



# The changing structure of GVCs: Are central hubs key for productivity?

Chiara Criscuolo and Jonathan Timmis  
OECD Directorate for Science, Technology and Innovation

[chiara.criscuolo@oecd.org](mailto:chiara.criscuolo@oecd.org)  
[jonathan.timmis@oecd.org](mailto:jonathan.timmis@oecd.org)





# Why “centrality”? The role of networks

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Economies are increasingly interconnected via participation in GVCs

which can impact productivity through ...

knowledge diffusion, new varieties of inputs  
competition, scale economies, specialisation, etc.

But we know much less about how effects differ by position within GVCs (central hubs vs periphery) and the composition of buyers / suppliers networks



# “Centrality” is a key feature of networks

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Centrality has been studied for:

- a) Domestic Shock Transmission
  - 2% most central sectors explain 80% US output growth <sup>1</sup>
  - 100 most central firms explain 91% Belgian GDP volatility<sup>2</sup>
- b) International Shock Transmission
- c) Role of social networks for knowledge diffusion amongst individuals:
  - “Central” individuals play key role in knowledge diffusion of new finance or insurance schemes, household wealth <sup>3</sup>

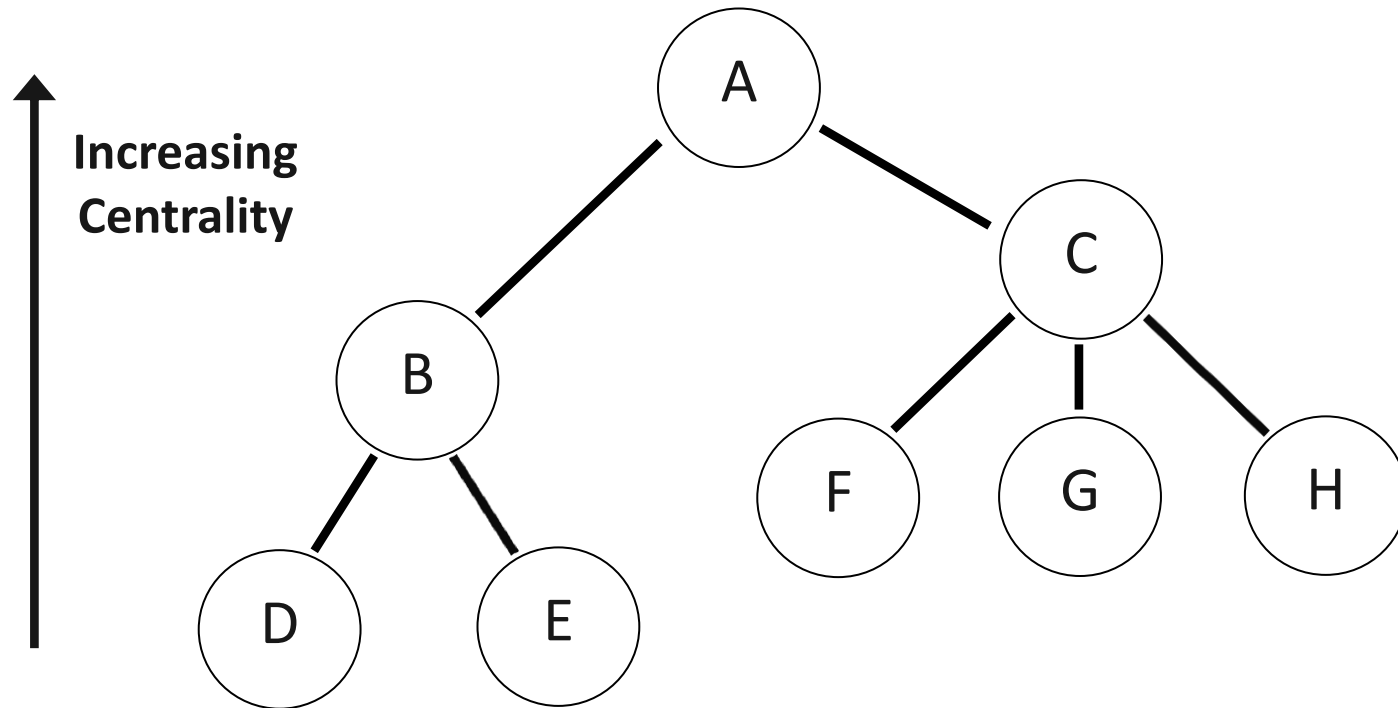
<sup>1</sup> – Carvalho (2014); <sup>2</sup> - Maggerman et al. (2016); <sup>3</sup> – Banerjee et al. (2013, 2016); Alatas et al. (2016)



