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EUROSYSTEM

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The post-crisis TFP growth slowdown in CEE countries:

Exploring the role of Global Value Chains

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This paper in a nutshell

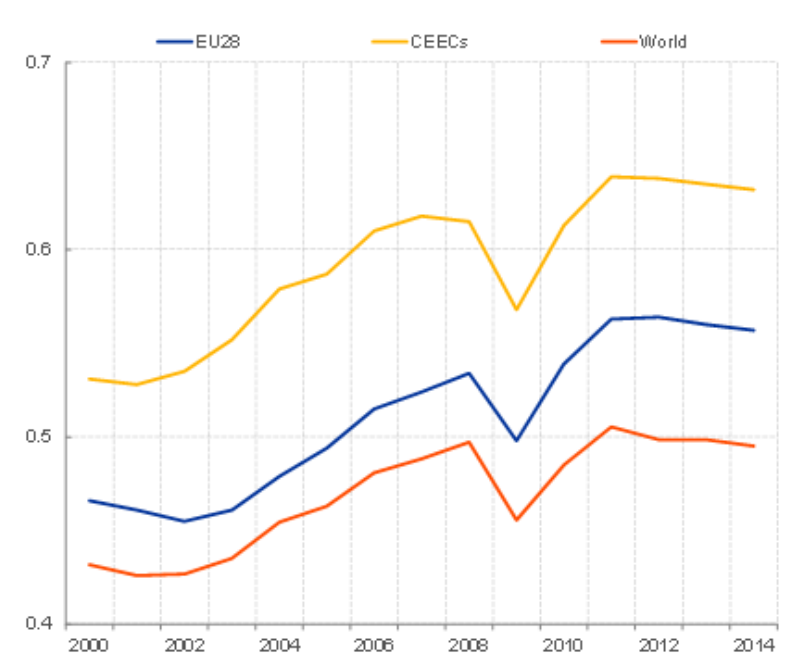
- In the big picture, we contribute to the literature exploring the role of GVCs (trade) as channel of technology transfer (and TFP growth)
- We use as a case study the observed TFP growth slowdown in CEECs. Interesting because:
 - They are deeply integrated in GVCs
 - They are catching-up economies in Europe and therefore rely on “acquired” knowledge
 - They have experienced a disproportionate slowdown in productivity growth
- Our framework of analysis:
 - Departs from a neo-Schumpeterian growth model (Acemoglu et al. 2006)
 - Adding insights from a 2-stage technology diffusion process (Bartelsman et al. 2013)
 - Including elements unique to the GVCs (Mariscal and Taglioni 2017)
- We use data for 9 CEE EU countries, 9 non-CEE EU countries, 9 macro-sectors and 12 years (2002-2013) from **CompNet and WIOD**

- 1 Motivation**
- 2 Framework of the analysis
- 2 Empirical specification, data and variable definition
- 3 Econometric results
- 4 Conclusions

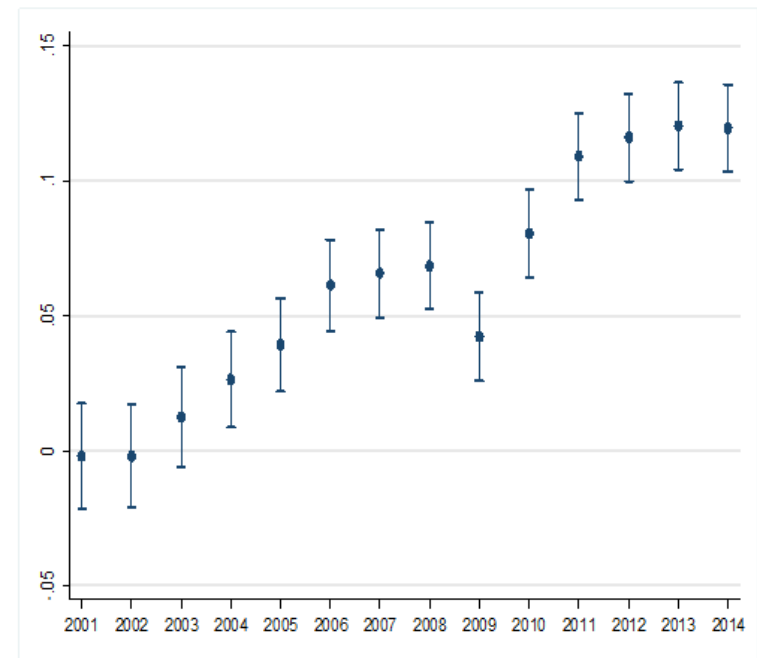
Why focusing on CEE countries? (I)

1. CEE countries are highly integrated in GVCs, however, growth of participation is slowing down since 2011

Total GVC participation



CEE countries' import intensity



Source: Authors' calculations based on WIOD (2016).

