Export-led growth and its determinants

Evidence from CEEC countries

Jan Hagemejer[13] & Jakub Mućk[23]

[1]University of Warsaw

[2]Warsaw School of Economics

[3]Narodowy Bank Polski

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Introduction

- Central and Eastern European EU members have substantially converged to the EU average income since the beginning of transition in the early 1990.
- We look into the trade-related sources of growth.
- In particular, we exploit the WIOD database to analyze trade in value added as a direct growth driver.
- We look at the determinants of domestically absorbed and exported value added.

Literature and motivation

- Trade is almost absent from macro growth literature. Exceptions include exceptions include Grossman and Helpman [1991] - trade and innovation as well as Ben-David and Loewy [1998] - knowledge spillovers that result in income convergence.
- The modern micro-founded trade literature sees trade and openness as a productivity booster. In the Melitz [2003] model opening to trade relocates resources to more productive exporting firms forcing least productive firms to exit hence improving aggregate productivity through self-selection. Learning by exporting present in empirical studies but not so much in the theory.
- On the macro level: net exports do not allow for an accurate assessment of the direct exports contribution to growth, in particular in countries undergoing a significant structural change (eg. investment goods imports) and vertical specialisation.
- Kranendonk and Verbruggen [2008] as well as Cardoso et al. [2013] use national input-output tables to identify the import content of exports as well as other GDP components

What we do?

- We contribute to growth accounting literature. We **decompose the supply-side aggregate of GDP** into the domestically absorbed and exported components using modern GVC-related measures. We look at changes in the (volumes) of these two components in GDP.
- We look at export-driven income convergence. We run **convergence equations on the domestic and exported value added.**
- We look for **determinants of exported value added**: factors of production, foreign value added content as well as FDI inflows

The decomposition of GDP

Familiar Leontief equation for output ($\mathbf{x}$) and the final demand ($\mathbf{y}$) also works for global input-output:

$$\mathbf{x}\underbrace{(I - \mathbf{A})}_{\mathbf{L}} = \mathbf{y}, \tag{1}$$

where $\mathbf{L}$ is the so-called Leontief matrix.
The global value added can be decomposed into four components:

$$\mathbf{y} = \underbrace{\sum_{i\in\mathcal{D}} \left[\mathbf{L}^{-1}\mathbf{y}^{\mathcal{D}}\right]_i}_{\mathbf{y}^{\mathcal{D}\to\mathcal{D}}} + \underbrace{\sum_{i\in\mathcal{D}} \left[\mathbf{L}^{-1}\mathbf{y}^{\mathcal{F}}\right]_i}_{\mathbf{y}^{\mathcal{D}\to\mathcal{F}}} + \underbrace{\sum_{i\notin\mathcal{D}} \left[\mathbf{L}^{-1}\mathbf{y}^{\mathcal{D}}\right]_i}_{\mathbf{y}^{\mathcal{F}\to\mathcal{D}}} + \underbrace{\sum_{i\notin\mathcal{D}} \left[\mathbf{L}^{-1}\mathbf{y}^{\mathcal{F}}\right]_i}_{\mathbf{y}^{\mathcal{F}\to\mathcal{F}}} \tag{2}$$

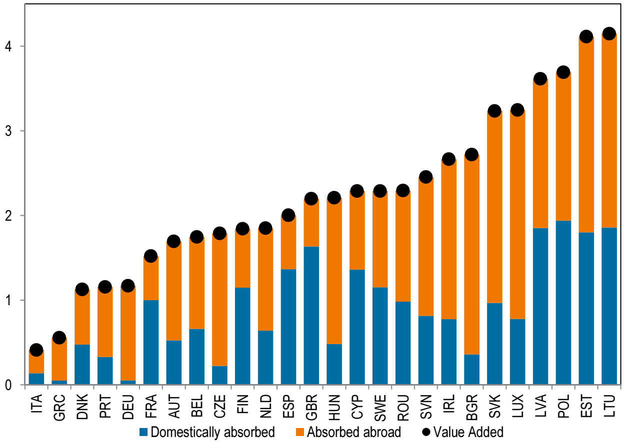
where $\mathbf{y}^{\mathcal{D}}$ ($\mathbf{y}^{\mathcal{F}}$) is the vector of domestic (foreign) absorption, i.e.,

$$\mathbf{y}^{\mathcal{D}} = \begin{cases} \mathbf{y}_i & \text{if} \quad i \in \mathcal{D} \\ 0 & \text{if} \quad i \notin \mathcal{D} \end{cases} \quad \text{and} \quad \mathbf{y}^{\mathcal{F}} = \begin{cases} 0 & \text{if} \quad i \in \mathcal{D} \\ \mathbf{y}_i & \text{if} \quad i \notin \mathcal{D} \end{cases}$$

