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A study on the determinants of participation in global value chains in the EU

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Introduction, background, and motivation

Introduction

- **Outsourcing** and **offshoring** disperse firm's activities to **different locations** based on efficiency/cost-minimization criteria (Ambos et al., 2021; Antràs, 2020), creating **complex production networks** (Xiao et al., 2017).

- A formal definition for a global value chain (GVC) by Antràs, (2020):

  *"A set of **production** activities **fragmented across the world** that add value to the development of a good or a service, and each of the firms participating in the production network are engaged in **at least one stage**"*

- And by Timmer (2013): *"all activities **directly** and **indirectly** required to produce a final manufactured product"*

- Firms, sectors, and at the aggregate level countries participate in GVCs based on their perceived comparative advantages to maximize their value-added (VA) gains

- Trade in GVCs is different from traditional trade: It relates **to trade in intermediates** while traditional trade focuses on final products

- Successive rounds of trade liberalization and rapid ICT advancements have paved the way for a deepening in GVC activities in the late 1990's and early 2000's (Antràs, 2020; World Bank, 2020) → account for ½ of all trade activities (World Bank, 2020).

Aim & motivation for this study

To empirically investigate the **antecedents** of **participation** in **GVCs** at the **country level** for a sample of 28 **EU countries** during 1995-2020, focusing on **technological/knowledge factors** that affect GVC activities, namely **intangible assets**.

- GVCs lead to a **finer international division** of labour/production across countries/sectors → **opportunities for greater specialization gains**.

- GVC participation can **enhance productivity** through **access to foreign inputs, knowledge spillovers, competition effects, and learning opportunities** (Criscuolo and Timmis, 2017).

- **GVC positioning** and **participation** patterns have been extensively considered for the comparative assessment of national **economic performance** (Gereffi, 1999).

- There is **no unique type** of backward/forward GVC participation
  - The degree of backward and/or forward fragmentation of the value chain varies according to the number of times VA crosses borders for production
  - More stages backward and forward → higher fragmentation

GVCs and intangible assets

Intangible assets are particularly relevant within the contextual framework of GVCs.

- **Intangible capital (IC)** *(Corrado et al., 2005; 2009, Haskel and Westlake, 2018)* is widely **recognized as a significant element in the coordination and the maximization of gains** within the global production network *(Gereffi et al., 2005; Mudambi, 2008; Fu and Ghauri, 2020)*.
- Accumulation of IC and GVC participation have some synergistic effects on EU's productivity growth *(Jona-Lasinio & Meliciani, 2019)*
- Durand and Millberg (2020) argued that **multinational enterprises become "intellectual monopolies" in GVCs** through the accumulation and control of significant intangible assets.
- **The nature of GVCs is transitioning to become knowledge-intensive,**
  - **Accumulation of VA shifts from traditional** manufacturing**/**assembly **towards** upstream and downstream **knowledge-intensive, innovative activities** *(conception, R&D, product design (for the upstream part) and marketing and branding (for the downstream part)* *Baldwin and Evenett (2015)*

Methodology

Methodology

- We develop a **3-stage** empirical strategy with elements from IO (Leontief,1936) analysis.
  - **Decomposition** of value-added flows in GVCs from IO Data
  - Estimation of GVC **participation** indicators.
  - **Econometric applications** for each participation **type** and **mode**
    - GVC participation direction → **type**
    - GVC participation "complexity" → **mode**
    - Internal innovation inputs (R&D and capital investments) are also accounted

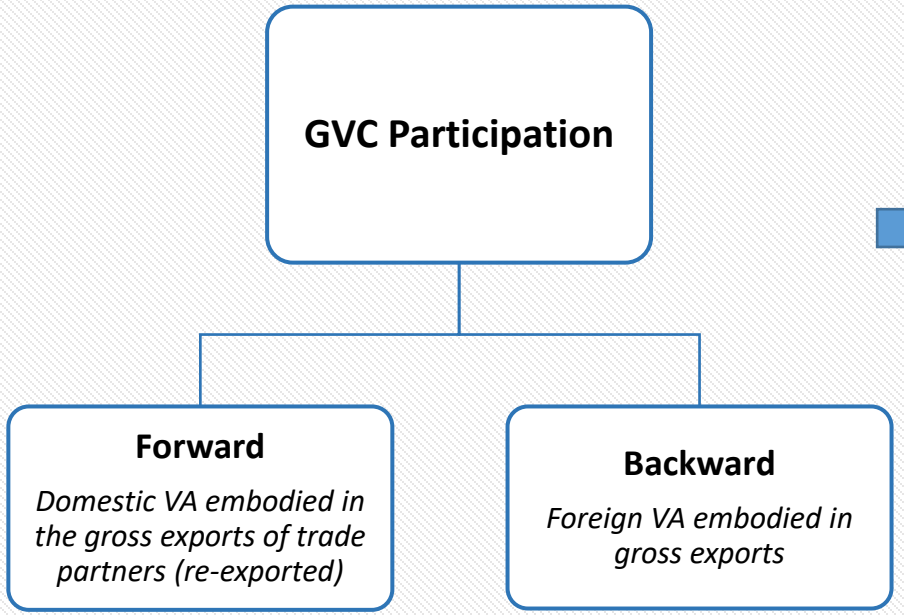
- **IO Data source**: OECD's Inter-Country Input-Output Tables (ICIOTs) (OECD 2023), EU-KLEMS intangibles and capital accounts (2024)

- The resulting dataset describes GVC participation and VA flows for **45 NACE rev.2 sectors for 76 countries** (includes all 27 EU members) **from 1995 to 2020.**

- This extensive period **contains rapid shifts** in world trade and the **rapid expansion of GVCs**, (WTO, 2013).
  - It also allows the study of **disruptions of global production activity** due to the 2008 economic crisis and the propagation of adverse shocks through borders, as GVCs can act as channels for transmitting economic downturns (Baldwin, 2009).

