

# Determinants of GVC Participation: Cross-Country Evidence

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Virtual Conference on Sustainable Development, Firm Performance and  
Competitiveness Policies in Small Open Economies

*Organized by*

CompNet and National Bank of Slovakia

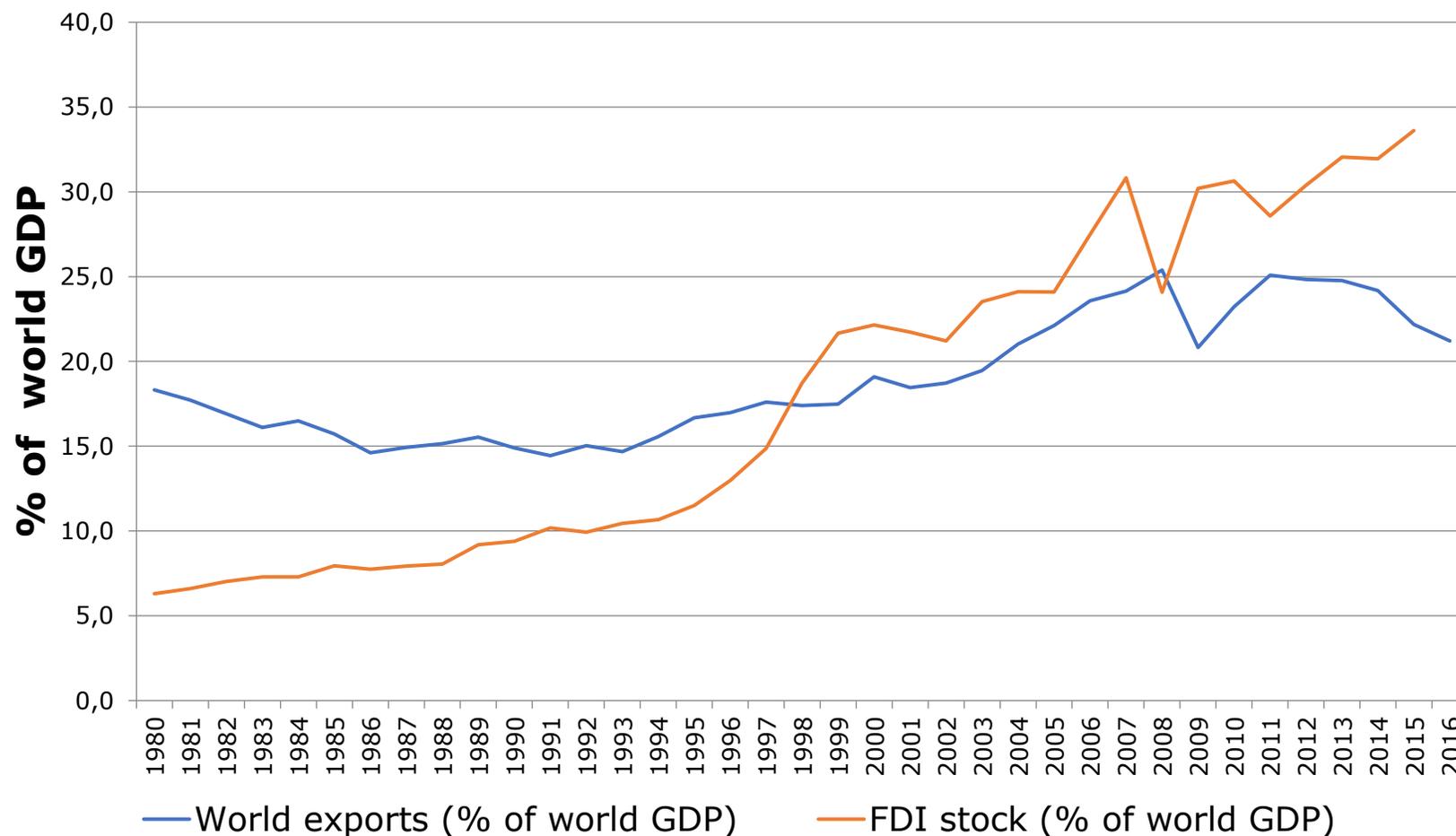
Bratislava, 22 June 2018



- Global Value Chains (GVC) and its evolution
- Literature survey on the factors influencing GVC indicators
- Multivariate analysis of GVC indicators
- Implications of GVCs

World trade has grown rapidly since 1990. FDI by MNCs has grown at a faster rate than world trade, and is a major force driving globalization of the world economy

### World Exports and Foreign Direct Investment



- Global value chains (GVC) have grown substantially in recent decades
  - For a wide range of goods and services, the production stages are sliced up and distributed across many countries.
  - components of products move through production centers with value being added at each stage.
- Most of these chains are spearheaded by multinational corporations, spurred by a number of factors
  - liberalization of trade and capital flows in emerging market and developing countries;
  - decline in transportation costs amid large wage differences between advanced, emerging market, and developing economies;
  - advances in information and communication technologies that made the complex coordination of production processes at distance possible.

- The rise of global value chains has led to far reaching changes in the nature of international trade
  - UNCTAD (2013) estimates that: about 80% of trade takes place within the international production networks of MNCs; and that about 33 % of global trade is intra-firm trade
  - a growing proportion of trade in goods and services is in intermediate goods as opposed to final goods
- A particular implication of global value chains is that traditional export statistics obscure how value added is traded in the global economy
  - conventional data overstate the domestic value added content of exports (since conventional gross trade statistics tally the gross value of goods at each stage of the border crossing instead of the net value added between border crossings).
- The main goal of researchers has been to go beyond the veil of gross flows to analyze changes in trade in value added directly (Johnson and Noguera, 2017).

- Computation of value added content of trade requires a global input-output table where individual country tables are combined and linked via international trade matrices
- Method of calculating trade in value added was first proposed by Hummels, Ishii and Yi (2001), and the accounting framework was further developed and improved by Johnson and Noguera (2012), and Koopman, Wang and Wei (2010, 2014)
- Several global input-output data sets have been developed under various data initiatives and are accessible to researchers: World Input-Output Data Base (WIOD); WTO-OECD TiVA Database (Trade in Value Added); UNCTAD's EORA Database; IDE-JETRO Asian Input-Output Tables.