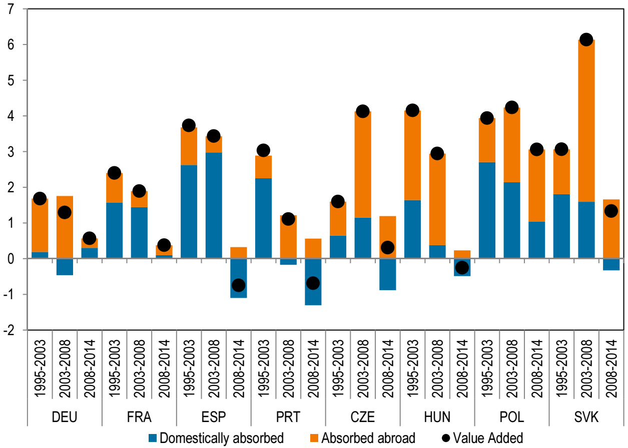
The data, deflators, volumes and growth rates

- Our principal source of data is the World Input Output Database (WIOD) database [Timmer et al., 2015].
- We use two editions of WIOD database, for the periods of 1995-2009 and 2000-2014.
- Since all flows of intermediate consumption are expressed in the current USD, we use:
  - WIOD-provided deflators and exchange rates for the first edition of the WIOD Socio Economic Accounts
  - the Eurostat deflators for the second edition.
- We deflate at sector-level and build series of volumes of value added absorbed at home and abroad.

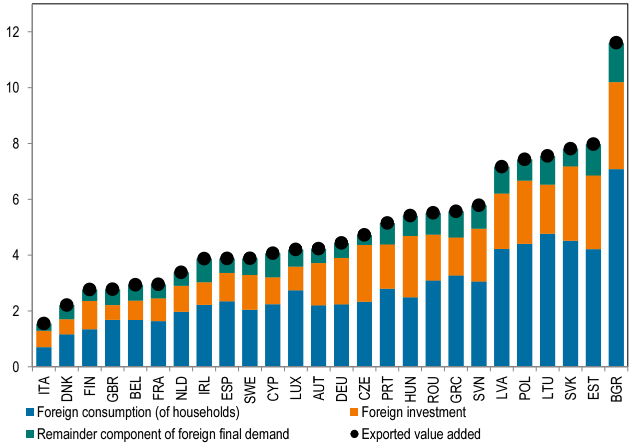
Exports and the overall growth 1995-2014



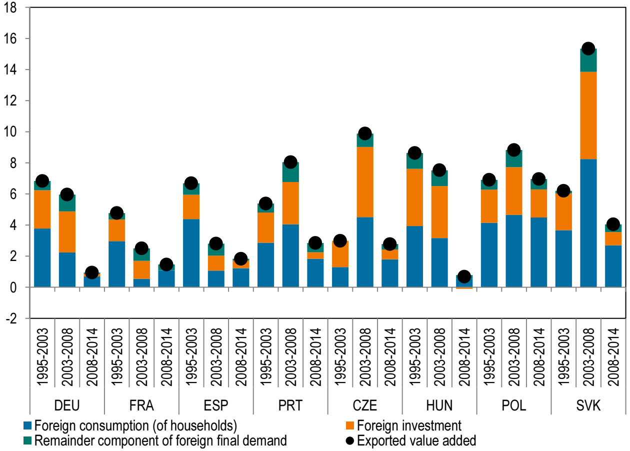
Exports and the overall growth, CEEC vs EU 1995-2014



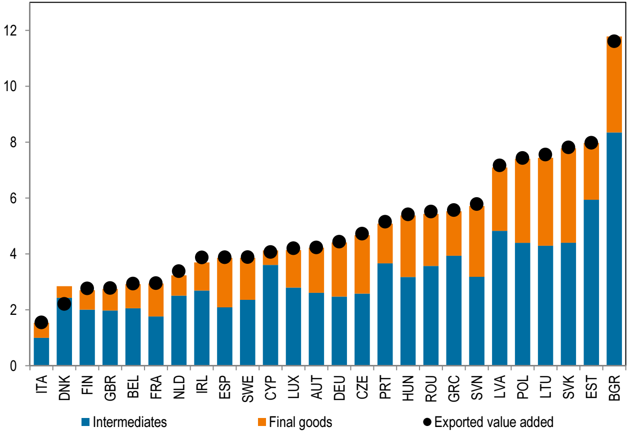
Exported value added growth and the final demand components