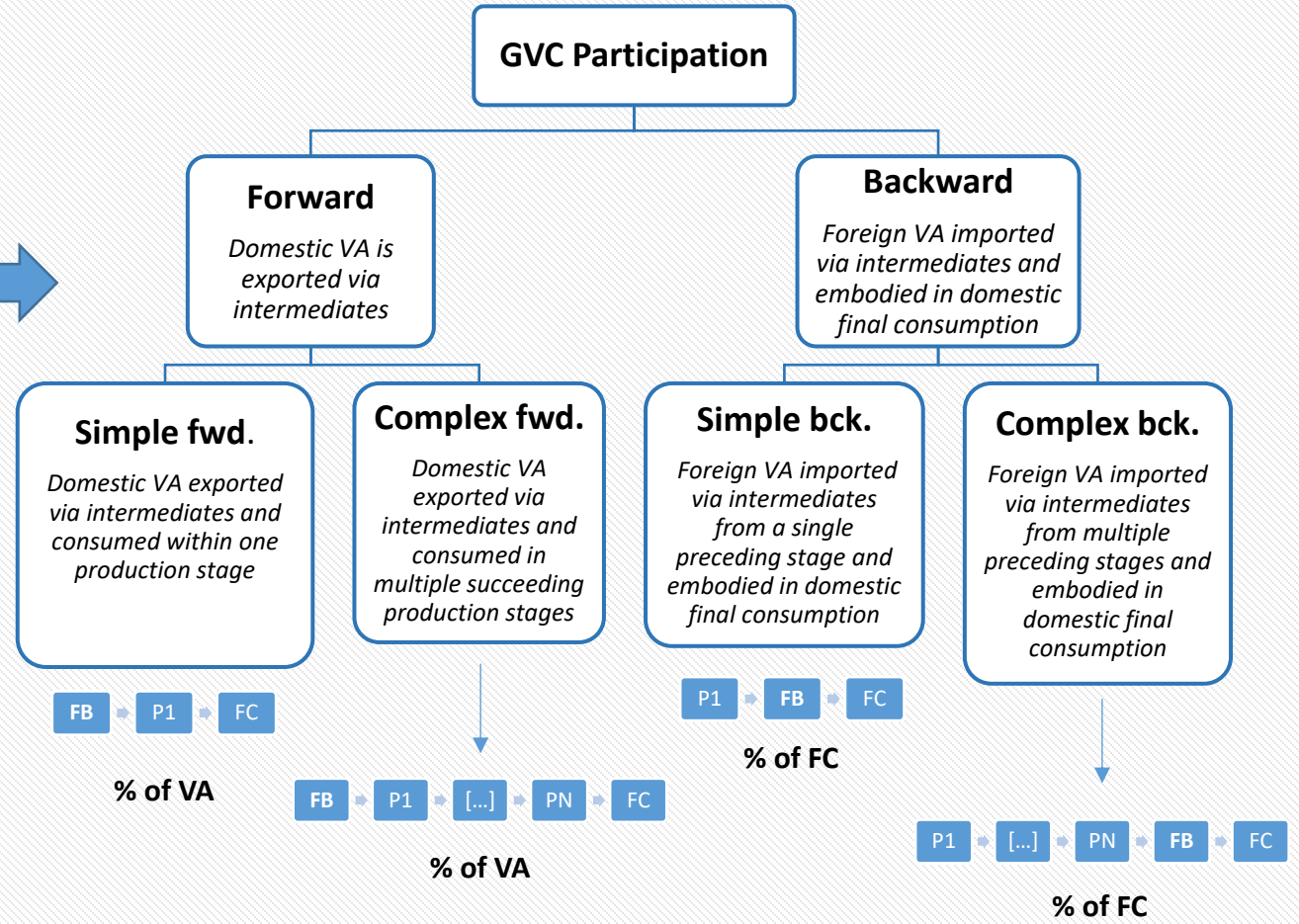
A decomposition framework for different types and modes of GVC participation

Metrics based on VA content of exports (Koopman et al. 2014)



The original approach

New production-based decomposition framework by Wang et al. 2022



P: Partner sector/country (for production)
VA: Value added
FC: Final consumption

A novel perspective

Econometric models

- The variables are modelled into an autoregressive panel model specification:

$$\mathbf{GVCpt_{i,t}} = \alpha_0 + \boldsymbol{GVCpt_{i,t-1}}\beta_1 + \boldsymbol{K_{i,t-1}}\beta_2 + \boldsymbol{T_{i,t-1}}\beta_3 + \lambda_i + \varepsilon_{i,c,t}$$

- $\mathbf{GVCpt_{i,t}}$ denotes a vector of GVC participation indicators as dependent variables that differentiate between type (backward vs. forward) and mode (simple vs. complex)

$$\boldsymbol{GVCpt_{i,t}} = (gvc\_b_{i,t}, gvc\_bs_{i,t}, gvc\_bc_{i,t}, gvc\_f_{i,t}, gvc\_fs_{i,t}, gvc\_fc_{i,t},)$$

- $\mathbf{K_{i,t-1}}$ denotes a vector of technology/knowledge-related determinants of GVC participation → different categories of intangible and tangible capital stock as shares of VA (adjusted to account for non-national accounts intangibles)

$$\boldsymbol{K_{i,t-1}} = (k_{i,t-1}^{Tang}, k_{i,t-1}^{Intang}, k_{i,t-1}^{NatAcc}, k_{i,t-1}^{NonNatAcc}, k_{i,t-1}^{Innovprop}, k_{i,t-1}^{EconComp}, k_{i,t-1}^{Soft\_DB}, k_{i,t-1}^{RD}, k_{i,t-1}^{OIPP}, k_{i,t-1}^{Brand}, k_{i,t-1}^{Design}, k_{i,t-1}^{OrgCap}, k_{i,t-1}^{Training})$$

- $\mathbf{T_{i,t-1}}$ denotes a vector of traditional trade/factor endowment determinants as controls for each model

$$\boldsymbol{T_{i,t-1}} = (EMPE_{i,t-1}, LandGDP_{i,t-1}, RegQual_{i,t-1})$$

Notes on the models

- All variables enter the model in logs
- Estimation strategy: Fixed effects with robust (country-clustered) robust standard errors
- The unavailability of reliable instruments and poor efficiency of GMM estimators prevent us from properly dealing with endogeneity implications
- We do not adopt a causal interpretation of the results
- Mitigation actions:
  - All explanatory variables enter the models lagged by one period
  - Rich set of fixed effects

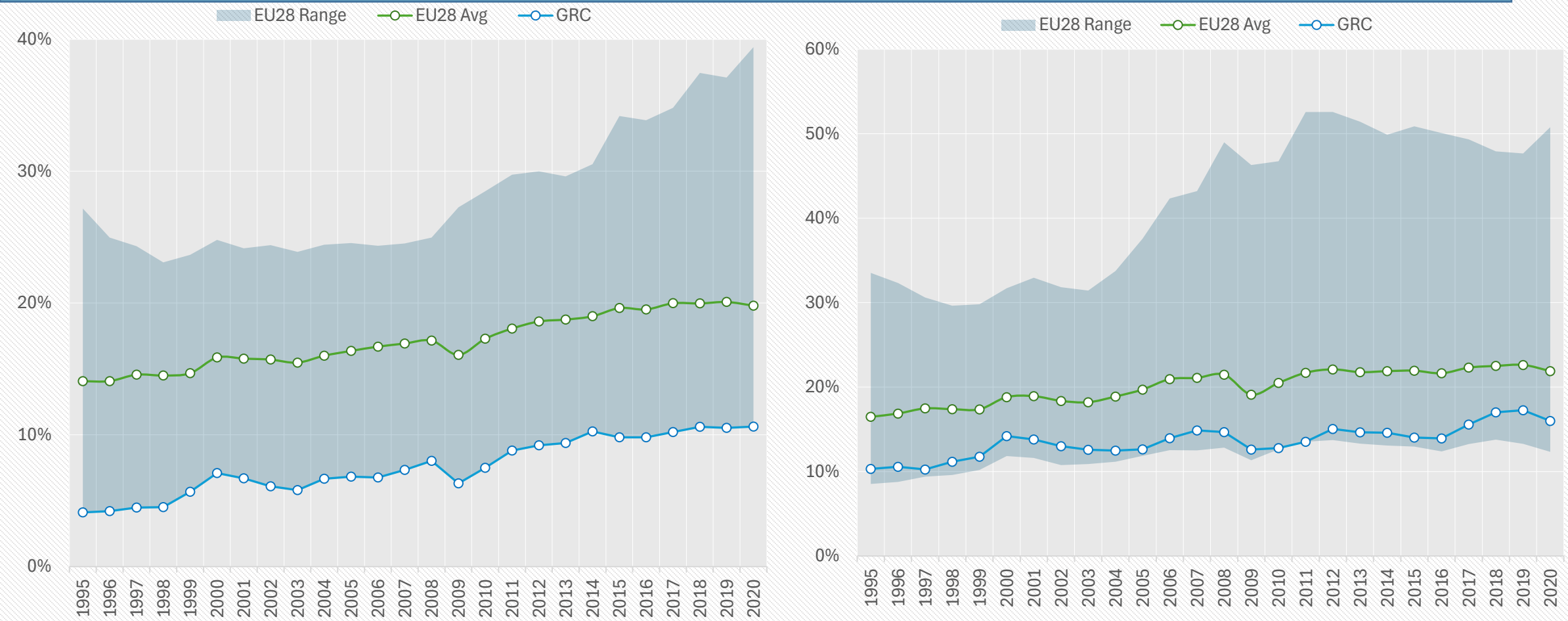
Model: country/time coverage and variables