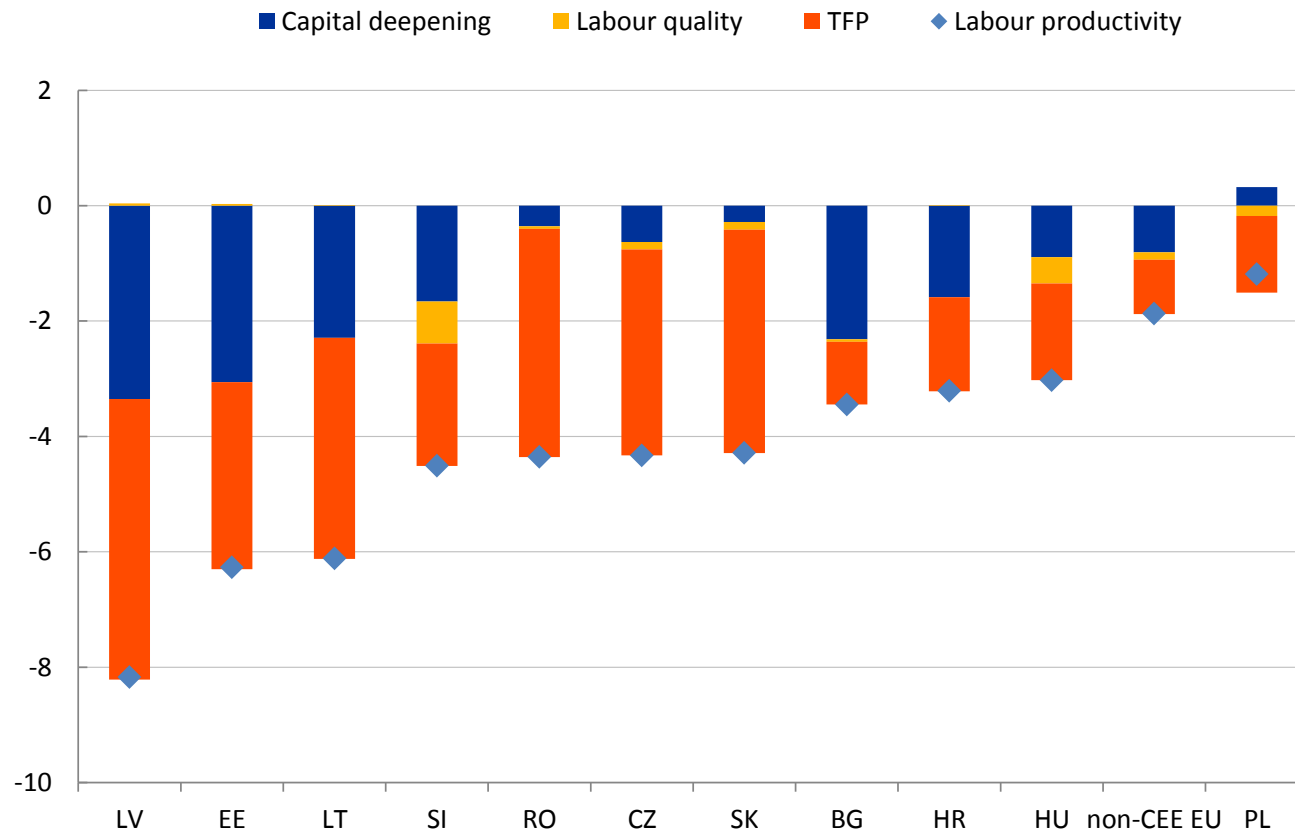
Note: GVC participation: share in gross exports of the sum of: (i) domestic value added in third country exports (forward GVC participation); and (ii) the foreign value added in own exports (backward GVC participation).

Source: Authors' calculations based on WIOD (2016) following Timmer et al. (2016).

Note: Estimated coefficients and 95%-confidence intervals on year dummies after regressing CEE countries' import intensity on country-sector and year fixed effects. Coefficients are relative to 2000.

2. Labour productivity growth slowed down to a larger extent in CEE countries relative to non-CEE EU countries, mainly driven by TFP

Difference in average labour productivity growth and its contributors (in %) between the crisis/post-crisis (2008-2015) and pre-crisis period (2000-2007)



Source: Authors' calculations based on Conference Board data.

[By year](#)

1 Motivation

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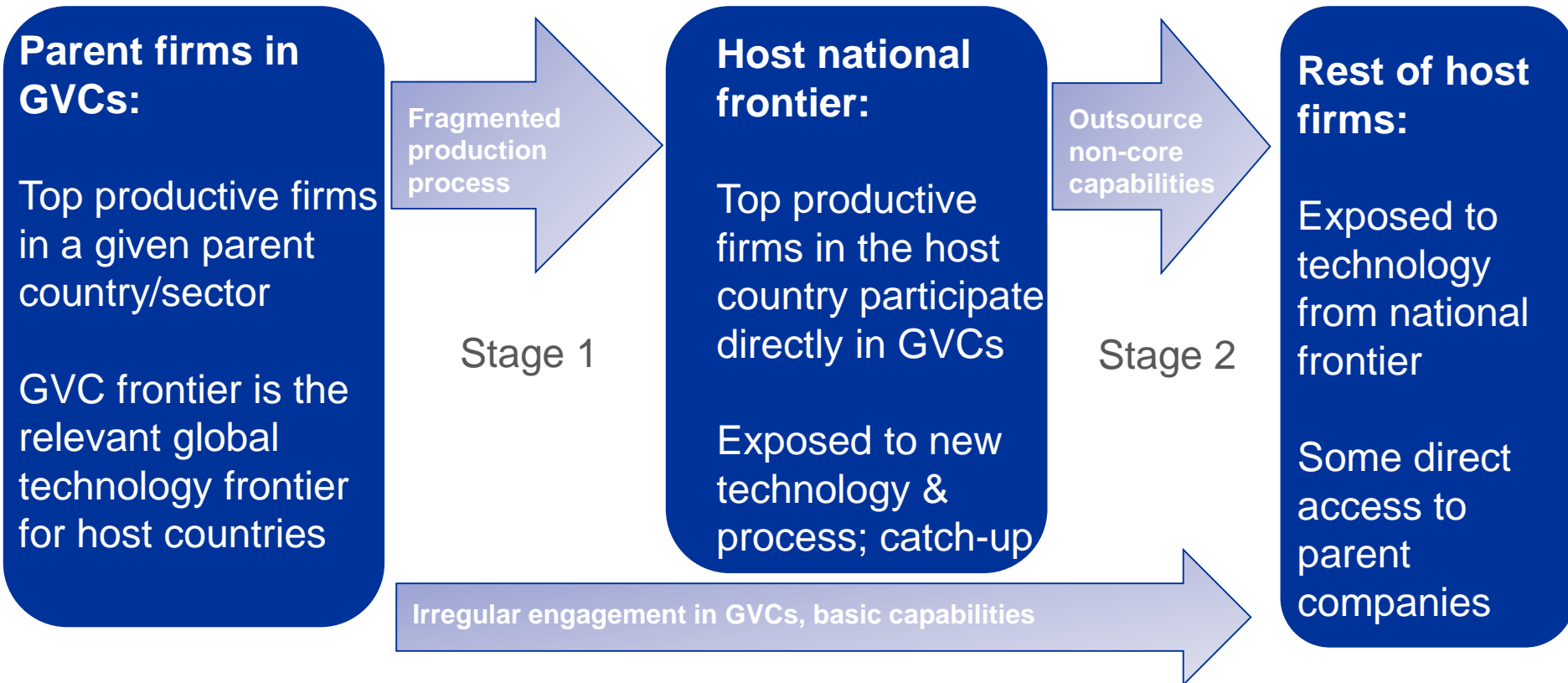
- **Neo-schumpeterian growth model** based on Acemoglu et al. (2006), Aghion and Howitt (1998), Griffith et al. (2006)...
- TFP growth in a given country-sector-year in a catch-up economy depends on:
 - **Technology created at the frontier**: proxied by TFP growth of global frontier firms
 - **Cath-up or distance to the global frontier**: proxied by lagged gap in productivity level to the global frontier
- **2-stage diffusion process** (Bartelsman et al. 2013):
 - New technology is transferred and adapted first by frontier firms, and then diffused to the rest of the (non-frontier) firms in the host country