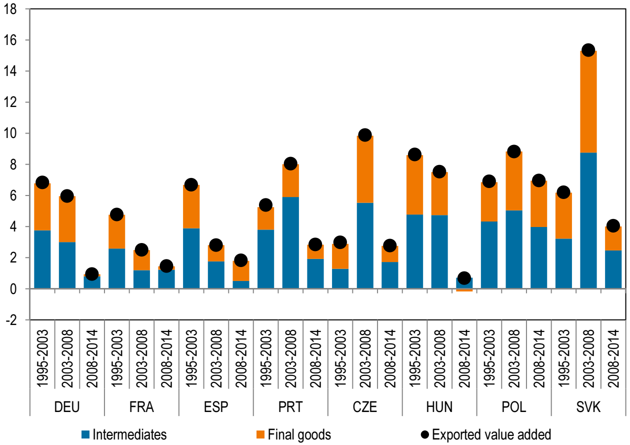
Exported value added growth and the final demand components



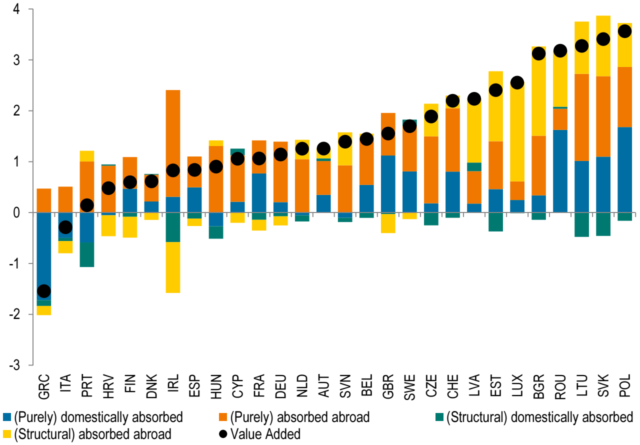
Final vs intermediate goods



Final vs intermediate goods



GDP growth and its components (annualized, in %, 2003-2014)



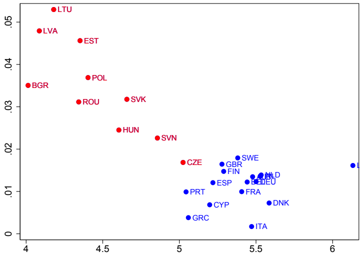
Unconditional convergence

- To assess the rising role of exports in the catching-up process we use the standard (unconditional) convergence equation [Durlauf et al., 2005]:

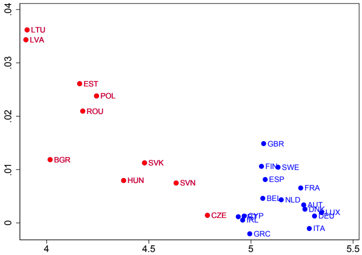
$$\Delta y_{it} = \beta_0 - \beta^{\mathcal{C}} y_{it-1} + \varepsilon_{it}, \tag{3}$$

  where Δy_{it} and y_{it-1} - value added PPP per capita (va_{it}^{PPP}) or its specific part, i.e., domestically absorbed (dva_{it}^{PPP}) or exported component (eva_{it}^{PPP}).
- $\beta^{\mathcal{C}}$ is the convergence rate and it measures the speed of (unconditional) catching-up process.
- For cross-section data then Δy_{it} denotes the average growth rate over period and y_{it-1} is the initial level.