# The GVC literature is mainly empirical and descriptive.

- Empirical work has mainly focused on developing novel indicators to measure GVC participation, and investigating developments in these indicators for the world in the aggregate, individual countries in the aggregate and across sectors, and for trade across bilateral partners.
- The methodology has varied from:
  - documenting the trend and patterns;
  - explaining cross-country variations by eye-balling graphical illustrations or using simple pair-wise correlation analysis with various country-specific characteristics;
  - Estimating gravity-style multivariate regressions to explain variations in selected GVC indicators across bilateral partners (e.g., Baldwin and Taglioni, 2013; Choi, 2013; Ignatenko et al., 2019; Johnson and Noguera, 2017).
  - estimating multivariate regressions on determinants of selected GVC indicators at the aggregate country or sector level to examine the role of country-specific structural and policy related factors (e.g., Kersan-Škabić, 2019; Kowalski et al., 2015; Stehrer and Stöllinger, 2015; and Vrh, 2018)

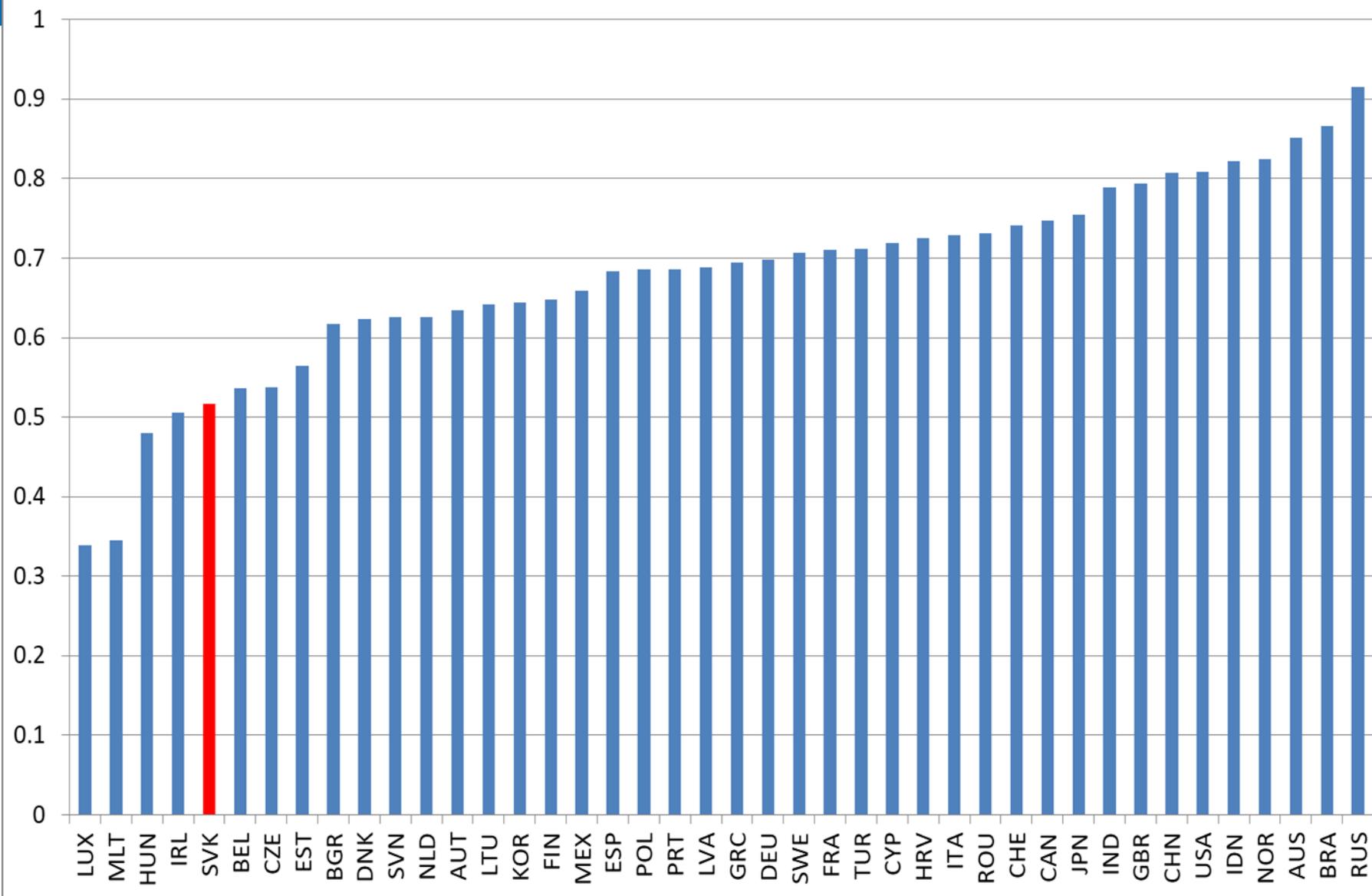
- Most common indicators analyzed include:
  - *VAX ratio*: a measure of the share of domestic value added in gross exports
  - *Backward linkage* (BL): a measure of the extent to which domestic firms use intermediate goods and services for exporting activity
  - *Forward linkage* (FL): a measure of the degree to which a given country's domestic value added in gross exports are used by partner countries as inputs in their own exports
  - *GVC participation rate*:  $BL + FL$
  - *GVC position index*:  $FL/BL$  ; a measure of the relative downstream or upstream position of a country

# Focus of the paper

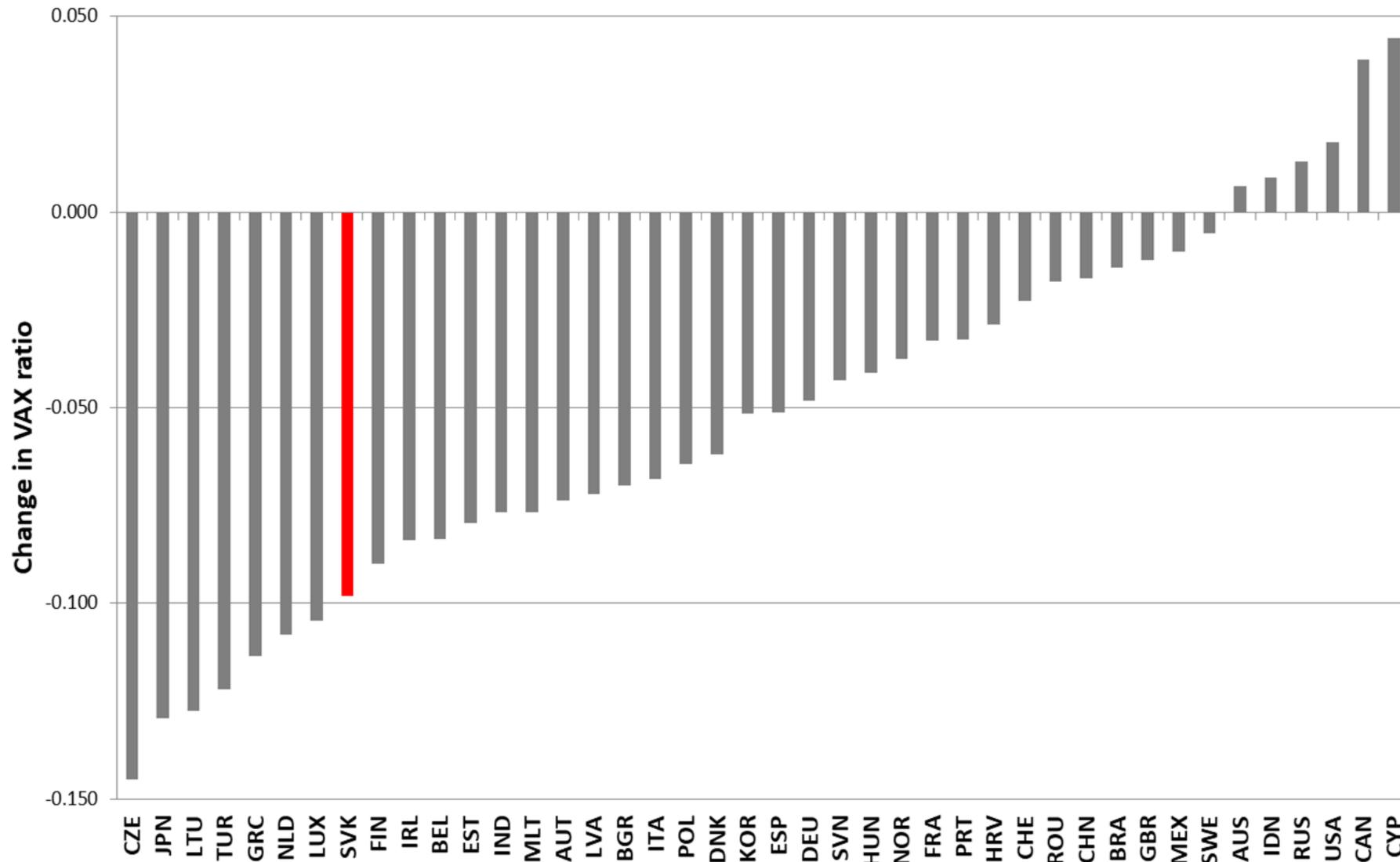
- Adds to the small but growing number of multivariate regression exercises at the aggregate country level.
  - Based on a sample of 43 countries for the period 2000-2014 utilizing the WIOD data base.
- Three notable features of the paper:
  - Sheds light on the interconnectedness of the various GVC indicators by simultaneous consideration of separate regressions for each indicator;
  - Classifies export composition into five groups: low-tech manufacturing, medium- and high-tech manufacturing, low-tech services, medium- and high-tech services, and “other” exports;
    - (more informative in explaining cross-country variations in GVC participation than a simple two-way distinction between manufacturing and non-manufacturing exports)
  - Examines the impact of the real exchange rate (REER) on GVC participation indicators
    - (an aspect which has not received much attention in the literature)