GVCs are generally considered key channels for technological diffusion from global frontier firms

- Firms' engagements in GVCs combines “arm's strength length transactions” with features typical of intragroup investment
- **Large opportunities for transferring capabilities** and absorbing foreign technology and processes
 - Baldwin and Yan (2014), Bas and Strauss-Kahn (2014), Goldberg et al (2010), IMF (2015), Guadalupe (2015), Mariscal and Taglioni (2017)
 - How? New technology embedded in inputs; new varieties; R&D collaboration; investment to meet quality standards...
- **Not all firms in host economy participate in GVCs**, only the most productive or “national frontier” (in a given sector of activity)
 - National frontier firms have their own domestic production networks (Mariscal and Taglioni 2017)

Putting everything together

When a neo-Schumpeterian model meets a 2-stage technology diffusion process and GVCs...



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1. TFP growth of **frontier** firms in **host** economy: directly involved in GVCs

$$\begin{aligned} & TFP\ growth_{z,j,i=p80-90,t} \\ & = \alpha_{zj} + \beta tfp\ growth\ GVC_{z,j,t} + \gamma Distance\ to\ the\ GVC\ frontier_{t-1} + crisis \\ & + postcrisis + c * s + u_{z,j,t} \end{aligned}$$

Crisis defined as 1 for years between 2008 and 2010; post crisis equal 1 for years 2011-2012
FE (country*sector), robust and clustered standard errors (at the country-sector level).

2. TFP growth of **non-frontier** firms in **host** economy: suppliers of top productive firms in the sector (directly involved in GVCs); with unstable engagement in GVCs

$$\begin{aligned} & TFP\ growth_{z,j,i=p10-20,t} \\ & = \alpha_{zj} + \beta_1 tfp\ growth\ national\ frontier_{z,j,t} + \gamma_1 Distance\ to\ national\ frontier_{t-1} \\ & + \beta_2 GVC\ frontier\ growth_{z,j,t} + \gamma_2 Distance\ to\ GVC\ frontier_{t-1} \\ & + \beta_3 GVC\ growth_{z,j,t} + crisis + postcrisis + c * s + u_{z,j,t} \end{aligned}$$

Crisis defined as 1 for years between 2008 and 2010; post crisis equal 1 for years 2011-2012
FE (country*sector), robust and clustered standard errors (at the country-sector level)

Variable definition

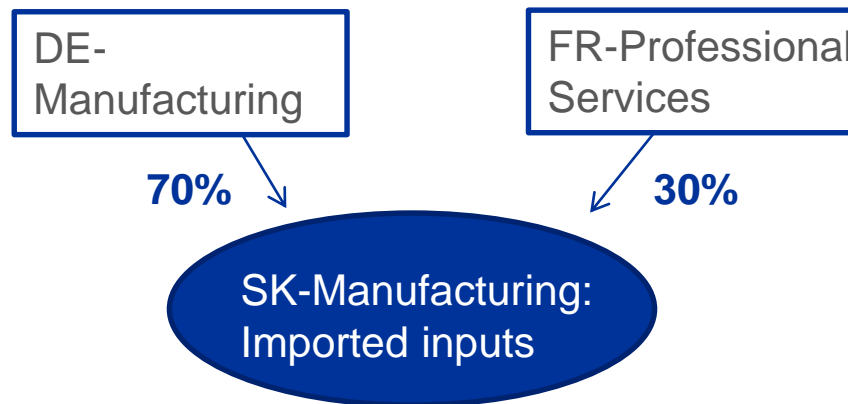
GVC participation:

$$GVC\ participation_{z,j,t} = \frac{Imports(Exports)\ of\ intermediates_{z,j,t}}{Domestic\ supply\ of\ intermediates_{z,j,t}}$$

TFP growth of GVC frontier (non-CEE EU countries):

$$GVC\ frontier_{z,j,t} = \sum_{p \in P} TFP_{p,i=top20\%,t} \cdot \frac{Imports(Exports)\ of\ intermediates_{p \rightarrow z,j,t}}{\sum_{p \in P} Imports(Exports)\ of\ intermediates_{p \rightarrow z,j,t}}$$

Example:



Other variables: R&D expenditure as a share of value added at the country-sector level

Data sources: **CompNet**, **WIOD** and **Eurostat**

- 9 CEE countries (all CEE EU countries but CZ and BG), 9 macro-sectors, period 2003-2012
- The ECB Competitiveness Research Network ([CompNet](#)) provides the productivity of frontier, middle and laggard firms in each country, macro-sector and year (4th vintage)
- **WIOD** provides the participation in GVCs of each CEE country-sector, and the link between each non-CEE country-sector and CEE country-sector
- Sector R&D (as a share of value added) comes from **Eurostat** (National Accounts)

Sample coverage: non-financial corporations with at least 1 employee operating in the business economy

Country	Sample period	Missing sectors	Exclusion rule	Coverage vis-a-vis National Accounts ^{1/}	
				Employment	VA
Croatia	2003-2012	none	none	56%	75%
Estonia	2003-2012	none	none	58%	34%
Hungary	2004-2012	none	none	56%	49%
Latvia	2006-2012	none	none	59%	43%
Lithuania	2003-2011	none	none	59%	36%
Poland	2005-2012	Accommodation and food service activities	>19 employees	38%	29%
Romania	2004-2012	none	>19 employees	41%	47%
Slovakia	2003-2012	none	>19 employees	38%	67%
Slovenia	2003-2012	none	none	55%	44%

1/ Source of reference: Eurostat – National Accounts Series.