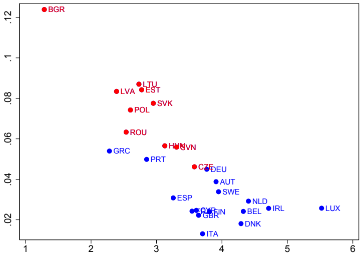
Unconditional convergence



total value added

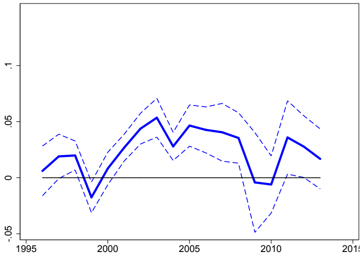


domestically absorbed value added

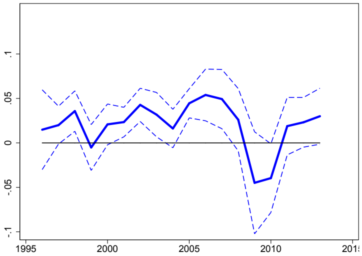


exported value added

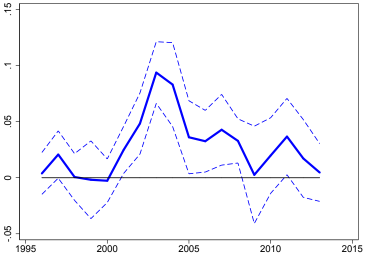
Rolling estimates of the pace of convergence



total value added



domestically absorbed value added



exported value added

GMM Estimates

Table 2: GMM estimates of the (unconditional) convergence parameter $\hat{\beta}^C$

	All countries			CEEC countries			non-CEEC countries		
	tva^{PPP}_{it}	dva^{PPP}_{it}	eva^{PPP}_{it}	tva^{PPP}_{it}	dva^{PPP}_{it}	eva^{PPP}_{it}	tva^{PPP}_{it}	dva^{PPP}_{it}	eva^{PPP}_{it}
$\hat{\beta}^C$	0.05***	0.023**	0.111***	0.112*	0.043*	0.113***	-0.002	-0.085	0.017
AR(2)	[0.413]	[0.096]	[0.712]	[0.698]	[0.372]	[0.880]	[0.251]	[0.514]	[0.307]
Sargan	[0.040]	[0.013]	[0.193]	[0.184]	[0.149]	[0.582]	[0.000]	[0.001]	[0.000]
Hansen	[0.478]	[0.200]	[0.129]	[0.557]	[0.643]	[0.589]	[0.132]	[0.190]	[0.132]

Note: the superscripts ***, ** and * denote the rejection of null about parameters' insignificance at 1%, 5% and 10% significance level, respectively. The expressions in round and squared brackets stand for robust standard errors and probabilities values corresponding to respective hypothesis, respectively. AR(2) it the test for serial correlation developed by Arellano and Bond (1991) and the null hypothesis in this case is about the error term time independence (of order two). The Sargan and Hansen statistics are used to test over-identifying restrictions and in both cases the null postulates validity of instruments. limit the role of short-run variation all above estimation performed on non-overlapping four-year averages.

Determinants of export-led growth

- Our starting point is the (logged) production function for the differenced variables:

$$\Delta y_{it} = \alpha_0 + \alpha_1 \Delta k_{it} + \alpha_2 \Delta l_{it} + \alpha_3 \Delta x_{it} + \varepsilon_{it}, \tag{4}$$

  where $\Delta y_{it} \in \{\Delta va_{it}, \Delta dva_{it}, \Delta eva_{it}\}$, k_{it} and l_{it} are the logged capital and labor input, x_{it} denotes the additional independent variables and ε_{it} is the error term
- We begin by running panel regressions of the total growth rate of value added, growth rate of domestically absorbed value added and exported value added on the supply side variables: growth rates of capital and labor.

Labor and capital elasticities

Table 4: The estimates of labor and capital elasticities for value added and its components