Countries
Austria
Belgium
Bulgaria
Croatia
Cyprus
Czechia
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
United Kingdom

Variable	Definition	Data source
$gvc\_b_{i,t}$	FVA in final demand relative to the final demand of each country (ln– lagged by one period).	OECD ICIOTs (own calc.)
$gvc\_bs_{i,t}$	FVA that derives from simple GVC activities in final demand, relative to the final demand of each country (ln– lagged by one period).	OECD ICIOTs (own calc.)
$gvc\_bc_{i,t}$	FVA that derives from complex GVC activities in final demand, relative to the final demand of each country (natural log – lagged by one period).	OECD ICIOTs (own calc.)
$gvc\_f_{i,t}$	exported DVA in partner production output relative to the VA of country (ln– lagged by one period).	OECD ICIOTs (own calc.)
$gvc\_fs_{i,t}$	exported DVA in partner production output for simple GVC activities (consumed in the partner economy), relative to the VA of country (ln– lagged by one period).	OECD ICIOTs (own calc.)
$gvc\_fc_{i,t}$	exported DVA in partner gross exports for complex GVC activities (further re-exported from partner), relative to the VA of country (natural log – lagged by one period).	OECD ICIOTs (own calc.)
$k_{i,t-1}^{Tang}$	Total tangible (GFCF with intangible components excluded) capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{Intang}$	Total intangible capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{NatAcc}$	Total intangible capital stock included in the National Accounts (i.e., R&D, OIPP, Soft_DB) as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{NonNatAcc}$	Total intangible capital stock not included in the National Accounts (i.e., Brand, Desing, OrgCap, Training) as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{Innovprop}$	Total innovative property (R&D, Desing, OIPP) intangible capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{EconComp}$	Total economic competencies (Brand, OrgCap, Training) intangible capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{RD}$	R&D capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{Soft\_DB}$	Computer software and databases capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{OIPP}$	Entertainment, artistic and literary originals + mineral explorations capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{Brand}$	Brand capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{OrgCap}$	Organisational capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{Training}$	Training capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$k_{i,t-1}^{Design}$	Industrial design capital stock as a share of intangible-adjusted VA (ln-lagged by one period)	EU-KLEMS (2023 edition)
$EMPE_{i,t-1}$	Number of employees, th. (ln-lagged by one period)	EU-KLEMS (2023 edition)
$LandGDP_{i,t-1}$	GDP by land area of country (ln-lagged by one period)	Eurostat
$RegQual_{i,t-1}$	Regulatory quality – index	World Bank

Results and discussion – Descriptives and some salient facts

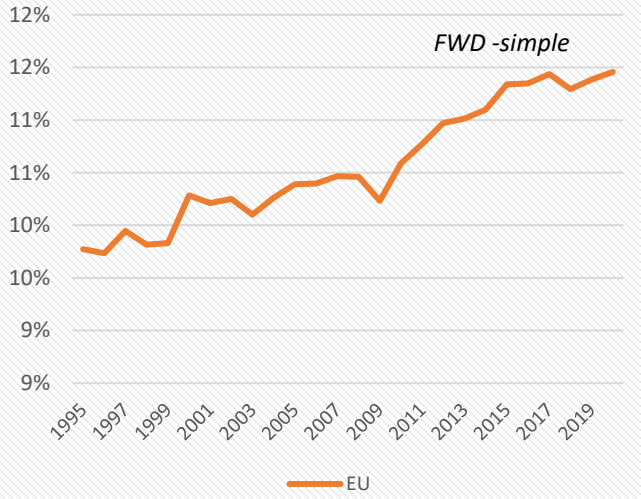
Results and discussion –1: Evolution in each GVC participation direction

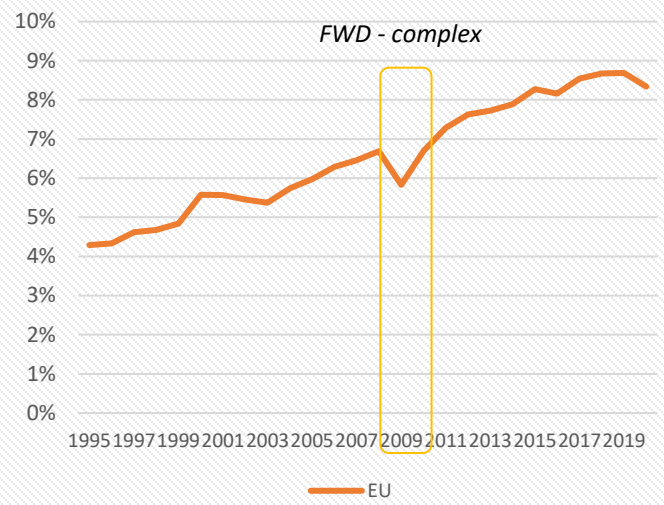


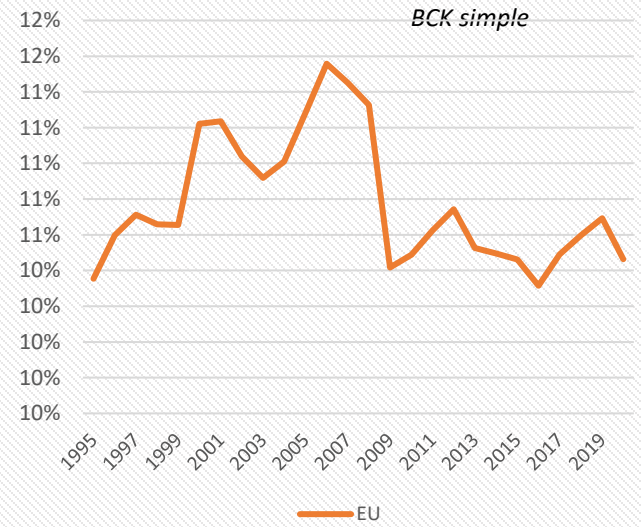
Forward (a) and backward GVC participation of the EU from 1995 to 2020.