Note: CompNet data for Poland, Romania and Slovakia refer to firms with 20 employees or more. Average coverage over the respective sample period.

[Descriptives](#)

- 1 Motivation
- 2 Framework of the analysis
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The baseline: TFP growth at the sector level (CEEC)

		GVC participation based on imports	GVC participation based on exports
	(1)	(2)	(3)
2008-2010 dummy	-0.082*** (0.01)	-0.051*** (0.01)	-0.048*** (0.02)
Post-2010 dummy	-0.023** (0.01)	-0.001 (0.01)	-0.003 (0.01)
TFP growth GVC frontier		0.483*** (0.06)	0.167*** (0.05)
Lagged gap TFP GVC frontier to sector		0.521*** (0.14)	0.426*** (0.10)
GVC participation growth		0.182* (0.11)	0.057 (0.06)
Constant	0.049*** (0.01)	-1.662*** (0.44)	-1.252*** (0.32)
Observations	613	613	613
Adjusted R-squared	0.062	0.345	0.267

Robust standard errors in parentheses, clustered at the country-sector level. Country-sector FE included.

*** p<0.01, ** p<0.05, * p<0.10

Robust standard errors in parentheses, clustered at the country-sector level. Country-sector FE included.

*** p<0.01, ** p<0.05, * p<0.10

- Sector TFP growth was lower relative to pre-crisis period both during the crisis and in the post-crisis
- Once we control for GVC-related variables, post-crisis TFP growth was not significantly different
- Both technology creation at the GVC frontier and catch-up matter for TFP growth
- Sectors where GVC participation grows relatively faster display larger TFP growth
- Stronger correlation through import of inputs

National frontier firms (most productive in the sector), CEEc

	(1)	(2)	(3)
2008-2010 dummy	-0.069*** (0.010)	-0.046*** (0.010)	0.033 (0.032)
Post-2010 dummy	-0.012 (0.009)	0.004 (0.011)	0.073* (0.039)
TFP growth GVC frontier		0.430*** (0.058)	0.445*** (0.118)
TFP growth GVC frontier*2008-2010 dummy			0.045 (0.145)
TFP growth GVC frontier*post-2010 dummy			-0.245* (0.143)
Lagged gap TFP GVC frontier to national frontier		0.364*** (0.054)	0.386*** (0.052)
Lagged gap*2008-2010 dummy			-0.030*** (0.010)
Lagged gap*post-2010 dummy			-0.028** (0.012)
GVC participation growth		0.199** (0.079)	-0.080 (0.107)
GVC participation growth*2008-2010 dummy			0.358*** (0.134)
GVC participation growth*post-2010 dummy			0.317* (0.181)
Constant	0.040*** (0.005)	-0.991*** (0.148)	-1.048*** (0.145)
Observations	642	642	642
Adjusted R-squared	0.087	0.334	0.355

- Same results as in sector baseline
- Capacity to learn from parent firms decreased in the crisis and post-crisis period
- Sectors with higher GVC growth were **more resilient** to the crisis (and post-crisis) slowdown

Robust standard errors in parentheses, clustered at the country-sector level. Country-sector FE included.

*** p<0.01, ** p<0.05, * p<0.10

Laggard firms

	(1)	(2)
2008-2010 dummy	-0.090*** (0.011)	-0.025*** (0.008)
Post-2010 dummy	-0.009 (0.012)	-0.022** (0.008)
TFP growth national frontier		0.920*** (0.049)
Lagged gap TFP national frontier to laggards		0.569*** (0.080)
TFP growth GVC frontier		0.151*** (0.041)
Lagged gap TFP GVC frontier to laggards		0.010 (0.024)
GVC participation growth		0.203** (0.079)
Constant	0.040*** (0.005)	-1.054*** (0.113)
Observations	642	642
Adjusted R-squared	0.092	0.736

- Exposure to national frontier firms is more important for laggards than direct exposure to GVC
 - 2-stage diffusion process
- Operating in a sector with expanding GVC participation growth is important
- Interaction with crisis and post-crisis period does not change anything
 - Crisis only affected absorptive capacity of frontier firms

Robustness: year dummies

Robustness: other FE

Robustness: GVC level

Robustness: Other GVC indicator

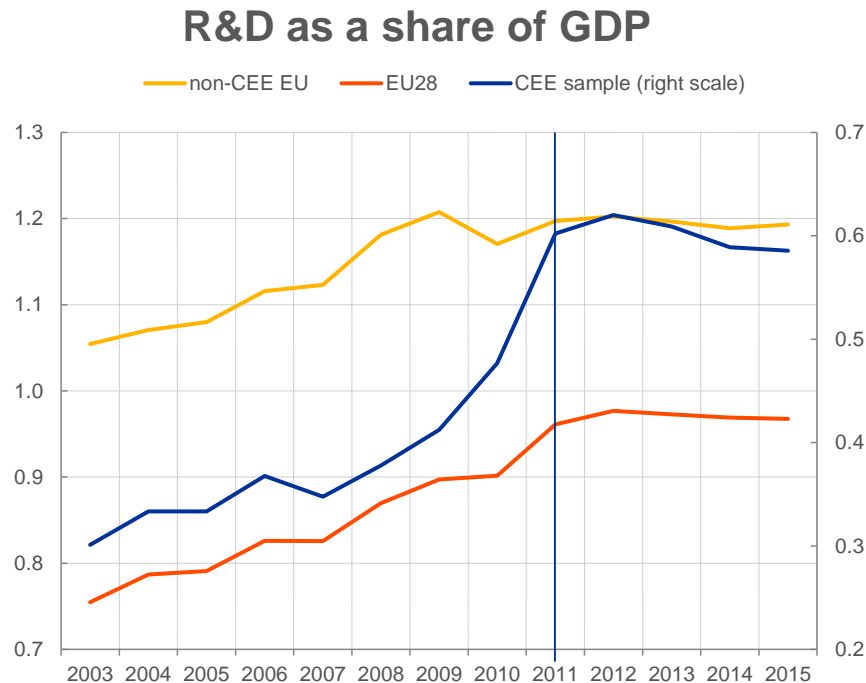
Robust standard errors in parentheses, clustered at the country-sector level. Country-sector FE included.