	Δva_{it}	Δdva_{it}	Δeva_{it}	Δva_{it}	Δdva_{it}	Δeva_{it}	Δva_{it}	Δdva_{it}	Δeva_{it}
		pooled			pooled			FE	
Δk_{it}	0.096	0.211	-0.307	0.134	0.091	-0.016	0.201	0.498**	-0.500
	(0.119)	(0.133)	(0.243)	(0.135)	(0.146)	(0.281)	(0.180)	(0.236)	(0.459)
Δl_{it}	0.902***	0.738***	1.175***	0.538***	0.555***	0.364*	0.535***	0.518***	0.574***
	(0.077)	(0.077)	(0.205)	(0.083)	(0.087)	(0.192)	(0.082)	(0.107)	(0.208)
$CEEC_i$	0.011*	-0.002	0.021*	0.009*	-0.005	0.019*			
	(0.006)	(0.007)	(0.011)	(0.005)	(0.007)	(0.010)			
$CEEC_i \times \Delta k_{it}$	0.342*	0.359	0.917**	0.284*	0.430**	0.670*	0.671***	0.771***	0.774
	(0.173)	(0.229)	(0.391)	(0.161)	(0.216)	(0.394)	(0.189)	(0.248)	(0.483)
$CEEC_i \times \Delta l_{it}$	-0.262	-0.254	-0.199	-0.061	-0.141	0.206	-0.066	-0.126	0.077
	(0.170)	(0.182)	(0.277)	(0.132)	(0.164)	(0.219)	(0.089)	(0.117)	(0.227)
μ	0.009***	0.000	0.036***	0.009***	0.007*	0.020***	0.009**	-0.003	0.032***
	(0.003)	(0.003)	(0.006)	(0.003)	(0.004)	(0.006)	(0.004)	(0.005)	(0.011)
Year Dummies	NO	NO	NO	YES	YES	YES	YES	YES	YES

Note: the superscripts ***, ** and * denote the rejection of null about parameters' insignificance at 1%, 5% and 10% significance level, respectively. The expressions in round brackets stands for robust stan-

Determinants of *eva*

Table A.3: The estimates of labor and capital elasticities for exported value added (FE)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10	(11)	(12)
Δk_{it}	0.078	-0.500	0.186	-0.524	0.166	-0.581	0.066	-0.429	0.279	-0.770*	0.233	-0.575
	(0.243)	(0.459)	(0.238)	(0.447)	(0.229)	(0.433)	(0.245)	(0.474)	(0.231)	(0.432)	(0.227)	(0.426)
Δl_{it}	0.580***	0.574***	0.596***	0.709***	0.532***	0.519***	0.580***	0.531**	0.545***	0.793***	0.548***	0.622***
	(0.108)	(0.208)	(0.106)	(0.205)	(0.102)	(0.196)	(0.109)	(0.213)	(0.103)	(0.197)	(0.101)	(0.194)
$CEEC_i \times \Delta k_{it}$		0.774		0.932**		1.005**		0.669		1.417***		1.085**
		(0.483)		(0.472)		(0.459)		(0.500)		(0.461)		(0.451)
$CEEC_i \times \Delta l_{it}$		0.077		-0.110		0.099		0.172		-0.277		-0.059
		(0.227)		(0.224)		(0.213)		(0.238)		(0.218)		(0.213)
ΔFAX_{it}			0.889***	0.597**							0.629***	0.189
			(0.183)	(0.249)							(0.179)	(0.251)
$CEEC_i \times \Delta FAX_{it}$				0.468*								0.661**
				(0.269)								(0.269)
$\Delta reer\_cpi_{it}$					-0.401***	-0.360***					-0.361***	-0.382***
					(0.053)	(0.101)					(0.053)	(0.106)
$CEEC_i \times \Delta reer\_cpi_{it}$						-0.072						-0.007
						(0.120)						(0.124)
Δfdi_{it}							0.004	0.004				
							(0.007)	(0.008)				
$CEEC_i \times \Delta fdi_{it}$								0.128*				
								(0.073)				
$\Delta GFCF_{it}^F$									0.871***	0.711***		
									(0.119)	(0.159)		
$CEEC_i \times \Delta GFCF_{it}^F$										0.416**		
										(0.209)		
μ	0.030***	0.032***	0.030***	0.033***	0.031***	0.033***	0.031***	0.036***	0.024**	0.028***	0.030***	0.034***
	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)

Error correction model for *eva*

- Our preliminary evidence exploits mostly the short-run variation of data
- The the long-run effect might differ from the short-run reaction reported in the previous section.
- We estimate the long-run elasticities with a panel error correction model (ECM)
- We use the Common Correlated Effect (CCE) estimator proposed by Pesaran [2006].