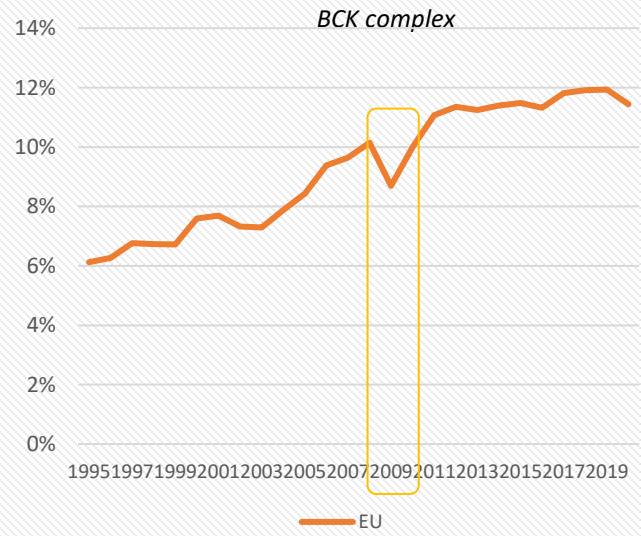
- **GVC deepening from 1995 to 2008**, ("*era of GVCs*" (World Bank, 2020)).
- Steep decline in participation in 2009-2010, caused by the financial crisis
- Resurgence in GVC activities in a new steady state from approximately 2012 onwards – the gap widens

Results and discussion – 2: Evolution of both modes of forward and backward GVC participation



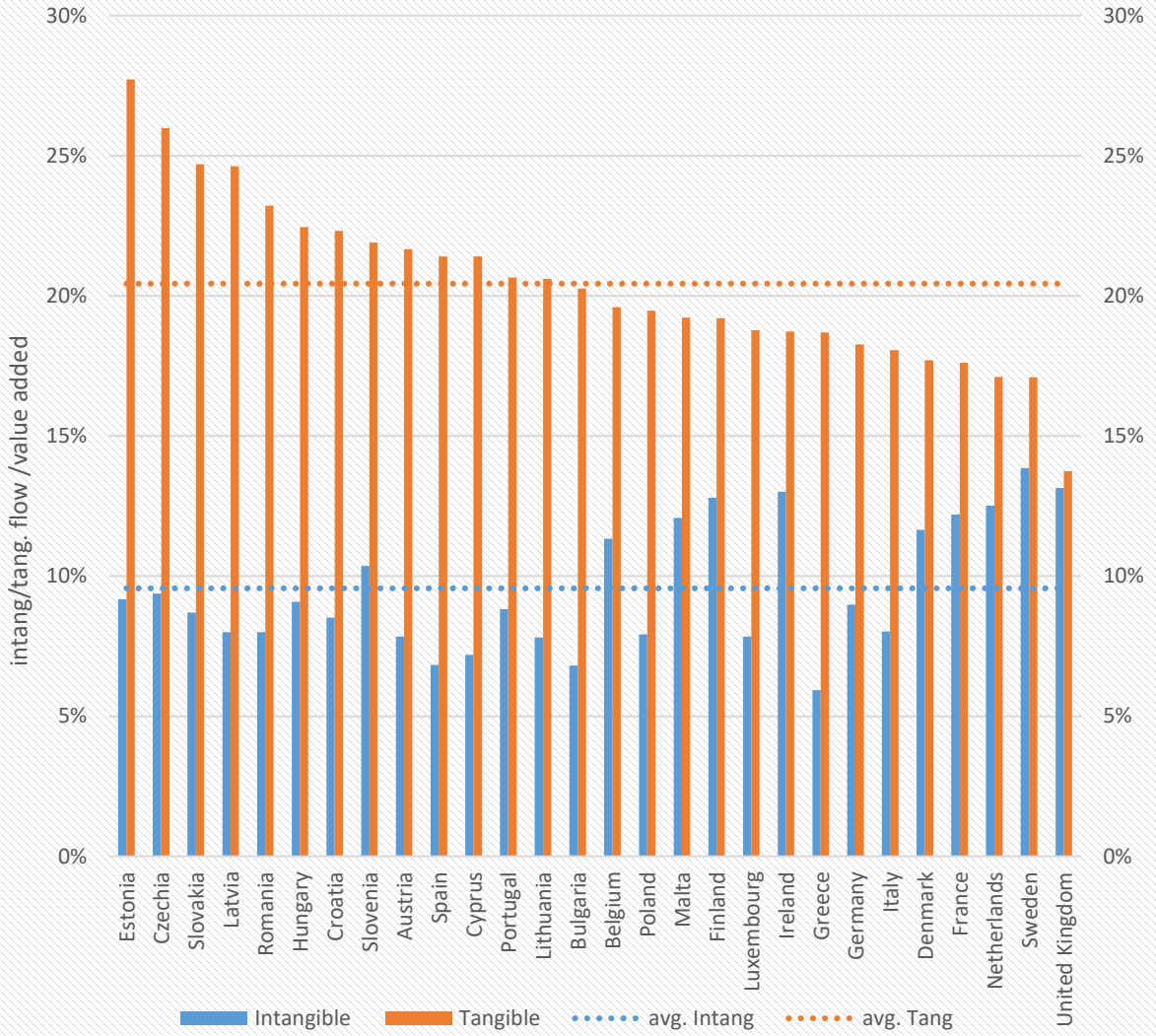






- More **profound deepening for complex** activities within in GVCs.
- All were affected by the 2008 crisis … **But simple bck. never recovered**
- **Convergence** between **simple** and **complex** participation → increased input complexity → longer production chains → integration of multiple activities (e.g., support services)?