*** p<0.01, ** p<0.05, * p<0.10

Middle firms

National frontier firms: why has absorptive capacity decreased?

- The absorptive capacity of firms depends on their own investment in R&D and human capital
 - Cohen and Levinthal (1989, 1990 and 1994); Griffith, R., S. Redding and J. Van Reenen (2004); Lopez-Garcia and Montero (2011)
- Our hypothesis is that during the post-crisis period, the investment in intangibles of CEE frontier firms decreased



Source: Eurostat.

Note: R&D expenditure of the business enterprise sector. Non-CEE EU refers to the unweighted average of AT, BE, CY, DK, FI, FR, DE, IT, IE, PT, PL, SI, ES, MA, NE, PT, SW and UK. CEE sample: HR, EE, HU, LV, LT, PO, RO, SK, SV.

No data on R&D of frontier firms; split sectors in more and less dependent on R&D

VARIABLES	1	2	3
	Pooled	Sectors more intensive in R&D	Sectors less intensive in R&D
2008-2010 dummy	-0.046*** (0.010)	0.027 (0.038)	0.013 (0.084)
Post-2010 dummy	0.004 (0.011)	0.088* (0.043)	0.084 (0.087)
TFP growth GVC frontier	0.430*** (0.058)	0.677** (0.255)	0.416+ (0.265)
TFP growth GVC frontier*2008-2010 dummy		-0.320 (0.250)	0.005 (0.347)
TFP growth GVC frontier*post-2010 dummy		-0.494** (0.212)	0.028 (0.274)
Lagged gap TFP GVC frontier to national frontier	0.364*** (0.054)	0.530*** (0.090)	0.511*** (0.108)
Lagged gap*2008-2010 dummy		-0.024* (0.014)	-0.027 (0.023)
Lagged gap*post-2010 dummy		-0.023* (0.012)	-0.036 (0.029)
GVC participation growth	0.199** (0.079)	-0.183 (0.148)	-0.538 (0.444)
GVC participation growth*2008-2010 dummy		0.618** (0.250)	1.217* (0.631)
GVC participation growth*post-2010 dummy		0.344* (0.191)	1.069+ (0.713)
Constant	-0.991*** (0.148)	-1.447*** (0.258)	-1.480*** (0.327)
Observations	642	184	185
Adjusted R-squared	0.334	0.461	0.408

- Identification à la Rajan and Zingales:
 - Significant impact only in sectors highly dependent on R&D
- Split sectors in a given country-year according to R&D intensity
- We find that drop in absorptive capacity only in R&D intensive sectors; all the rest equal

Robust standard errors in parentheses, clustered at the country-sector level. Country-sector FE included.

*** p<0.01, ** p<0.05, * p<0.10, + p<0.15

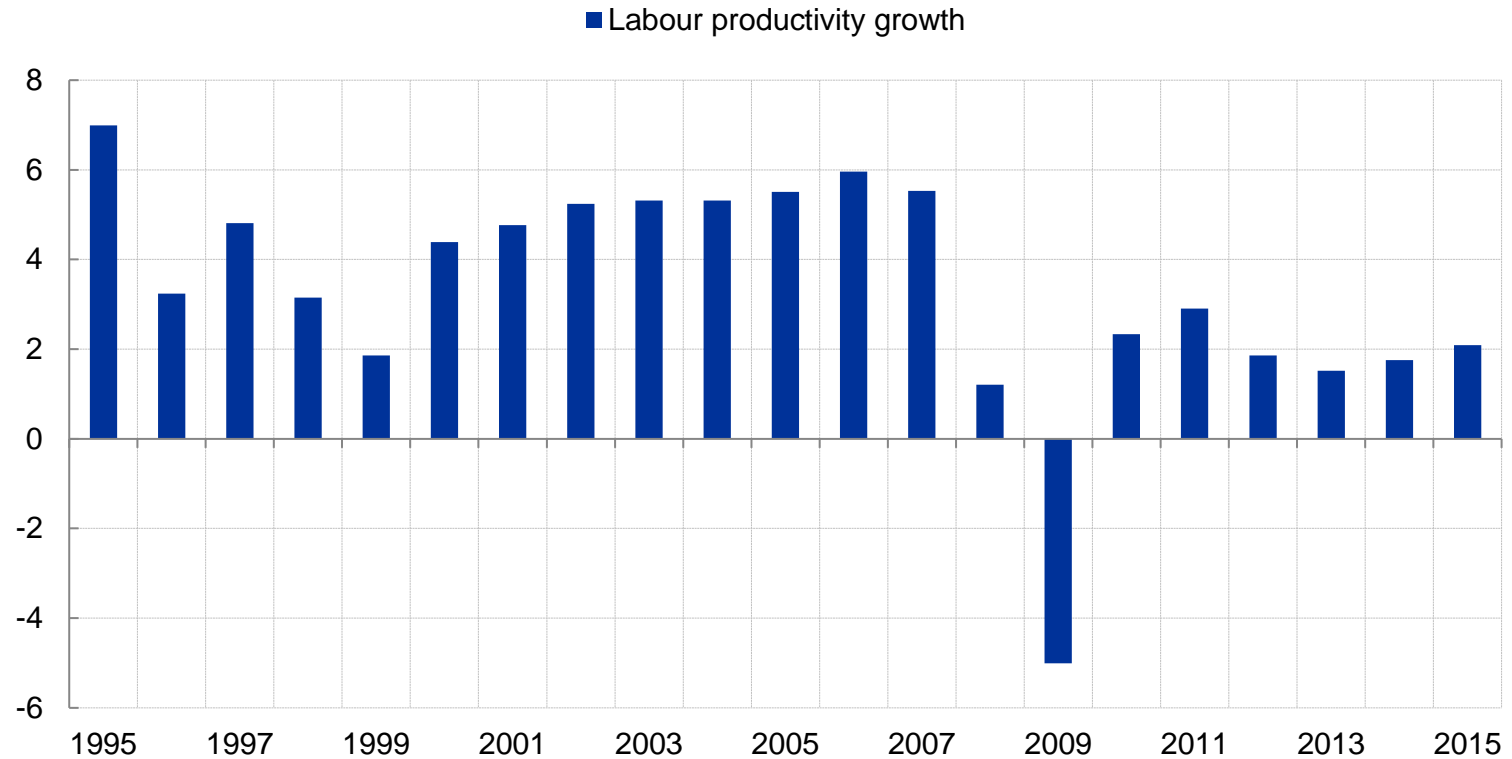
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- Frontier and laggard firms in host countries benefit from GVC participation in different ways:
 - **Frontier firms** are directly involved in GVCs and benefit from technology transfers from parent companies
 - **Laggards** benefit from contact with national frontier firms and also, to a lesser extent, from direct contact with parent companies
- In post-crisis period, frontier firms have decreased their absorptive capacity
 - Therefore benefit less from technology creation
- One possible reason is their reduction in investment in intangibles: **scarring effect of the crisis?**

Thanks for your attention!