- For the world as a whole, the VAX ratio has declined by about 10 percentage points over four decades, but the decline has not been uniform through time
- The magnitude of the VAX ratio and the extent of its decline are heterogeneous across sectors, countries, and bilateral partners

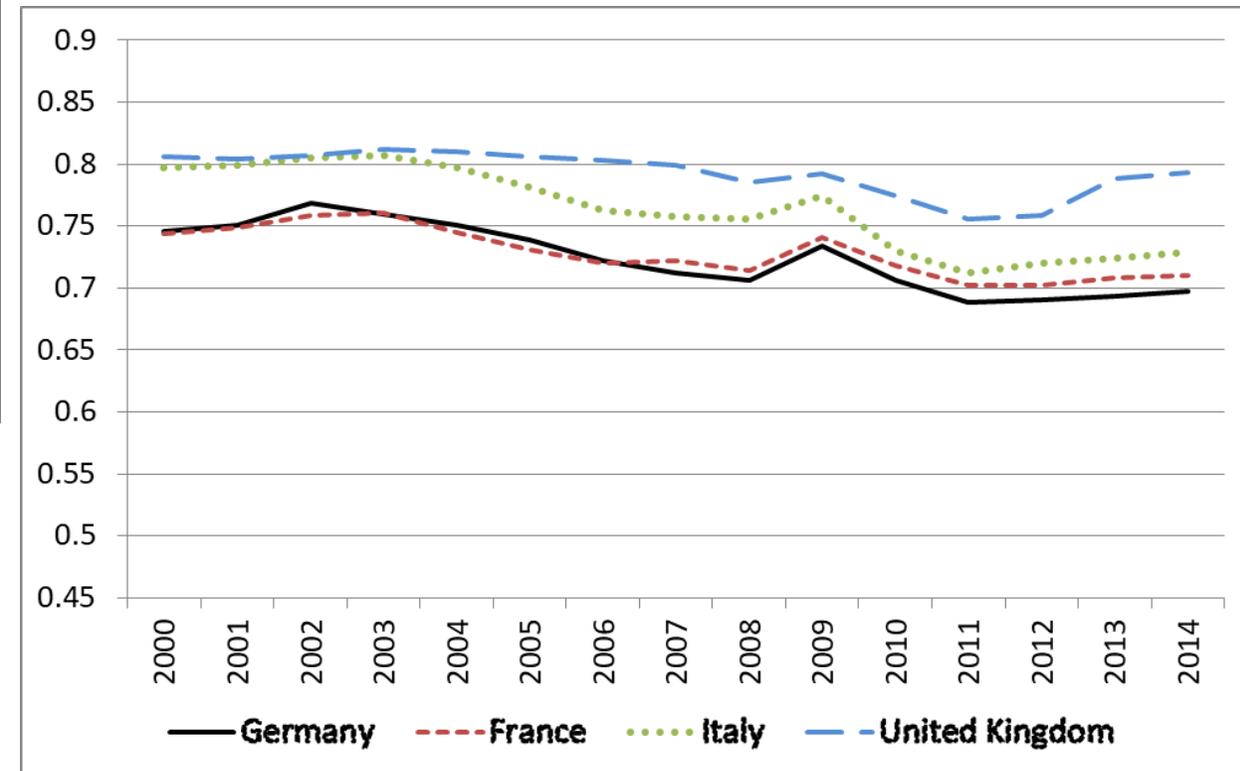
