965) to the recent one introduced by Yu *et al.* (2009). However, it is easy to prove that all these indicators are equivalent in term of the dichotomous choice about competitive advantages, i.e. if a sector is competitive according to the Balassa criterion then it do so according to the other ones because if BRCA > 1 then SRCA > 0, ARCA > 0, and NRCA > 0. Hence, we restrict our analysis and take into account sectoral RCA indicators using Gross Exports and Value Added in Trade. The country net trade surplus/deficit is the same in both cases while, at the disaggregated industry level, values can differ as the VAiT includes both value added in its direct exports and the value added it supplies as inputs to other domestic industries' exports. A large literature shows global supply chains can change the picture a lot. It is interesting to check differences in competitiveness of the countries under scrutiny. For such a task, we embrace the WIOD dataset that provides a series of annual world input output tables from which we can derive gross and net exports by industry. This approach is extremely useful as it allows us to consider the tertiary as well manufacturing. The complete inclusion of services is important for several reasons. First, most advanced economies shifted their production towards the tertiary, which is now the main bulk of GDP. Second, even if services are not directly exported they are often embodied in goods. Hence, a Balassa index smaller than one in Gross Export but larger than unity in VAiT can reveal a sector whose output

is included in other goods that are sold abroad. The opposite shows an international shipment mainly made by foreign value added. Hence, the information conveyed by gross and net flows may be very different (Johnson and Noguera 2012). Koopman *et al.* (2014) give examples how, for some sectors, a comparative advantage according to the former can turn in a disadvantage for the latter. Recently, Brackman and Marrewijk (2016), using a previous and modified version of WIOD, conclude countries specialize dissimilarly. "*Consistent with the theory of comparative advantage, distributions of RCA between different countries are different. This holds for gross export RCA as well as for value added RCA… The distributions of cross export RCA and value added RCA are almost always significantly different for a country. These measures thus do not convey the same information*" (Brackman and Marrewijk 2016, 9-10). Their analysis drops three sectors, does not consider the last two years, and converts current dollars to constant ones using the US GDP deflator. This global deflation is questionable and I prefer to stick to current values using all the observations available. Nonetheless, differences for our CEEC-5 are minimal and stylized facts are mostly confirmed. For instance, Bulgaria appears to be a very competitive country in terms of number of sectors when data about Gross Exports are used. Nineteen industries out of 35 (32 for Brackman and Marrewijk) display an export share larger than worldwide, but this number is reduced when we deem net flows. However, this finding applies predominantly in the first part of the sample, when European GVCs were still building up. This phenomenon could have been at work at the turn of the century in Slovakia and Hungary too, as the number of competitive industries is increasing in both secondary and tertiary. On the opposite, it is not so apparent in Romania and the Czech Republic. This calls for a better understating of the strength and the deepness of the links within and between supply chains and, first of all, for a quantitative assessment about the magnitude of comparative advantages. Future research should address both issues.

References

Balassa, B. 1965. 'Trade Liberalization and Revealed Comparative Advantage.' *The Manchester School of Economic and Social Studies* 33 (2): 99-124.

Brackman, S., and C. V. Marrewijk. 2016. 'A closer look at revealed comparative advantage: Gross-versus value-added trade flows.' *Papers in Regional Science* http://dx.doi.org/10.1111/pirs.12208

Ceglowski, J. 2015. 'Assessing Export Competitiveness through the Lens of Value Added.' *The World Economy* 1-22.

Dalum, B., K. Laursen, and G. Villumsen. 1998. 'Structural change in OECD export specialisation patterns: de-specialisation and stickiness.' *International Review of Applied Economics* 12 (3): 447–67.

Deardorff, A. V. 1980. 'The General Validity of the Law of Comparative Advantage.' *The Journal of Political Economy* 88 (5): 941-57.

De Benedictis, L. and M. Tamberi. 2004. 'Overall Specialization Empirics: Techniques and Applications.' *Open Economies Review* 15 (4): 323–46.

Durand, M., and C. Giorno. 1987. 'Indicators of International Competitiveness: Conceptual Aspects and Evaluation.' *OECD Journal: Economic Studies* 9: 147-182.