Reserve slides

Labour productivity (y-o-y change)



Source: Authors' calculations based on Conference Board.
Note: Y-o-Y labour productivity, average over CEE-countries.



Data Sources, some more details

Country	Name of the source of the microdata used to produce the CompNet indicators (both in English and in original language):
Belgium	Annual account : Centrale des bilans / Balanscentral / Central Balance Sheet Office database (Version commercial : Belfirst, Bureau Van Dijk) International trade date : Intra-Stat and Extra-Stat database
Croatia	Annual Financial Statements Registry (in Croatian: Registar godišnjih financijskih izvještaja, RGFI). All modules are based on this source.
Estonia	Source 1: Foreign trade statistics data (Väliskaubanduse andmed)
Finland	Structural Business Statistics (Yritysten rakenne- ja tilinpäätöstilastoaineistot)
France	Fiscal Form – liasse fiscale
Germany	Financial Statements Data Pool (Jahresabschlussdatenpool) based on different sources which partly cannot be revealed in detail. The sources are: - Financial statements collected within the framework of the Bundesbank's refinancing operations - Customers' formally anonymized financial statements from seven voluntarily participating financial institutions (so-called partners of the Data Pool) - Financial statements from commercial data providers Bisnode and Bureau van Dijk (DAFNE database)
Italy	Financial statements from Chamber of Commerce (Bilanci delle società presentati alle CCIA)
Latvia	Source 1: Complex report on activities "1-annual" (Kompleksais parskaits par darbibu "1-gada") Source 2: Foreign trade /Areja tirdznieciba/ Source 3: Annual reports of companies (balance sheet and profit or loss account). Gada parskaits (balance, pelnas vai zaudejumu aprekins)
Poland	F-01 and F-02 forms (dane z formularzy F-01 i F-02)
Portugal	The source is called Informação Empresarial Simplificada (Simplified Corporate Information, Portuguese acronym: IES). The IES is an integrated system that meets different reporting needs, namely trade registers and provision of notarial services, accounting statements and tax returns, production of statistics and economic analysis of corporations and activity sectors. Under the IES, data submitted by non-financial corporations are integrated in the Balance Sheet Database of Banco de Portugal, which discloses aggregate statistics based on such data. Simplified Corporate Information / Informação Empresarial Simplificada (IES).
Slovakia	Report on production industries (Výkaz produkčných odvetví)
Slovenia	Letna poročila slovenskih podjetij (Slovenian companies' annual reports). [For detailed information please refer to: http://www.ajpes.si/Registers/Annual_Reports/Information
Spain	Source 1: Annual Central Balance Sheet Data Office (CBA), Central de Balances Anual (CBA) Source 2: Annual Accounts Deposited in Mercantile Registries Data Base (CBB-RM), Base de Datos de Cuentas Anuales Depositadas en los Registros Mercantiles (CBB-RM)
Sweden	SBS (Företagens ekonomi), VAT register (Momsregister), Trade statistics (Utrikeshandelsstatistik)



A solution to the non-comparability of cross-country firm data and confidentiality problem is to use a micro-distributed approach

- Write a code (in STATA) to compute different indicators of interest at the firm-level
 - In our case: competitiveness –related indicators; computed from items of the balance sheets, matched, if possible, with customs or exports info
- Harmonise definitions, target samples and cleaning and treatment of the raw data
- Distribute code to our national counterparts; they run the code in their computers (we do not see the data)
- Collect results, aggregated at a country/sector/size/year level to preserve confidentiality, but keeping much of the richness of the firm-level data

Keeping the richness of the firm-level data

- For each indicator, in addition to mean, median, sd and skewness, CompNet compiles:
 - **Full distribution (10 deciles)** considering all firms operating in a given **level of aggregation** (country, macro-sector, 2-digit industry, country/size class and macro-sector/size class)
 - **Full set of firms' characteristics** within a given level of aggregation for different splits of firms (e.g. exporting vs. non-exporting firms)
 - **Joint distributions:** median characteristics of firms in a given decile of the productivity, size etc. distribution in each level of aggregation

What is available?

Productivity and allocative efficiency

Labor productivity

TFP

ULC

LC per employee

Firm size

Capital intensity

Static Allocative Efficiency

Dynamic Allocative Efficiency

Financial

Investment Ratio

RoA

Cash holdings

Leverage

Financing gap

Collateral

Equity to Debt

Cash flow

Implicit interest rate

Trade Credit/Debt

Debt burden

Credit constraint index

Trade

% permanent exp.

% sporadic exp.

Export value

Export value added

Productivity premium of exporters

Competition

Weighted PCM

Sector-specific mark-ups

Sector-specific collective bargaining power

Concentration measures

Labour

% firms that increase/decrease employment productivity or ULC between t and t+3

Characteristics of growing and shrinking firms

Share of High-growth firms

More info on CompNet at:
www.comp-net.org



Lower TFP growth in the post-crisis compared to the pre-crisis period

	2003-2007	2008-2010	2011-2012	2003-2012
TFP growth GVC frontier	3.0	-0.4	-1.5	0.9
TFP growth sector	4.7	-3.2	2.8	1.3
TFP growth national frontier	3.9	-2.9	2.8	1.1
TFP growth middle	3.8	-3.1	2.5	0.9
TFP growth laggards	4.0	-5.0	3.1	0.4
GVC participation growth	1.4	-0.0	1.0	1.1

Source: Authors' calculations based on CompNet and WIOD (2016).