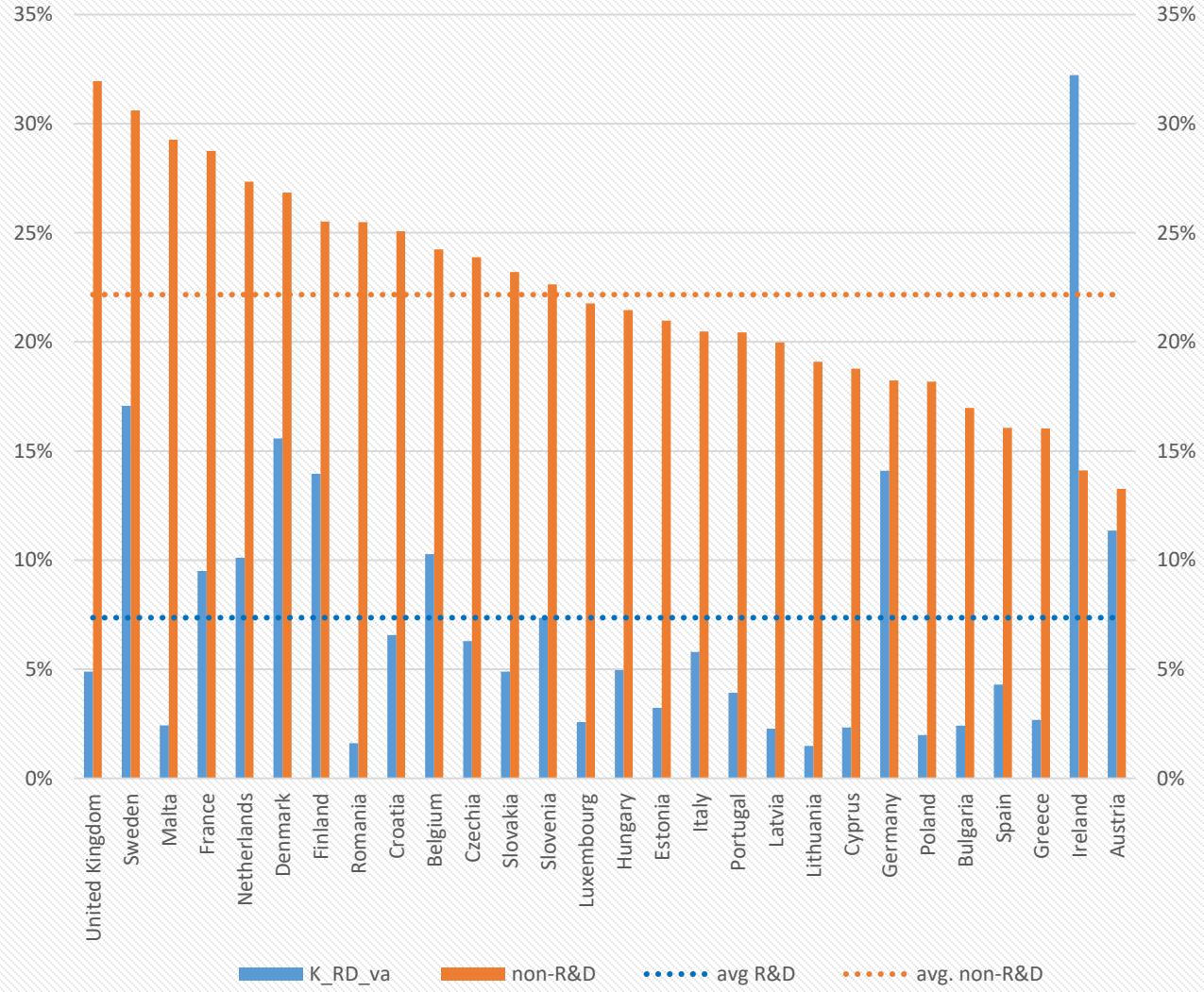
Results and discussion –3: Intangibles have already proliferated – but tangible capital still is the largest component of value added



Avg. intangible/tangible investment as % of VA, mean for 1995 to 2020.

- large discrepancies between the two capital types among the EU28 members
- Central and eastern economies have the largest tangible capital as a share of their annual VA;
  - all but one (Slovenia) that are above the EU average for intangible capital intensity are simultaneously above the EU average for tangible capital intensity.
- The most intangible-intensive economies are the central-northern EU members (Sweden, Finland, Netherlands), along with Ireland and the UK.

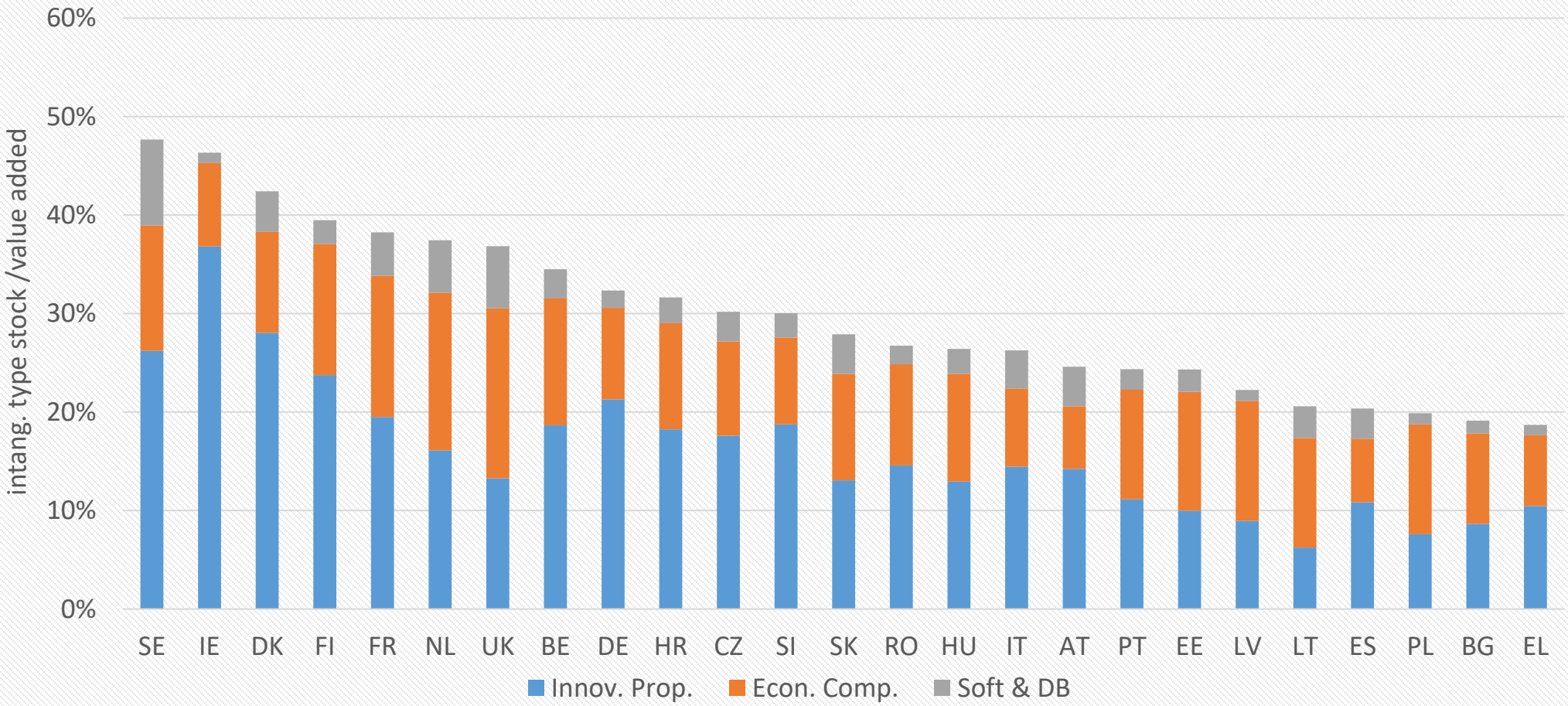
Results and discussion –4: Intangibles are not limited to R&D



Stock of intangible asset by asset type and country as % of VA, mean for 1995 to 2020.