### VAX ratio in 2014 by country



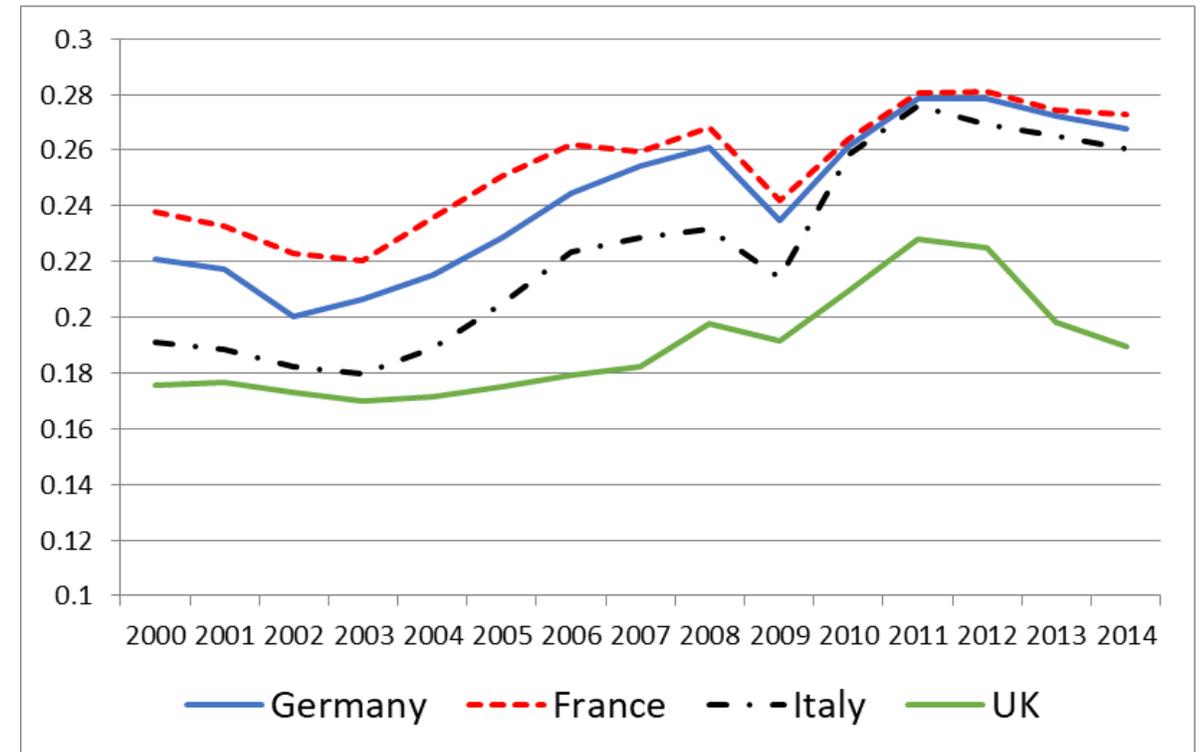
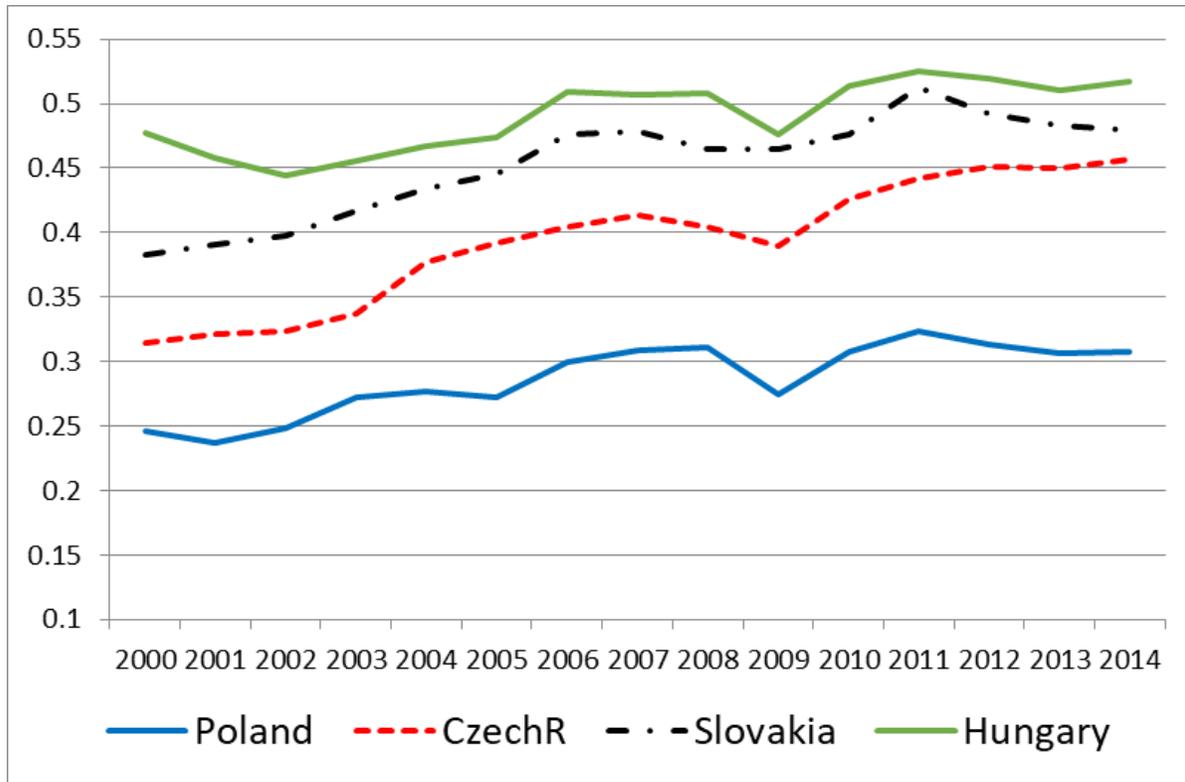
## Change in VAX ratio from 2000 to 2014, by country



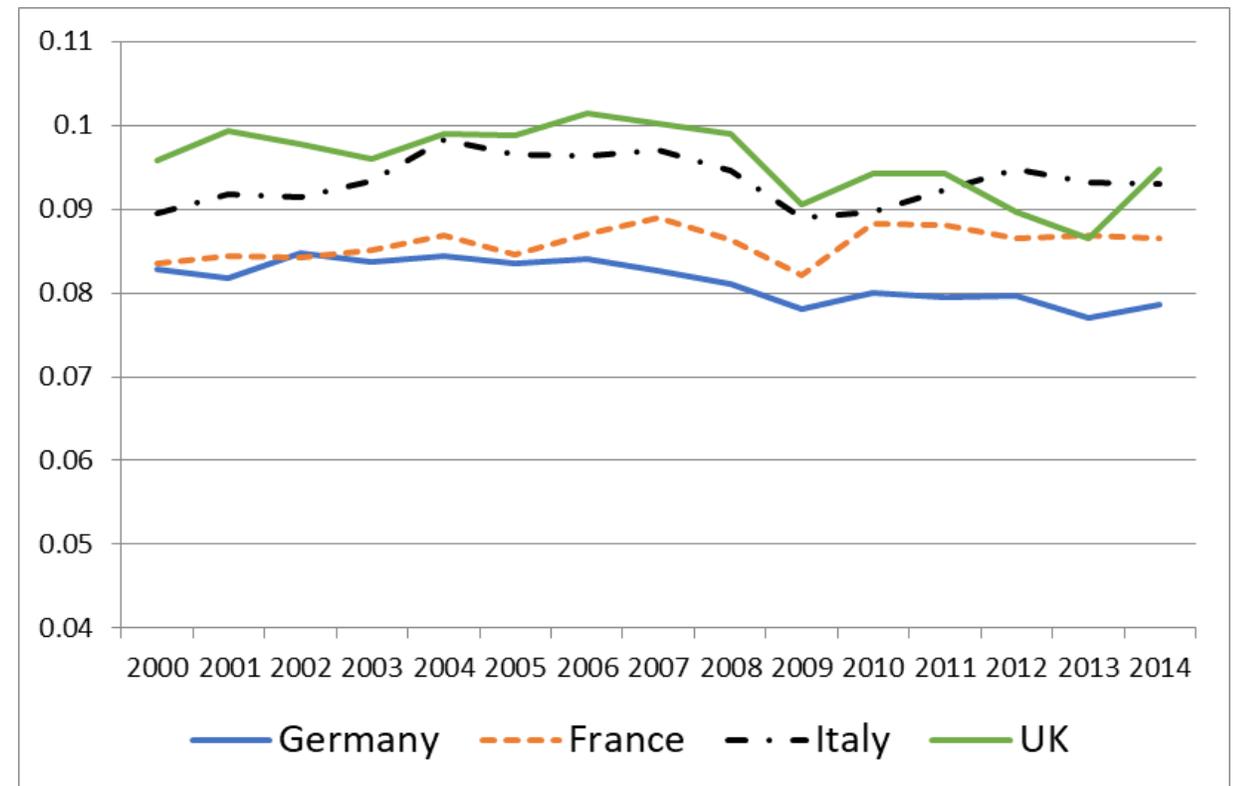
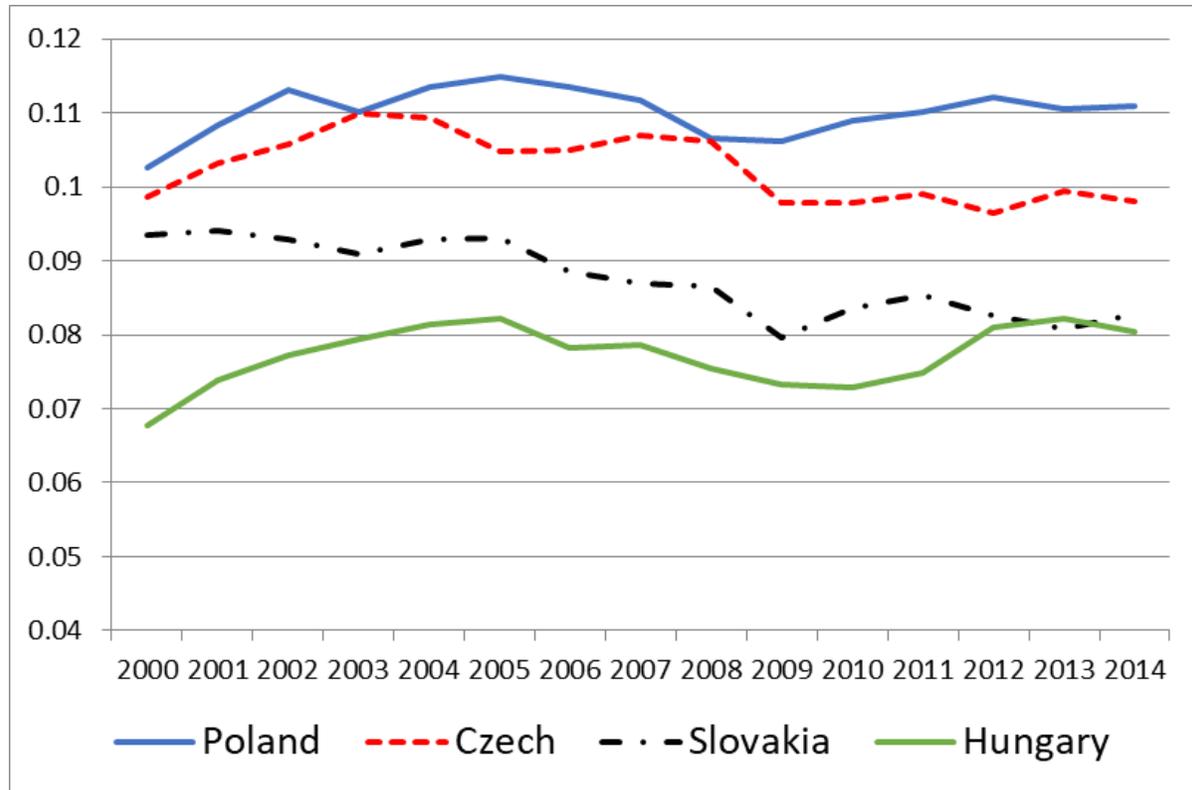
# VAX ratio (Ratio of export value added to total gross exports) for selected EU countries