Middle firms

	(1)	(2)
2008-2010 dummy	-0.069*** (0.009)	-0.004 (0.005)
Post-2010 dummy	-0.014 (0.009)	-0.004 (0.005)
TFP growth national frontier		0.862*** (0.028)
Lagged gap TFP national frontier to middle		0.593*** (0.072)
TFP growth GVC frontier		0.095*** (0.019)
Lagged gap TFP GVC frontier to middle		0.032* (0.018)
GVC participation growth		0.065* (0.037)
Constant	0.038*** (0.004)	-0.608*** (0.064)
Observations	642	642
Adjusted R-squared	0.093	0.861

Robust standard errors in parentheses, clustered at the country-sector level. Country-sector FE included.

*** p<0.01, ** p<0.05, * p<0.10

Baseline with year dummies

	Sector	Frontier	Middle	Laggards
	(1)	(2)	(3)	(4)
TFP growth national frontier			0.852*** (0.029)	0.896*** (0.049)
Lagged gap TFP national frontier to middle			0.584*** (0.070)	
Lagged gap TFP national frontier to laggards				0.565*** (0.076)
TFP growth GVC frontier	0.395*** (0.088)	0.269*** (0.072)	0.080*** (0.022)	0.099** (0.045)
Lagged gap TFP GVC frontier to sector	0.520*** (0.142)			
Lagged gap TFP GVC frontier to national frontier		0.347*** (0.057)		
Lagged gap TFP GVC frontier to middle			0.036* (0.019)	
Lagged gap TFP GVC frontier to laggards				0.024 (0.023)
GVC participation growth	0.171* (0.093)	0.103 (0.070)	0.068 (0.043)	0.207** (0.087)
Constant	-1.661*** (0.464)	-0.960*** (0.164)	-0.624*** (0.067)	-1.130*** (0.124)
Observations	613	642	642	642
Adjusted R-squared	0.352	0.366	0.862	0.744



Robust standard errors in parentheses, clustered at the country-sector level.³¹
Country-sector and year FE included. *** p<0.01, ** p<0.05, * p<0.10

Baseline with country, year and sector dummies

	Sector	Frontier	Middle	Laggards
	(1)	(2)	(3)	(4)
TFP growth national frontier			0.816*** (0.033)	0.878*** (0.052)
Lagged gap TFP national frontier to middle			0.054*** (0.017)	
Lagged gap TFP national frontier to laggards				0.015* (0.008)
TFP growth GVC frontier	0.161* (0.090)	0.095 (0.083)	0.043 (0.027)	0.050 (0.053)
Lagged gap TFP GVC frontier to sector	0.018 (0.016)			
Lagged gap TFP GVC frontier to national frontier		0.002 (0.008)		
Lagged gap TFP GVC frontier to middle			0.009*** (0.003)	
Lagged gap TFP GVC frontier to laggards				0.024*** (0.006)
GVC participation growth	0.287*** (0.086)	0.155** (0.063)	0.084** (0.042)	0.247** (0.094)
Constant	-0.055 (0.042)	-0.001 (0.023)	-0.082*** (0.020)	-0.147*** (0.030)
Observations	613	642	642	642
Adjusted R-squared	0.101	0.199	0.812	0.636

Robust standard errors in parentheses, clustered at the country-sector level.³²

Country, sector, and year FE included. *** p<0.01, ** p<0.05, * p<0.10



Alternative GVC measure: level of GVC participation

	Sector	Frontier	Middle	Laggards
	(1)	(2)	(3)	(4)
2008-2010 dummy	-0.054*** (0.014)	-0.049*** (0.011)	-0.005 (0.005)	-0.028*** (0.009)
2011-2012 dummy	-0.014 (0.017)	-0.002 (0.012)	-0.007 (0.006)	-0.026** (0.010)
TFP growth national frontier			0.859*** (0.029)	0.921*** (0.050)
Lagged gap TFP national frontier to middle			0.597*** (0.070)	
Lagged gap TFP national frontier to laggards				0.572*** (0.080)
TFP growth GVC frontier	0.493*** (0.057)	0.452*** (0.056)	0.101*** (0.018)	0.176*** (0.039)
Lagged gap TFP GVC frontier to sector	0.542*** (0.137)			
Lagged gap TFP GVC frontier to national frontier		0.380*** (0.056)		
Lagged gap TFP GVC frontier to middle			0.040** (0.019)	
Lagged gap TFP GVC frontier to laggards				0.023 (0.026)
GVC participation	0.270*** (0.089)	0.169*** (0.060)	0.086** (0.039)	0.122** (0.054)
Constant	-1.815*** (0.461)	-1.089*** (0.164)	-0.671*** (0.065)	-1.157*** (0.114)
Observations	613	642	642	642
Adjusted R-squared	0.354	0.336	0.863	0.735

Robust standard errors in parentheses, clustered at the country-sector level.³³
Country-sector FE included. *** p<0.01, ** p<0.05, * p<0.10



Alternative GVC measure: Imported intermediates / total intermediates

	Sector	Frontier	Middle	Laggards
	(1)	(2)	(3)	(4)
2008-2010 dummy	-0.050*** (0.013)	-0.046*** (0.011)	-0.003 (0.005)	-0.024*** (0.009)
Post-2010 dummy	-0.001 (0.014)	0.004 (0.011)	-0.004 (0.005)	-0.022*** (0.008)
TFP growth national frontier			0.861*** (0.028)	0.921*** (0.049)
Lagged gap TFP national frontier to middle			0.591*** (0.072)	
Lagged gap TFP national frontier to laggards				0.567*** (0.081)
TFP growth GVC frontier	0.486*** (0.068)	0.426*** (0.059)	0.088*** (0.020)	0.140*** (0.044)
Lagged gap TFP GVC frontier to sector	0.522*** (0.137)			
Lagged gap TFP GVC frontier to national frontier		0.364*** (0.054)		
Lagged gap TFP GVC frontier to middle			0.030* (0.018)	
Lagged gap TFP GVC frontier to laggards				0.007 (0.024)
GVC participation growth	0.360 (0.354)	0.456* (0.260)	0.218** (0.106)	0.549** (0.219)
Constant	-1.663*** (0.445)	-0.990*** (0.151)	-0.602*** (0.064)	-1.040*** (0.116)
Observations	613	642	642	642
Adjusted R-squared	0.343	0.333	0.862	0.736