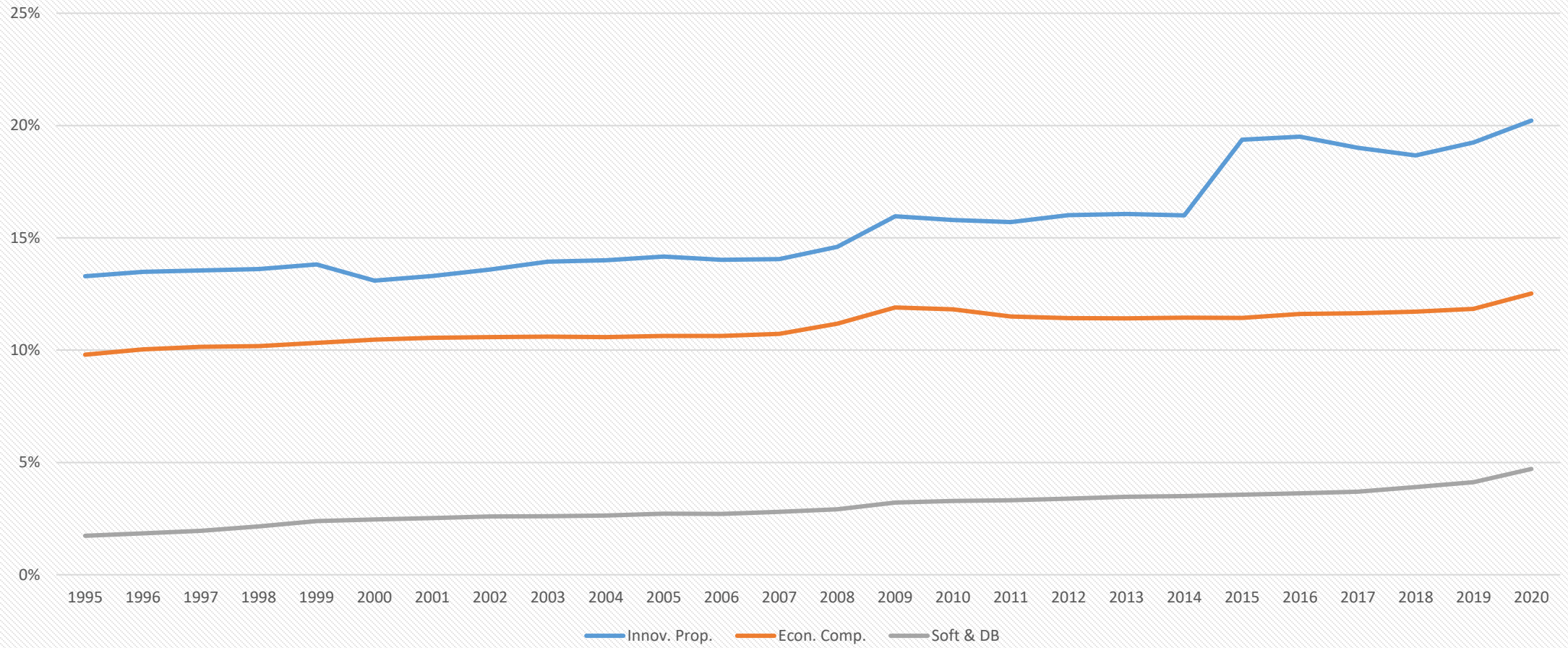
- In terms of capital stocks, most intangible intensive economies: Sweden, Denmark, Finland, France, and the Netherlands .
  - Belgium, Germany and Austria: among the top 5 in R&D capital,
  - UK leads in non-R&D assets.
  - Greece ranks near the bottom, 9th from last in R&D and 3rd from last in non-R&D assets

Results and discussion –5: Intangibles intensity by EU country (all years)



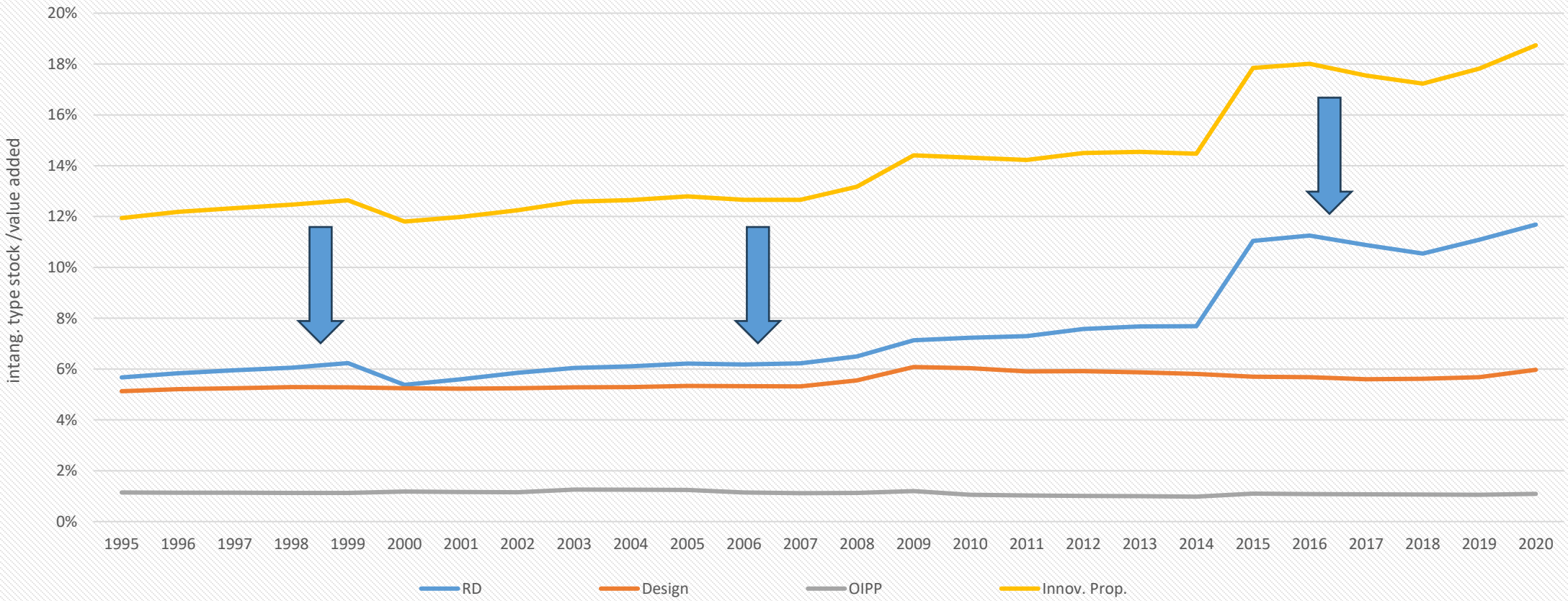
- Nordics and central EU are most intangible intensive
- Countries rely ***alternatingly*** upon either innovative property or economic competencies -> elasticities among intangible capital types?

Results and discussion – 6: Evolution of aggregate intangible types (all countries)



- Innovative property is the most important intangible asset – especially in later years
- Software assets double – but still less than 5%
- Economic competencies are stable.