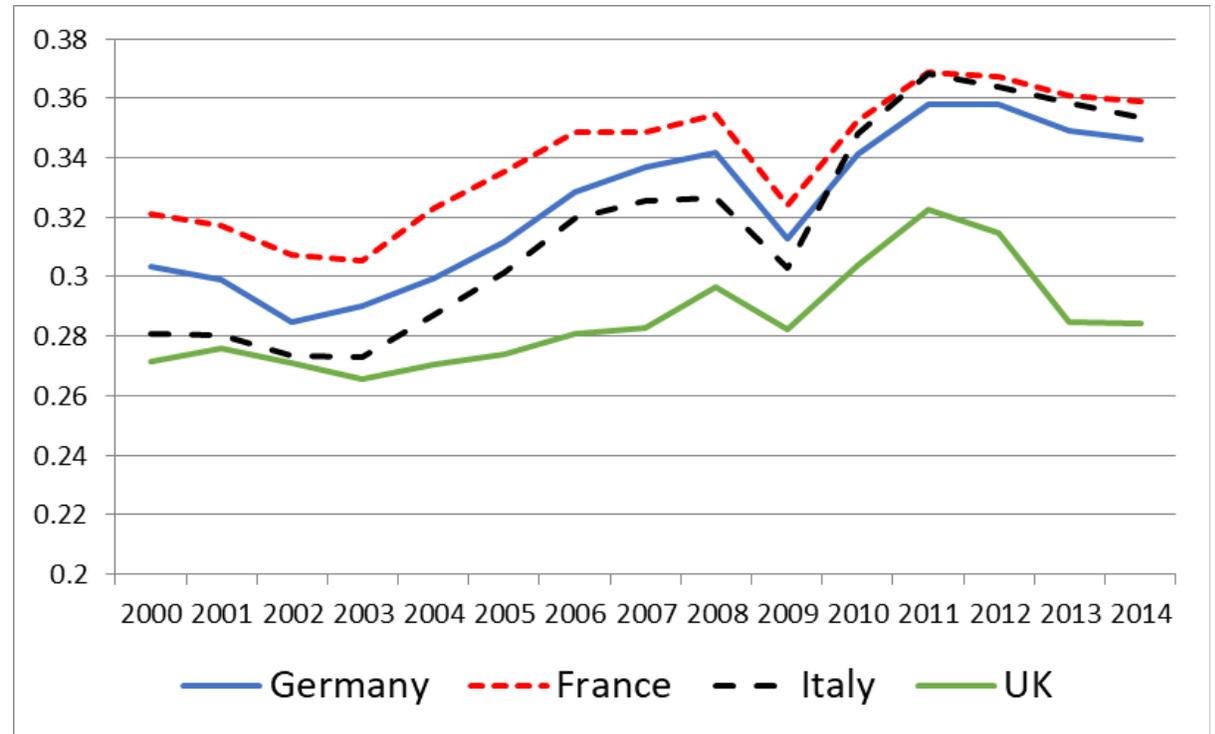
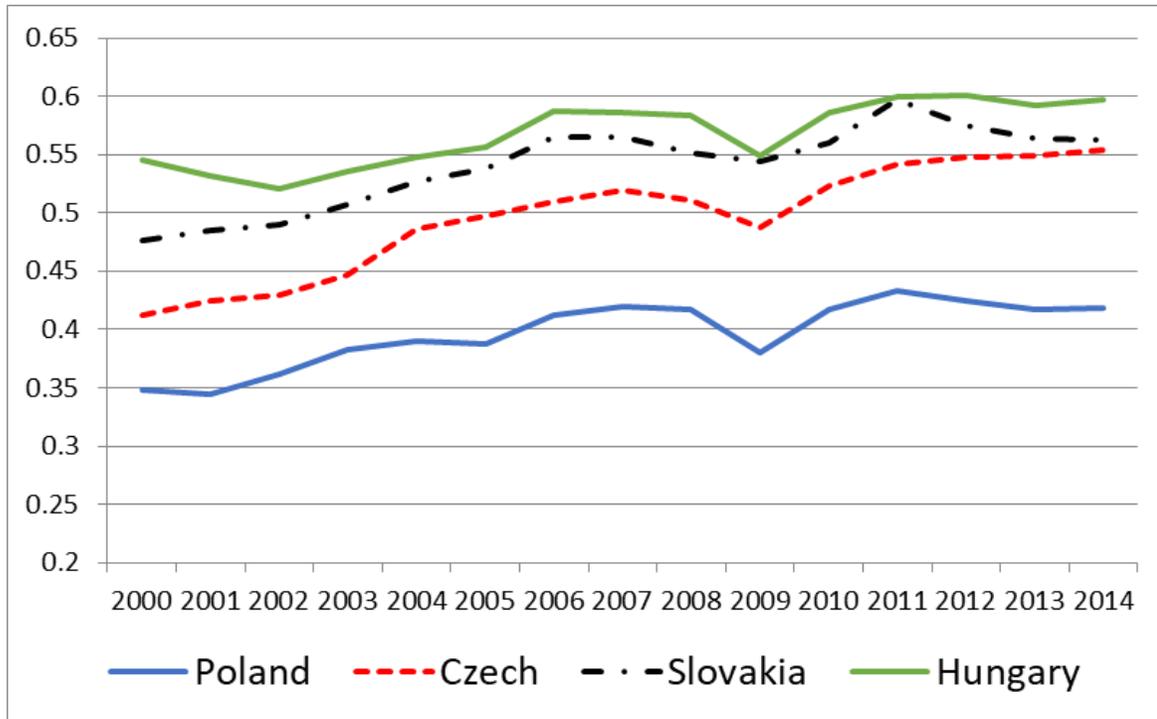
# Backward linkage for selected EU countries