Robust standard errors in parentheses, clustered at the country-sector level.³⁴

Country-sector FE included. *** p<0.01, ** p<0.05, * p<0.10

No data on R&D of frontier firms; split sectors in more and less dependent on R&D

- Same results using other indicators to split sample
 - Here Intellectual Property

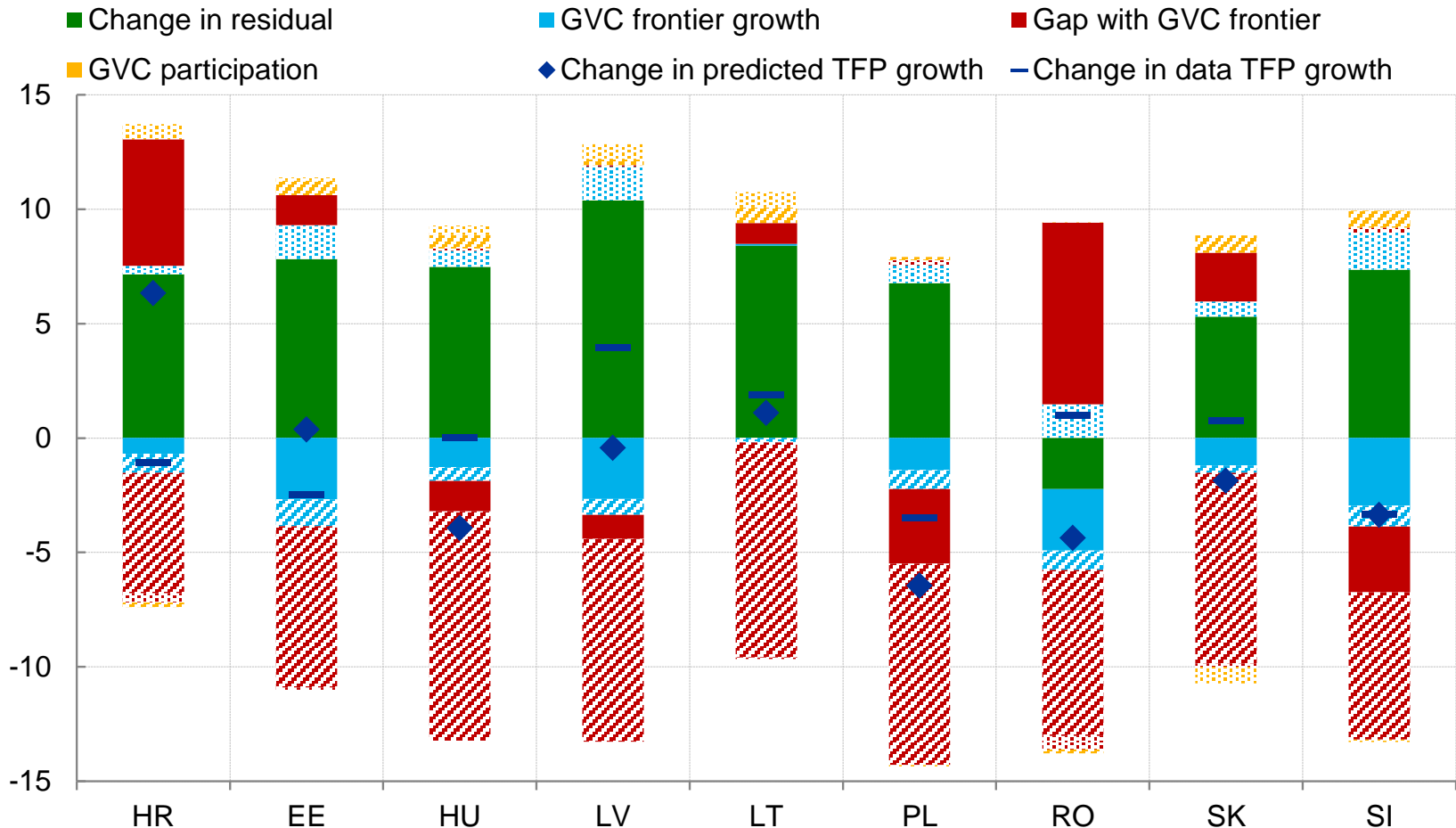
VARIABLES	1	2	3
	Pooled	Sectors more intensive in IPP	Sectors less intensive in IPP
2008-2010 dummy	-0.046*** (0.010)	0.046 (0.041)	-0.086 (0.097)
Post-2010 dummy	0.004 (0.011)	0.074* (0.044)	0.006 (0.091)
TFP growth GVC frontier	0.430*** (0.058)	0.931** (0.358)	0.303 (0.255)
TFP growth GVC frontier*2008-2010 dummy		-0.476+ (0.320)	0.025 (0.330)
TFP growth GVC frontier*post-2010 dummy		-0.731** (0.320)	0.282 (0.292)
Lagged gap TFP GVC frontier to national frontier	0.364*** (0.054)	0.535*** (0.092)	0.447*** (0.103)
Lagged gap*2008-2010 dummy		-0.024* (0.014)	0.007 (0.028)
Lagged gap*post-2010 dummy		-0.018+ (0.011)	-0.010 (0.028)
GVC participation growth	0.199** (0.079)	-0.142 (0.116)	-0.485 (0.434)
GVC participation growth*2008-2010 dummy		0.504*** (0.180)	1.370** (0.565)
GVC participation growth*post-2010 dummy		0.359** (0.142)	1.216+ (0.759)
Constant	-0.991*** (0.148)	-1.455*** (0.263)	-1.373*** (0.330)
Observations	642	188	182
Adjusted R-squared	0.334	0.447	0.408

Robust standard errors in parentheses, clustered at the country-sector level.
Country-sector FE included.
*** p<0.01, ** p<0.05, * p<0.10

Robust to different indicators of R&D
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Why has TFP growth slowed down?

Shift-share analysis (*p.p.*, frontier, 2012-2011 vs. 2003-2007)



Legend	GVC frontier			Gap with GVC frontier			GVC participation		
	Data ch.	Coeff. ch.	Covariance	Data ch.	Coeff. ch.	Covariance	Data ch.	Coeff. ch.	Covariance
Residual							No effect		