Error correction model

Table 5: The Error Correction Model estimates for the value added and its components

	Value added (va_{it})		Domestically abs.(dva_{it})		Exported (eva_{it})	
Short run						
Δk_{it}	1.808***	1.949***	2.005***	2.767***	1.821**	2.076***
	(0.408)	(0.407)	(0.544)	(0.657)	(0.744)	(0.722)
Δl_{it}	0.254***	0.285***	0.511***	0.712***	0.727***	0.520**
	(0.058)	(0.064)	(0.091)	(0.090)	(0.185)	(0.213)
Long run						
y_{it-1}	-0.490***	-0.551***	-0.483***	-0.644***	-0.350***	-0.442***
	(0.045)	(0.049)	(0.040)	(0.059)	(0.038)	(0.044)
k_{it}	0.452**	0.712**	0.257**	0.897**	1.846***	0.312
	(0.196)	(0.338)	(0.122)	(0.452)	(0.288)	(0.502)
l_{it}	0.313**	0.411**	0.017	-0.019	0.263	0.953**
	(0.137)	(0.159)	(0.177)	(0.190)	(0.527)	(0.443)
t		-0.002		-0.014*		0.049***
		(0.006)		(0.008)		(0.013)

Error correction model for *eva* - short run

Table 6: The Error Correction Model estimates for the exported value added

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			SHORT RUN				
Δk_{it}	1.821**	1.019	1.719**	2.080***	0.972	1.143	1.860**
	(0.747)	(0.828)	(0.800)	(0.788)	(1.087)	(1.056)	(0.871)
Δl_{it}	0.511***	0.712***	0.413**	0.598***	0.727***	0.520**	0.492***
	(0.511)	(0.169)	(0.167)	(0.162)	(0.185)	(0.213)	
ΔFAX_{it}			0.771***				
			(0.222)				
Δfdi_{it}				0.142**			
				(0.056)			
$\Delta reer\_ulc_{it}$					-0.297***		
					(0.081)		
$\Delta GFCF^F_{it}$						0.905***	
						(0.195)	
Δhc_{it}							-0.564
							(0.504)
			RESIDUALS AND ERROR CORRECTION DIAGNOSTICS				
Hausman	[0.671]	[0.544]	[0.993]	[0.918]	[0.000]	[0.093]	[0.134]
CD	[0.662]	[0.696]	[0.951]	[0.480]	[0.191]	[0.270]	[0.855]
IPS	[0.000]	[0.002]	[0.003]	[0.000]	[0.000]	[0.070]	[0.005]
CADF	[0.050]	[0.036]	[0.000]	[0.003]	[0.486]	[0.081]	[0.062]
Chang	[0.000]	[0.002]	[0.000]	[0.003]	[0.486]	[0.012]	[0.014]

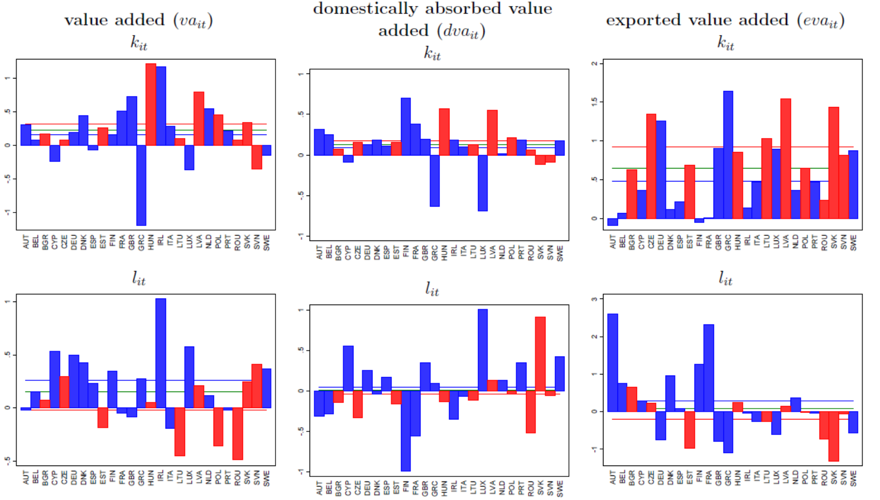
Error correction model for *eva* - long run