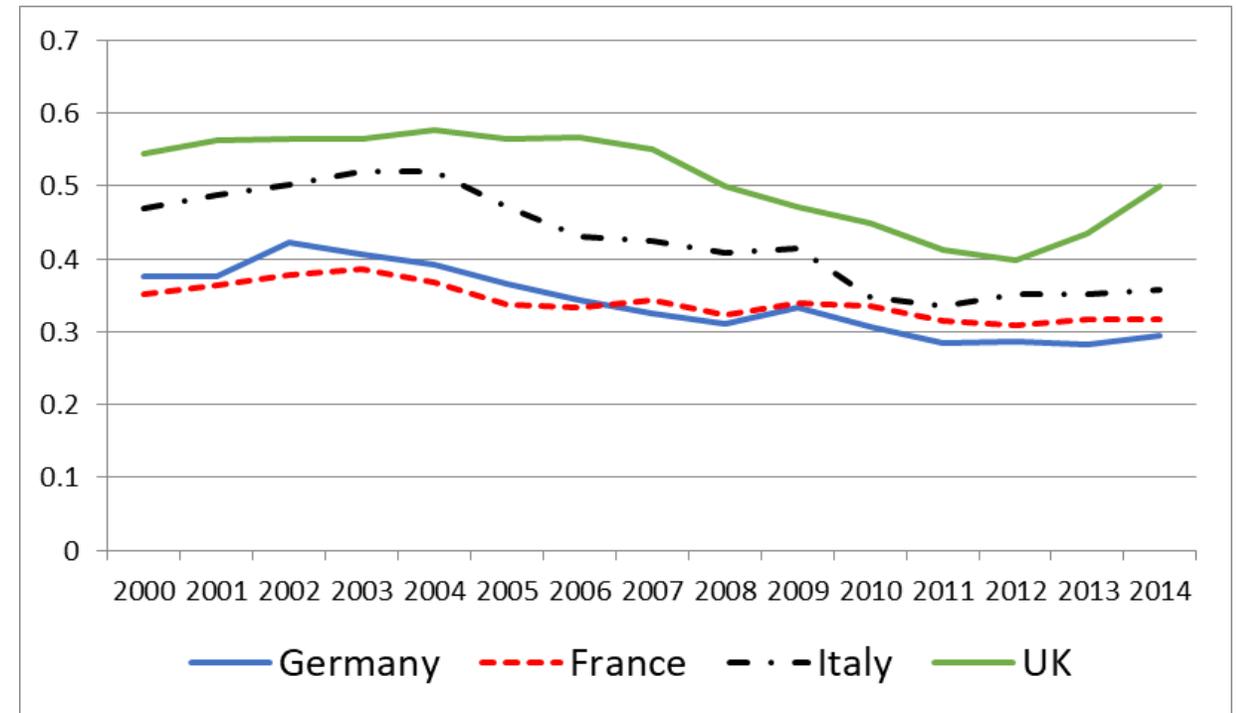
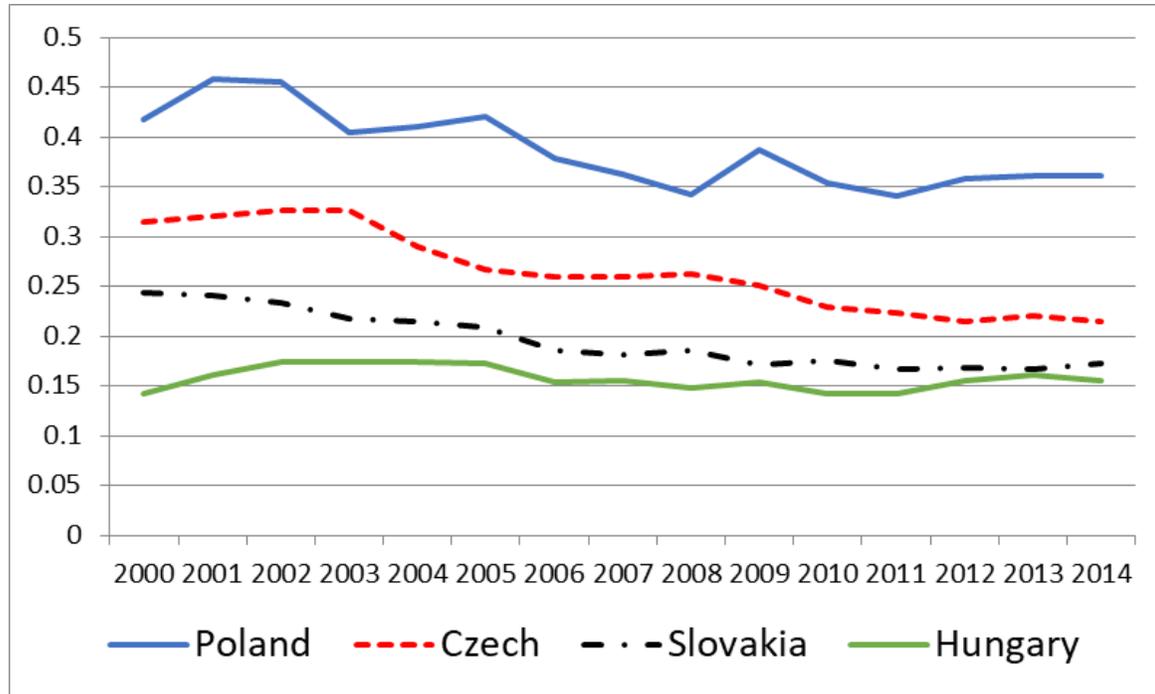
# Forward linkage for selected EU countries