# How do we measure “centrality”?

## Identifying key hubs

“Bonacich-Katz eigenvector” centrality  
= Strength of direct & **indirect** connections  
– measure of influence in network



# Which data for measuring “centrality” and identifying key hubs?

Connections are input flows from ICIO tables underlying TiVA 2015 edition

- 34 sectors (ISIC rev.3), 62 economies = 4.4million (potential) flows

Input shares (rather than values) – relative measure

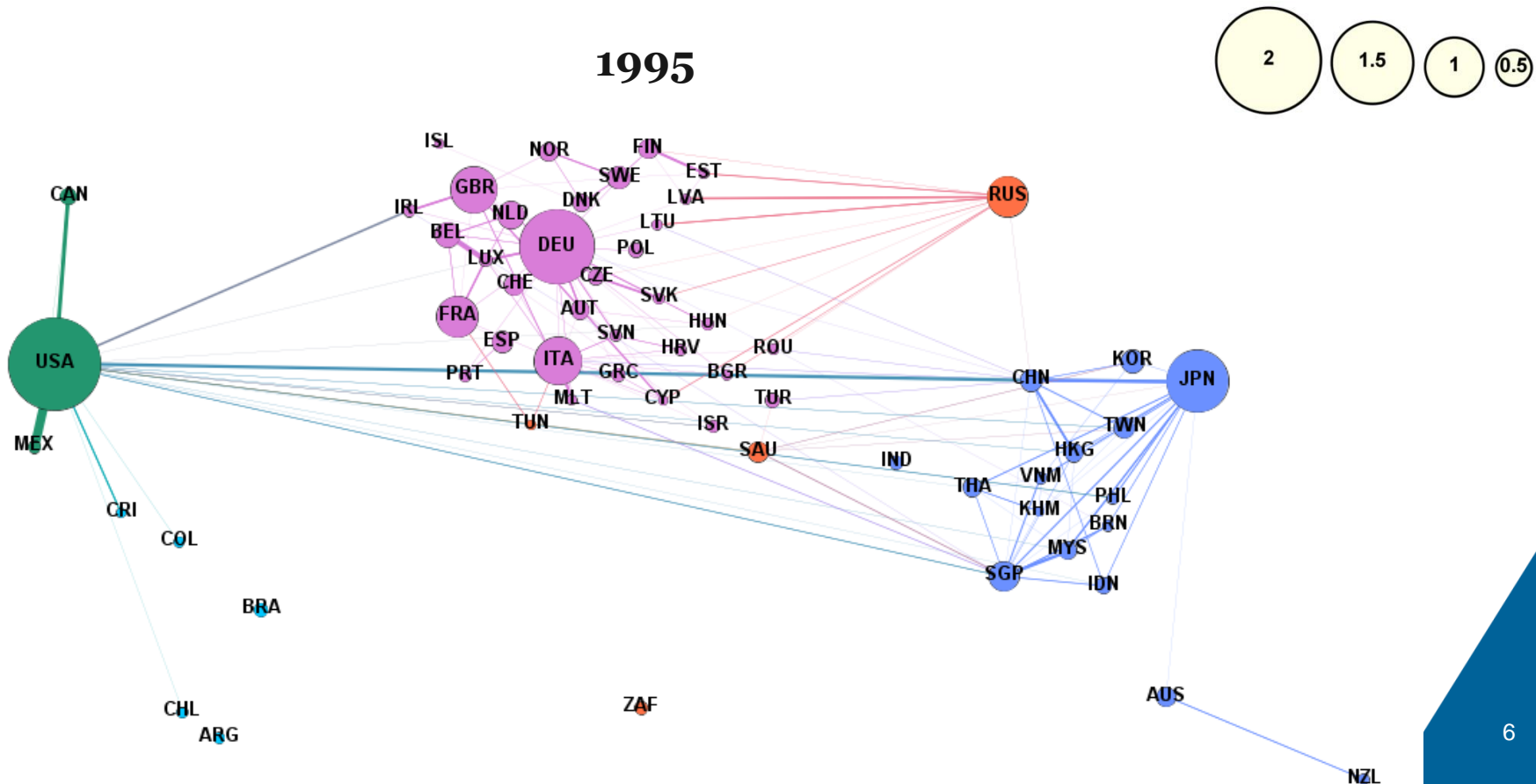
Focus on foreign sources of centrality

			Use by Countries						
			Country 1			....	Country 62		
			Sector 1	....	Sector 34	....	Sector 1	....	Sector 34
Supply from Countries	Country 1	Sector 1							
		....							
		Sector 34							
	....	....							
	Country 62	Sector 1							
		....							
		Sector 34							