Table 6: The Error Correction Model estimates for the exported value added

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Long run							
eva_{it-1}	-0.350***	-0.448***	-0.331***	-0.426***	-0.353***	-0.409***	-0.372***
	(0.038)	(0.051)	(0.046)	(0.046)	(0.045)	(0.046)	(0.042)
k_{it}	1.846***	0.312	1.125***	1.788***	1.772***	1.462***	1.109***
	(0.287)	(0.521)	(0.389)	(0.316)	(0.351)	(0.329)	(0.310)
l_{it}	0.262	0.953**	0.173	0.356	0.783	0.412	0.594
	(0.527)	(0.413)	(0.647)	(0.429)	(0.562)	(0.485)	(0.504)
t		0.049***					
		(0.015)					
FAX_{it}			3.008***				
			(0.819)				
fdi_{it}				0.346			
				(0.230)			
$reer\_ulc_{it}$					-0.458***		
					(0.176)		
$GFCF^F_{it}$						2.268***	
						(0.469)	
hc_{it}							3.286***
							(1.228)
Residuals and Error Correction diagnostics							
Hausman	[0.671]	[0.544]	[0.993]	[0.918]	[0.000]	[0.093]	[0.134]
CD	[0.662]	[0.696]	[0.951]	[0.480]	[0.191]	[0.270]	[0.855]
IPS	[0.000]	[0.002]	[0.003]	[0.000]	[0.000]	[0.070]	[0.005]
CADF	[0.050]	[0.036]	[0.000]	[0.003]	[0.486]	[0.081]	[0.062]
Chang	[0.000]	[0.002]	[0.000]	[0.003]	[0.486]	[0.012]	[0.014]

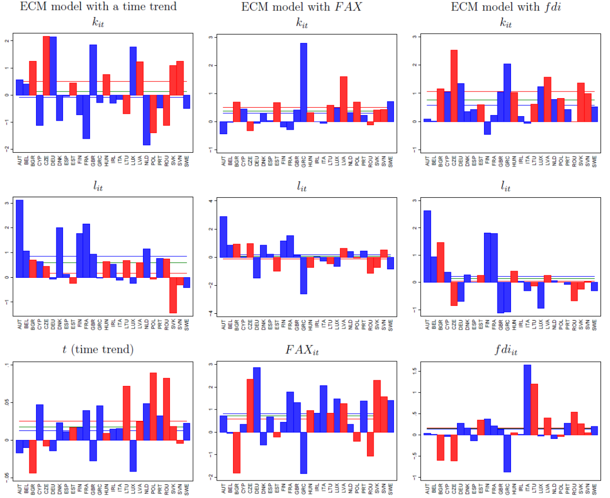
Country-specific slopes

Figure A.6: The long-run elasticities at the country level – the baseline ECM model (without a linear



Error correction model for *eva* - long run

Figure A.8: The long-run elasticities at the country level – the ECM for the exported value added



Conclusions

- Our decompositions show that exports have been a predominant component of the GDP growth rate of the CEEC in the analyzed period.
- Export performance of the CEEC have been better than most of the comparator EU-15 countries and remained to be important even after the global economic crisis.
- We show that the rate of convergence within the CEEC that was due to exports was twice as large as the one due to supply to the domestic market. In the case of the CEEC countries catching up with the rest of the EU-15, exports played an even larger role.
- We show that the growth rate of exports was mainly driven by the capital deepening (including imports of investment goods) as well as increased participation in GVC and to a smaller extent FDI and that growth of the labor input did not play a significant role

Bibliography

Dan Ben-David and Michael B Loewy. Free Trade, Growth, and Convergence. *Journal of Economic Growth*, 3(2):143–170, June 1998.

Fatima Cardoso, Paulo Soares Esteves, and Antonio Rua. The import content of global demand in Portugal. *Economic Bulletin and Financial Stability Report Articles*, 2013. URL `https://ideas.repec.org/a/ptu/bdpart/b201314.html`.

Steven N. Durlauf, Paul A. Johnson, and Jonathan R.W. Temple. Growth Econometrics. In Philippe Aghion and Steven Durlauf, editors, *Handbook of Economic Growth*, volume 1 of *Handbook of Economic Growth*, chapter 8, pages 555–677. Elsevier, 2005. URL `https://ideas.repec.org/h/eee/grochp/1-08.html`.

Gene M. Grossman and Elhanan Helpman. Trade, knowledge spillovers, and growth. *European Economic Review*, 35(2):517 – 526, 1991. ISSN 0014-2921. doi: https://doi.org/10.1016/0014-2921(91)90153-A.

Henk Kranendonk and Johan Verbruggen. Decomposition of gdp growth in some european countries and the united states. *De Economist*, 156(3):295–306, Sep 2008. ISSN 1572-9982. doi: 10.1007/s10645-008-9095-0. URL `https://doi.org/10.1007/s10645-008-9095-0`.

Marc J. Melitz. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, 71(6):1695–1725, November 2003. URL `https://ideas.repec.org/a/ecm/emetrp/v71y2003i6p1695-1725.html`.