Hoen, A.R., and J. Oosterhaven. 2006. 'On the measurement of comparative advantage.' *Annals of Regional Science* 40 (3) :677–691.

Hoover, E. M. 1936. 'The Measurement of Industrial Location.' *Review of Economics and Statistics* 18 (4): 162-71.

Johnson, R. C., G. Noguera. 2012. 'Accounting for Intermediates: Production Sharing and Trade in Value Added.' *Journal of International Economics* 86 (2): 224 –36.

Koopman, R., Z. Wang, and Z. Wei. 2014. 'Tracing Value-Added and Double Counting in Gross Exports.' *American Economic Review* 104 (2): 459–94.

Laursen, K. 1998. 'Revealed comparative advantage and the alternatives as measures of international specialisation.' DRUID Working Paper 98–30 Copenhagen Business School.

Liesner, H. H. 1958. 'The European Common Market and the British Industry.' *Economic Journal* 68 (270): 302-16.

Miller, R., and P. Blair. 2009. *Input-Output Analysis: Foundations and Extensions*, 2nd ed. Cambridge: Cambridge University Press.

Roja-Ramagosa, H. 2015. 'Bilateral trade balances for the Netherlands and eight selected countries: Comparing gross and value added trade statistics and data sources.' CPB Background Document. Amsterdam.

Sanidas, E., and Y. Shin. 2010. 'Comparison of Revealed Comparative Advantage Indices with Application to Trade Tendencies of East Asian Countries.' Paper Presented at the 9th Korea and the World Economy Conference, Incheon, 2010.

Timmer, M. P., E. Dietzenbacher, B. Los, R. Stehrer, and G. J. de Vries. 2015. 'An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production.' *Review of International Economics* 23 (3): 575–605.

Vollrath, T. L. 1991. 'A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage.' *Weltwirtschaftliches Archiv* 127 (2): 265–80.

Wiedmann, T., H. C. Wilting, M. Lenzen, S. Lutter, and V. Palm. 2011. 'Quo Vadis MRIO? Methodological, Data and Institutional Requirements for Multi-Region Input-Output Analysis.' *Ecological Economics* 70 (11): 1937–45.

Yeats, A. 1985. 'On the Appropriate Interpretation of the Revealed Comparative Advantage Index: Implications of a Methodology Based on Industry Sector Analysis.' *Weltwirtschaftliches Archiv* 121 (1): 61–73.

Yu, R., J. Cai, and P. S. Leung. 2009. 'The Normalized Revealed Comparative Advantage Index.' *Annals of Regional Science*, 43 (1): 267–82.

Appendix

Sectoral Classification and NACE rev. 1

1	AtB	Agriculture, Hunting, Forestry and Fishing
2	C	Mining and Quarrying
3	15t16	Food, Beverages and Tobacco
4	17t18	Textiles and Textile Products
5	19	Leather, Leather and Footwear
6	390	Wood and Products of Wood and Cork
7	391t3939	Pulp, Paper, Paper , Printing and Publishing
8	393	Coke, Refined Petroleum and Nuclear Fuel
9	394	Chemicals and Chemical Products
10	395	Rubber and Plastics
11	396	Other Non-Metallic Mineral
12	397t398	Basic Metals and Fabricated Metal
13	399	Machinery, Nec
14	30t33	Electrical and Optical Equipment
15	34t35	Transport Equipment
16	73t37	Manufacturing, Nec; Recycling
17	E	Electricity, Gas and Water Supply
18	F	Construction
19	50	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles;
20	51	Wholesale Trade and Commission Trade, Except of Motor Vehicles
21	539	Retail Trade, Except of Motor Vehicles and Motorcycles;
22	H	Hotels and Restaurants
23	60	Inland Transport
24	61	Water Transport
25	639	Air Transport
26	63	Other Supporting and Auxiliary Transport Activities;
27	64	Post and Telecommunications
28	J	Financial Intermediation
29	70	Real Estate Activities
30	71t74	Renting of M&Eq and Other Business Activities
31	L	Public Admin and Defence; Compulsory Social Security
32	M	Education
33	N	Health and Social Work
34	O	Other Community, Social and Personal Services
35	P	Private Households with Employed Persons