# GVC participation rate for selected EU countries



# GVC position index for selected EU countries



# Literature survey: GDP/GDPpc and GVC indicators

- **VAX ratio and Backward linkage:**
  - Larger or more developed countries tend to have a higher VAX ratio and a lower backward linkage
  - (ECB, 2019; Foster-McGregor and Stehrer, 2013; Hummels et al., 2001; Ignatenko et al., 2019; Kowalski et al., 2015 ; Taglioni and Winkler, 2016; and Vrh, 2018)
  - No significant relationship (Johnson and Noguera, 2011 and 2012, based on simple correlation analysis between VAX ratio and GDPpc for sample of 94 countries in 2004).
- **Forward linkage: Findings on the relationship between forward linkage and GDP/GDPpc are mixed.**
  - positive relationship; i.e. larger economies are located more upstream than smaller economies (ECB, 2019; Kowalski et al., 2015)
  - No significant relationship between GDPpc and country's location in the supply chain (van der Marel, 2015)
  - The relationship changes over time during 1995-2005 from cubic to no significant relationship (Lopez-Gonzalez, 2012)
- **GVC participation rate: Findings are mixed.**
  - positive relationship (ECB, 2019; Ignatenko et al., 2019; Stehrer and Stöllinger, 2015; van der Marel, 2015, Kersan-Škabić, 2019 for EU-15 )
  - negative relationship (Criscoulo et al. 2015; Taglioni and Winkler, 2016)
  - no significant relationship (Kersan-Škabić, 2019 for EU-NMS)

- Cross-country variation in GVC indicators is driven by variation in composition of exports and technological characteristics of industries
  - The aggregate **VAX ratio** is lower for countries that have a higher share of manufacturing in total exports (Johnson and Noguera, 2011 and 2012)
  - In contrast, Hummels et al. (2001) found that for a sample of mainly advanced countries differences in sector composition played a fairly minor role.
  - Kowalski et al. (2015) found a significant positive relationship between **backward linkage** and the share of manufacturing in GDP, and negative relationship between **forward linkage** and share of manufacturing in GDP.
  - **VAX ratio** is higher and **backward linkage** is lower for low-tech industries compared with medium and high-tech industries (Banga, 2014; Olczyk and Kordalska, 2017).
  - **GVC participation index** and share of high-tech manufacturing in total exports: negative for EU-15 and positive for EU-NMS (Kersan-Škabić, 2019).

- **Forward linkage** of services is stronger than **backward linkage** in most countries (De Backer and Miroudot, 2013; Ignatenko et al., 2019; Taglioni and Winkler, 2016)
- **GVC participation rate** and share of services in total exports: positive relationship in EU-15 but negative impact in EU-NMS (Kersan-Škabić, 2019).

# Literature survey: Real exchange rate changes and VAX ratio

- Recent research suggests:
  - that the impact of exchange rate on trade has decreased with the growth of global value chains and increased availability of hedging products (Ahmed et al., 2017; de Soyres et al., 2018; Varela and Lovo, 2016).
  - The more foreign value added is embedded in firms' exports, the less sensitive they are to real exchange rate fluctuations. (When share of imported intermediates is greater than 30% the effect of REER on export participation fades)
  - The effect of REER on value added exports was lower than the effect of REER on total exports (Ahmed et al (2015)
    - Implication: *A **positive** relationship between REER and VAX ratio!!!*
  - Caraballo and Jiang (2016) obtained a positive and significant relationship between REER and VAX ratio.

- **General considerations:**
  - FDI driven by the resource-seeking motive is expected to be associated with higher VAX ratio and forward linkage
  - Vertical efficiency-seeking FDI directed towards exports process entails considerable intermediate inputs and is expected to be positively correlated with backward linkage
  - If distance from final demand in production chain is large, there should be positive correlation between FDI and forward linkage.
- **Findings:**
  - **VAX ratio:** Negative relationship (Vrh, 2018)
  - **Backward linkage:** Positive relationship (Kowalski et al., 2015; Stehrer and Stöllinger, 2015)
  - **Forward linkage:** No significant relationship (Kowalski et al., 2015).
  - **GVC participation rate:**
    - Negative in EU-15 and positive in EU\_NMS (Kersan-Škabić, 2019);
    - No significant relationship in euro area (ECB, 2019)

- Separate regression equations are estimated for each of the GVC participation indicators with the same set of explanatory variables.
- The regression equations take the following form:

$$\begin{aligned} \log(GVCPI_{it}) = & \beta_1 \log(GDP\_PPP_{it-1}) + \beta_2 shareX\_mfgLT_{it} + \beta_3 shareX\_mfgMHT_{it} \\ & + \beta_4 shareX\_servLT_{it} + \beta_5 shareX\_servMHT_{it} + \beta_6 \log(TertiaryED_{it}) \\ & + \beta_7 \log(CapCoef_{it}) + \beta_8 \log(FDI\_stock_{it-1}) + \beta_9 \log(REER_{it}) \\ & + \beta_{10} CorControl_{it} + \mu_t + \varepsilon_{it} \end{aligned}$$

- All regressions are estimated with at the country level with time fixed effects, and robust standard error estimator for panel models has been used.
- Time fixed effect specification allows us to test between-country differences in the influence of the explanatory variables.
- Exclusion of country fixed effects is justified by our goal to explain cross-sectional differences across countries, rather than uncovering causal relationships between dependent and independent variables.

# Determinants of GVC Participation Indicators

	VAX ratio	Backward linkage (BL)	Forward linkage (FL)	GVC participation rate (FL+BL)	GVC position index (FL/BL)
<b>log(lag(GDP_PPP))</b>	0,06651*** (0.00829)	-0,18848*** (0.02231)	0,01007 (0.01673)	-0,13644*** (0.01546)	0,19855*** (0.03053)
<b>shareX_mfgLT</b>	-0,01385 (0.14604)	0,90298** (0.37198)	0,07574 (0.58098)	0,26868 (0.20758)	-0,82724 (0.86666)
<b>shareX_mfgHT</b>	-0,67341*** (0.07588)	2,13199*** (0.19337)	-0,71675*** (0.22797)	1,17152*** (0.10126)	-2,84874*** (0.37170)
<b>shareX_servLT</b>	0,06242 (0.18657)	0,64219* (0.34446)	-0,15773 (0.40645)	0,11193 (0.22649)	-0,79992 (0.68089)
<b>shareX_servHT</b>	-0,58260*** (0.12718)	0,92001*** (0.32118)	-0,70725 (0.54228)	0,41703** (0.19431)	-1,62727** (0.77009)
<b>log(TertiaryED)</b>	0,00162 (0.03103)	-0,10837 (0.07160)	0,04442 (0.06814)	-0,02396 (0.04504)	0,15279 (0.12668)
<b>log (CapCoef)</b>	0,09064* (0.04981)	-0,27104*** (0.10297)	0,33117 (0.24596)	-0,13771* (0.07988)	0,60220** (0.30430)
<b>log(lag(FDI stock/GDP))</b>	-0,04330** (0.01936)	0,09635** (0.04816)	-0,05377 (0.04578)	0,06610** (0.02805)	-0,15013* (0.08314)
<b>log(REER)</b>	0,18059** (0.08146)	-0,32602 (0.20156)	0,10543 (0.29590)	-0,23784** (0.11416)	0,43145 (0.44808)

- The direction of influence of the various explanatory variables on backward linkage is the opposite to that on the VAX ratio.
- Variables that have a significant influence on backward linkage in a particular direction have a significant impact in the same direction on the GVC participation rate and in the opposite direction on the GVC position index.
  - Indicates that for the sample of countries in the analysis, higher backward linkage is the path to greater GVC participation and involves a relatively more downstream position in GVCs.
- Explanatory power of the equation for forward linkage is much lower than that for the other GVC position indicators, and only coefficient on high-tech manufacturing is significant.
  - This suggests that supply side of value chains that forward linkage represents has more diverse determinants beyond those included in the regression exercise.