Results and discussion – 7: Breakdown of innovative property assets (all countries)



- R&D still dominates innovative property
- Design diverges from R&D after the millennium, but even more so after the 2009 crisis
- OIPP still marginal

Results and discussion – Econometric results and discussion

Econometric results (1): Aggregate GVC participation

Table 1: The determinants of forward and backward GVC participation

gvc_f	(1)	(2)	(3)	(4)
gvc_f_L1	0.861***	0.848***	0.849***	0.823***
	(0.021)	(0.025)	(0.021)	(0.025)
K_Tang_L1	0.086***	0.052**	0.035	0.047
	(0.02)	(0.022)	(0.035)	(0.029)
K_Intang_L1	0.061**			
	(0.023)			
K_NatAcc_L1		0.045***		
		(0.008)		
K_NonNatAcc_L1		0.116***		
		(0.027)		
K_Innovprop_L1			0.045***	
			(0.009)	
K_EconComp_L1			0.153***	
			(0.029)	
K_Soft_DB_L1			0.017	0.005
			(0.017)	(0.014)
K_RD_L1				0.033***
				(0.005)
K_OIPP_L1				-0.005
				(0.008)
K_Brand_L1				0.024
				(0.027)
K_Design_L1				0.000
				(0.016)
K_OrgCap_L1				0.108***
				(0.024)
K_Train_L1				0.054**
				(0.023)
EMPE_L1	-0.233***	-0.196***	-0.197***	-0.205***
	(0.063)	(0.063)	(0.067)	(0.045)
Land_GDP_L1	-0.094***	-0.047	-0.033	-0.043*
	(0.029)	(0.029)	(0.037)	(0.024)
RegQuality_L1	-0.031	-0.032*	-0.094*	-0.016
	(0.018)	(0.0161)	(0.017)	(0.015)
constant	0.271	0.929***	1.368***	1.410***
	(0.324)	(0.308)	(0.371)	(0.350)
Country-sector FE	yes	yes	yes	yes
Observations	590	590	590	584
R2	0.818	0.839	0.835	0.846
No. of groups	25	25	25	25

gvc_b	(1)	(2)	(3)	(4)
gvc_b_L1	0.770***	0.764***	0.768***	0.745***
	(0.025)	(0.026)	(0.027)	(0.026)
K_Tang_L1	0.067**	0.041	0.039	0.031
	(0.027)	(0.025)	(0.035)	(0.028)
K_Intang_L1	0.043*			
	(0.023)			
K_NatAcc_L1		0.034***		
		(0.008)		
K_NonNatAcc_L1		0.080**		
		(0.033)		
K_Innovprop_L1			0.032**	
			(0.012)	
K_EconComp_L1			0.063	
			(0.043)	
K_Soft_DB_L1			0.013	0.003
			(0.012)	(0.010)
K_RD_L1				0.022***
				(0.007)
K_OIPP_L1				-0.001
				(0.005)
K_Brand_L1				-0.029
				(0.022)
K_Design_L1				0.031**
				(0.015)
K_OrgCap_L1				0.058*
				(0.034)
K_Train_L1				0.033**
				(0.016)
EMPE_L1	-0.133**	-0.100*	-0.111*	-0.124**
	(0.052)	(0.053)	(0.054)	(0.046)
Land_GDP_L1	-0.064**	-0.022	-0.025	-0.039
	(0.030)	(0.033)	(0.033)	(0.032)
RegQuality_L1	-0.028*	-0.027*	-0.028*	-0.018
	(0.014)	(0.015)	(0.015)	(0.014)
constant	-0.249	0.302	0.396	0.356
	(0.530)	(0.525)	(0.493)	(0.534)
Country-sector FE	yes	yes	yes	yes
Observations	590	590	590	584
R2	0.888	0.901	0.896	0.886
No. of groups	25	25	25	25

- **Intangibles are positively and significantly associated with GVC pt.** (both forward and backward)
  - **Higher magnitude for forward** participation → importance of each country's **knowledge base** for its exporting activities
- Disaggregation based on measurement:
  - Both National Accounts and Non-National Accounts are positively associated to GVC participation
  - For both types of participation, **Non-National Accounts intangibles** present significantly higher correlation to GVC participation
  - → importance of a diverse knowledge base comprising different types of knolwedge
- Disaggregation based on knowledge type:
  - **Innovative property** is positively associated to GVC participation in both cases
  - **Economic competences** are statistically important **only for forward** activities → reflects the nature of the underlying assets and their importance for competitiveness
- Disaggregation per intangible asset:
  - 3 assets stand out: **R&D**, **organizational capital** (critical for coordination gains), and **training** (linked to human capital readiness)
  - **Design** appears to be positively associated to backward participation

Econometric results (2): Per type and mode of GVC participation

Table 2: The determinants of forward GVC participation modes

gvc_fs	(1)	(2)	(3)	(4)
gvc_fs_L1	0.857***	0.844***	0.848***	0.825***
	(0.020)	(0.026)	(0.022)	(0.030)
K_Tang_L1	0.051**	0.027	0.011	0.020
	(0.019)	(0.021)	(0.028)	(0.025)
K_Intang_L1	0.047**			
	(0.019)			
K_NatAcc_L1		0.038***		
		(0.009)		
K_NonNatAcc_L1		0.074***		
		(0.025)		
K_Innovprop_L1			0.035***	
			(0.007)	
K_EconComp_L1			0.114***	
			(0.021)	
K_Soft_DB_L1			0.014	0.002
			(0.015)	(0.013)
K_RD_L1				0.027***
				(0.006)
K_OIPP_L1				-0.002
				(0.007)
K_Brand_L1				0.032
				(0.021)
K_Design_L1				-0.187
				(0.014)
K_OrgCap_L1				0.077***
				(0.020)
K_Train_L1				0.048**
				(0.022)
EMPE_L1	-0.188***	-0.162***	-0.160***	-0.153***
	(0.056)	(0.053)	(0.054)	(0.034)
Land_GDP_L1	-0.057**	-0.019	-0.006	-0.007
	(0.023)	(0.021)	(0.0281)	(0.023)
RegQuality_L1	-0.024	-0.023	-0.025	-0.0105
	(0.015)	(0.014)	(0.015)	0.014
constant	0.388	0.915***	1.296***	1.311***
	(0.344)	(0.316)	(0.387)	(0.354)
Country-sector FE	yes	yes	yes	yes
Observations	590	590	590	584
R2	0.852	0.861	0.858	0.884
No. of groups	25	25	25	25

gvc_fc	(1)	(2)	(3)	(4)
gvc_fc_L1	0.866***	0.850***	0.851***	0.818***
	(0.021)	(0.022)	(0.018)	(0.021)
K_Tang_L1	0.138***	0.093***	0.074	0.093**
	(0.031)	(0.030)	(0.049)	(0.038)
K_Intang_L1	0.087***			
	(0.029)			
K_NatAcc_L1		0.059***		
		(0.010)		
K_NonNatAcc_L1		0.175***		
		(0.034)		
K_Innovprop_L1			0.064***	
			(0.012)	
K_EconComp_L1			0.214***	
			(0.045)	
K_Soft_DB_L1			0.020	0.009
			(0.020)	(0.017)
K_RD_L1				0.044***
				(0.007)
K_OIPP_L1				-0.008
				(0.009)
K_Brand_L1				0.017
				(0.038)
K_Design_L1				0.024
				(0.022)
K_OrgCap_L1				0.158***
				(0.032)
K_Train_L1				0.063**
				(0.029)
EMPE_L1	-0.310***	-0.254***	-0.259***	-0.284***
	(0.082)	(0.084)	(0.092)	(0.074)
Land_GDP_L1	-0.146***	-0.088*	-0.071	-0.099**
	(0.041)	(0.047)	(0.055)	(0.039)
RegQuality_L1	-0.041*	-0.46**	-0.048**	-0.028
	(0.023)	(0.020)	(0.022)	(0.020)
constant	-0.000	0.763*	1.327**	1.262**
	(0.415)	(0.020)	(0.502)	(0.484)
Country-sector FE	yes	yes	yes	yes
Observations	590	590	590	584
R2	0.764	0.800	0.797	0.793
No. of groups	25	25	25	25