	VAX ratio	Backward linkage (BL)	Forward linkage (FL)	GVC participation rate (FL+BL)	GVC position index (FL/BL)
$\log(\text{lag}(\text{GDP\_PP P}))$	0,06651***	-0,18848***	0,01007	-0,13644***	0,19855***

- **VAX ratio: (+)** The larger is the size of the economy, the higher is the share of domestic value added in gross exports
- **Backward linkage: (-)** The larger is the size of the economy, the lower is the foreign value added content in exports
- **Forward linkage:** No significant association between the size of the economy and forward linkage
  - This suggests that even small countries that typically source inputs from abroad have become increasingly involved in forward linkage; the supply chains have become longer.
- **GVC participation rate: (-)** Smaller economies are more integrated in GVCs than larger economies
- **GVC position index: (+)** Larger economies are associated with a more upstream position in GVCs

# Empirical results: Export composition and GVC indicators (1)

	VAX ratio	Backward linkage (BL)	Forward linkage (FL)	GVC participation rate (FL+BL)	GVC position index (FL/BL)
shareX_mfgLT	-0,01385	0,90298**	0,07574	0,26868	-0,82724
	(0.14604)	(0.37198)	(0.58098)	(0.20758)	(0.86666)
shareX_mfgHT	-0,67341***	2,13199***	-0,71675***	1,17152***	-2,84874***
	(0.07588)	(0.19337)	(0.22797)	(0.10126)	(0.37170)
shareX_servLT	0,06242	0,64219*	-0,15773	0,11193	-0,79992
	(0.18657)	(0.34446)	(0.40645)	(0.22649)	(0.68089)
shareX_servHT	-0,58260***	0,92001***	-0,70725	0,41703**	-1,62727**

- Participation in GVCs varies by industry groups and its technological classification. A comparison of the coefficients on different industry groups indicate their differential impact on GVC participation
- **VAX ratio:** lower for high-tech manufacturing exports compared to exports of other industry groups
- **Backward linkage:** Higher for high-tech manufacturing exports compared to other industry groups X
- **Forward linkage:** lower for high-tech manufacturing exports compared to other industry groups X
- **GVC participation rate:** Integration in GVCs is greater for high-tech mfg. exports
- **GVC position index:** High-tech manufacturing exports have more downstream position in supply chain (consistent with the negative coefficient for forward linkage)

# Empirical results: Export composition and GVC indicators (2)

	VAX ratio	Backward linkage (BL)	Forward linkage (FL)	GVC participation rate (FL+BL)	GVC position index (FL/BL)
<b>shareX_mfgLT</b>	<b>-0,01385</b>	<b>0,90298**</b>	<b>0,07574</b>	<b>0,26868</b>	<b>-0,82724</b>
	(0.14604)	(0.37198)	(0.58098)	(0.20758)	(0.86666)
<b>shareX_mfgHT</b>	<b>-0,67341***</b>	<b>2,13199***</b>	<b>-0,71675***</b>	<b>1,17152***</b>	<b>-2,84874***</b>
	(0.07588)	(0.19337)	(0.22797)	(0.10126)	(0.37170)
<b>shareX_servLT</b>	<b>0,06242</b>	<b>0,64219*</b>	<b>-0,15773</b>	<b>0,11193</b>	<b>-0,79992</b>
	(0.18657)	(0.34446)	(0.40645)	(0.22649)	(0.68089)
<b>shareX_servHT</b>	<b>-0,58260***</b>	<b>0,92001***</b>	<b>-0,70725</b>	<b>0,41703**</b>	<b>-1,62727**</b>

- Except for forward linkage, the pattern of relationship between **high-tech services exports** and various GVC indicators is similar to that for high-tech manufacturing exports, but the correlations are weaker.
- The impact of **low-tech manufacturing exports** and **low-tech services exports** are qualitatively similar. Both categories of exports have significant positive backward linkage, but import intensity is higher for low-tech manufacturing exports. The relationship of both categories with other GVC indicators is not statistically significant.

# Empirical results: FDI and GVC indicators

	VAX ratio	Backward linkage (BL)	Forward linkage (FL)	GVC participation rate (FL+BL)	GVC position index (FL/BL)
<b>log(lag(FDI stock/GDP))</b>	<b>-0,04330**</b>	<b>0,09635**</b>	<b>-0,05377</b>	<b>0,06610**</b>	<b>-0,15013*</b>
	(0.01936)	(0.04816)	(0.04578)	(0.02805)	(0.08314)

The regression results suggest that in the sample of countries covered in the analysis, inward FDI is mainly driven by the efficiency-seeking motive with the objective of processing imported intermediate inputs for exports to final destinations.

- **VAX ratio:** Higher stocks of inward FDI are associated with lower VAX ratio
- **Backward linkage:** Higher stocks of inward FDI are associated with higher backward linkage
- **Forward linkage:** Inward FDI is not statistically significant in explaining forward linkage
- **GVC participation rate:** Higher stocks of inward FDI are associated with higher GVC participation rate
- **GVC position index:** Inward FDI is significantly associated with a more downstream position in GVCs

# Empirical results: REER and GVC indicators

	VAX ratio	Backward linkage (BL)	Forward linkage (FL)	GVC participation rate (FL+BL)	GVC position index (FL/BL)
log(REER)	0,18059**	-0,32602	0,10543	-0,23784**	0,43145
	(0.08146)	(0.20156)	(0.29590)	(0.11416)	(0.44808)

**VAX ratio:** Significant positive association with REER, in line with the finding of Caraballo and Jiang (2016).

*--This is a manifestation of the exchange rate elasticity of export value added being smaller than the exchange rate elasticity of gross exports.*

- **Backward linkage:** No significant association
- **Forward linkage:** No significant association
- **GVC participation rate:** Significant negative association.  
*--Suggests that an appreciated real exchange rate hinders integration into GVCs.*
- **GVC position index:** No significant association.

# Implications of GVCs (1)

- Higher export share may not necessarily imply higher competitiveness if exports contain a large share of imported intermediate goods
- If the elasticity of substitution across production stages is very low, then shocks to production in one country could be transmitted forcefully to other stages undertaken elsewhere
- If demand shocks are concentrated on goods that are vertically specialized, then trade is highly sensitive to changes in demand

# Implications of GVCs (2)

- As intra-firm trade has increased globally, the proportion of trade that takes place within a more hierarchical structure of governance has increased
  - *Policy makers need to address the relationship between trade and FDI policy and management in the context of GVCs*
- Some of the risks associated with GVC participation include being locked into low value-added stages of GVCs with limited spillovers to the domestic economy.
- The importance of looking at a chain (rather than at individual stages of production) suggests that *approaches to trade capacity-building should start from a broad view of how a country would like to change its trade pattern and then assess all the obstacles to this.*
  - Not all the barriers will be under direct government control. Nor will they be within trade policymakers' toolboxes.

**Thank you for your  
attention**



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