Table 3: The determinants of backward GVC participation modes

gvc_bs	(1)	(2)	(3)	(4)
gvc_bs_L1	0.759***	0.752***	0.760***	0.747***
	(0.034)	-0.033	(0.0330	(0.040)
K_Tang_L1	0.035*	0.015	0.010	0.002
	(0.020)	-0.025	(0.029)	(0.025)
K_Intang_L1	-0.011			
	(0.024)			
K_NatAcc_L1		0.009		
		(0.014)		
K_NonNatAcc_L1		0.048		
		(0.042)		
K_Innovprop_L1			-0.010	
			(0.014)	
K_EconComp_L1			0.023	
			(0.063)	
K_Soft_DB_L1			0.015*	0.008
			(0.063)	(0.008)
K_RD_L1				-0.000
				(0.010)
K_OIPP_L1				0.007
				(0.005)
K_Brand_L1				-0.020
				(0.026)
K_Design_L1				0.024
				(0.017)
K_OrgCap_L1				-0.010
				(0.044)
K_Train_L1				0.021
				(0.015)
EMPE_L1	0.000	0.016	0.016	0.023
	(0.055)	(0.056)	(0.054)	(0.064)
Land_GDP_L1	0.022	0.059*	0.057	0.040
	(0.011)	(0.033)	(0.034)	(0.042)
RegQuality_L1	-0.006	-0.002	-0.006	-0.005
	(0.011)	(0.012)	(0.012)	(0.014)
constant	-0.259	0.298	-0.280	0.090
	(0.475)	(0.497)	(0.617)	(0.719)
Country-sector FE	yes	yes	yes	yes
Observations	590	590	590	0.584
R2	0.906	0.836	0.841	0.850
No. of groups	25	25	25	25

gvc_bc	(1)	(2)	(3)	(4)
gvc_bc_L1	0.815***	0.806***	0.808***	0.765***
	(0.026)	(0.027)	(0.025)	(0.020)
K_Tang_L1	0.125**	0.078*	0.075	0.067
	(0.045)	(0.040)	(0.057)	(0.045)
K_Intang_L1	0.075**			
	(0.035)			
K_NatAcc_L1		0.055***		
		(0.012)		
K_NonNatAcc_L1		0.156***		
		(0.039)		
K_Innovprop_L1			0.059***	
			(0.019)	
K_EconComp_L1			0.142***	
			(0.043)	
K_Soft_DB_L1			0.018	0.001
			(0.023)	(0.018)
K_RD_L1				0.043***
				(0.011)
K_OIPP_L1				-0.0130
				(0.009)
K_Brand_L1				-0.031
				(0.038)
K_Design_L1				0.062***
				(0.021)
K_OrgCap_L1				0.124***
				(0.041)
K_Train_L1				0.068**
				(0.033)
EMPE_L1	-0.301***	-0.249***	-0.263**	-0.310***
	(0.085)	(0.085)	(0.093)	(0.079)
Land_GDP_L1	-0.143***	-0.077	-0.078	-0.123**
	(0.044)	(0.050)	(0.059)	(0.044)
RegQuality_L1	-0.051*	-0.051*	-0.052*	-0.031
	(0.027)	(0.026)	(0.026)	(0.021)
constant	-0.106	0.780	0.995	0.847
	(0.656)	(0.646)	(0.659)	(0.608)
Country-sector FE	yes	yes	yes	yes
Observations	590	590	590	584
R2	0.840	0.856	0.849	0.827
No. of groups	25	25	25	25

Econometric results: Discussion

- When disaggregating into different modes of participation some interesting patterns emerge
- The statistical significance of aggregate intangible assets is **persistent across all specifications → general link** between intangibles and GVCs already highlighted in the firm level literature
- Simple and complex forward participation present similar patters (aligned with the aggregate indicators)
  - Non-National Accounts intangibles present a stronger association to these modes of GVC participation compared to National Accounts → importance of measuring intangible correctly
  - **Economic Competencies are more important than Innovative Property** → importance of softer types of knowledge for exporting activities in GVCs
  - **The same trio of assets emerges: R&D, organizational capital, and training**
    - Organizational capital presents the strongest association to both modes of forward participation → business model effectiveness and coordination benefits
    - R&D hints towards specialization in more upstream product development stages → forward orientation
    - Training highlights the importance of human capital readiness for exporting activities
- Simple and complex backward activities are significantly different!
  - **Simple participation appears to be unassociated with each country's knowledge base** → related to the nature of GVC activities (presumably **bulk direct imports of intermediates**) and the specialization of the countries at hand
  - Complex backward participation presents the same pattern with complex forward participation → importance of intangible assets, i.e., knowledge intensity, for complex, multi border-crossing production sharing activities
- Tangible capital intensity is positively associated to all types and modes of participation
  - The link is stronger for forward participation and its modes
- Traditional trade controls present the expected (negative) signs

Summary and closing points

Summary and key take-away points

- This paper examines the antecedents of GVC participation at the country level for a sample of 28 EU countries during the 1995-2020 period
- We focus on technological/knowledge factors that affect GVC activities → intangible assets
  - Traditional trade factors are examined as controls
- We adopt a new perspective on GVC participation measurement through a decomposition framework that enables us to account for GVC participation direction (type) and complexity level (mode)
- Our key findings are summarized below
  - ✓Intangible assets are significantly associated to all aggregate GVC participation
  - ✓Accounting for intangibles outside the National Accounts matters → they present a stronger correlation to GVC participation compared to those included in the system
  - ✓Economic Competencies are more important for forward-oriented activities compared to Innovative Property, especially for complex activities
  - ✓Simple backward participation is not related to any type of intangible assets
  - ✓A clear trio of intangibles emerges as the driving factor of the above trends: R&D, organizational capital, and training

Limitations

- The usual i-o analysis constraints (single product per industry, no scale effects etc.)
- 45-sector definition can be challenging for delving deep in specific economic activities and identifying corresponding patterns and typologies

Next steps

- Map further sectoral patterns and dynamics
- Disaggregate RoW and EU regions to contrast country specific trends
- Isolate sector-specific case studies (e.g. the GVC of automobiles)
- Examine the crossover with regional diversification/relatedness applications
- Examine the combines effects of GVC participation and position in spatial econometric applications

Thank you for your time and attention

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