# Changing GVC structure over time: the world in 1995

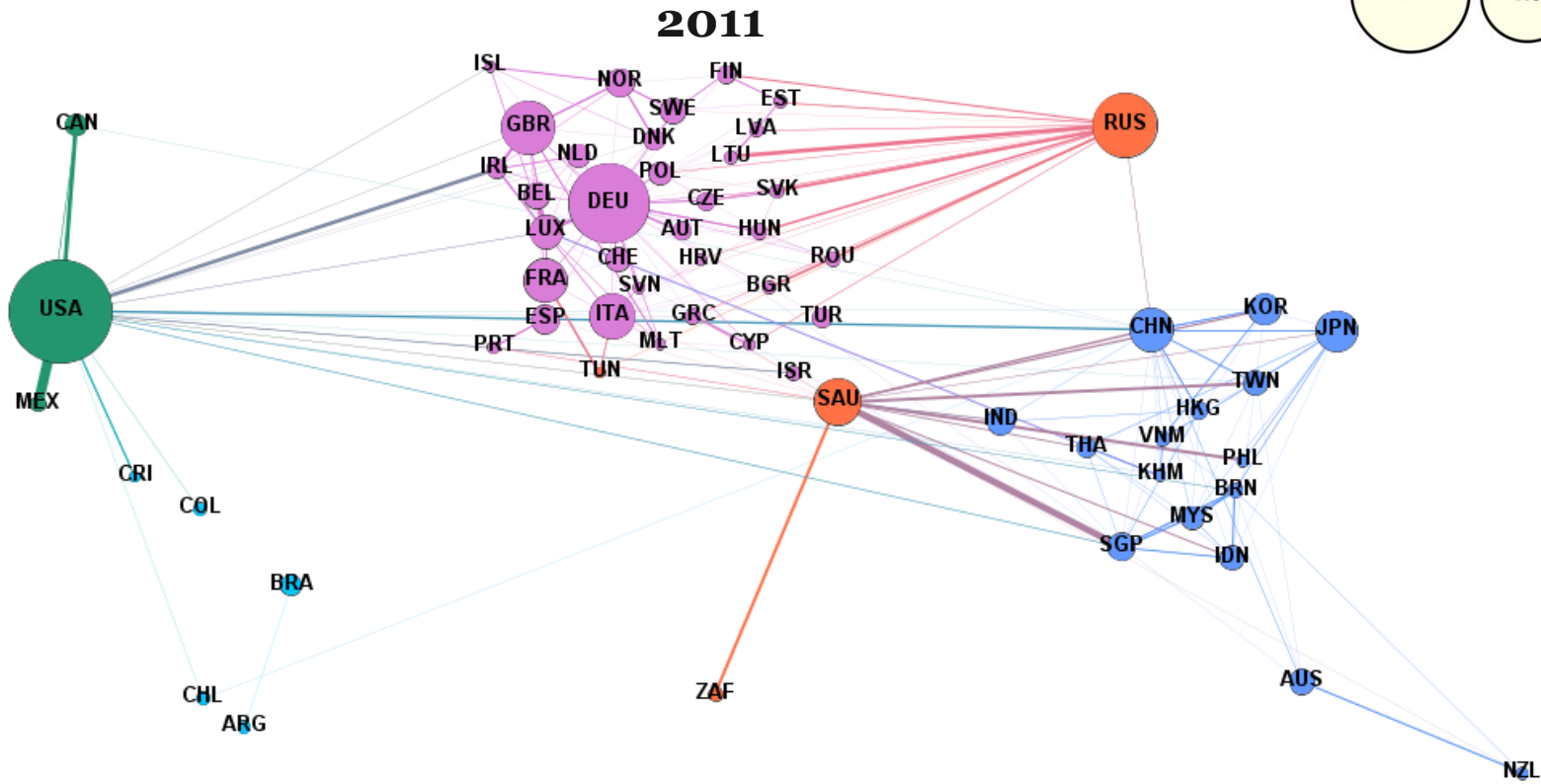
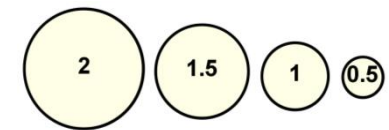
- Minority of key hubs dominate regional value chains in 1995 e.g. USA, Japan, Germany
  - Limited role of Latin America





# Changing GVC structure over time: the world in 2011

- Many key hubs persist in 2011...but....
  - Rising importance of services e.g. Luxembourg, UK, Ireland
  - Increasing influence of emerging economies
  - And declining influence of Japan

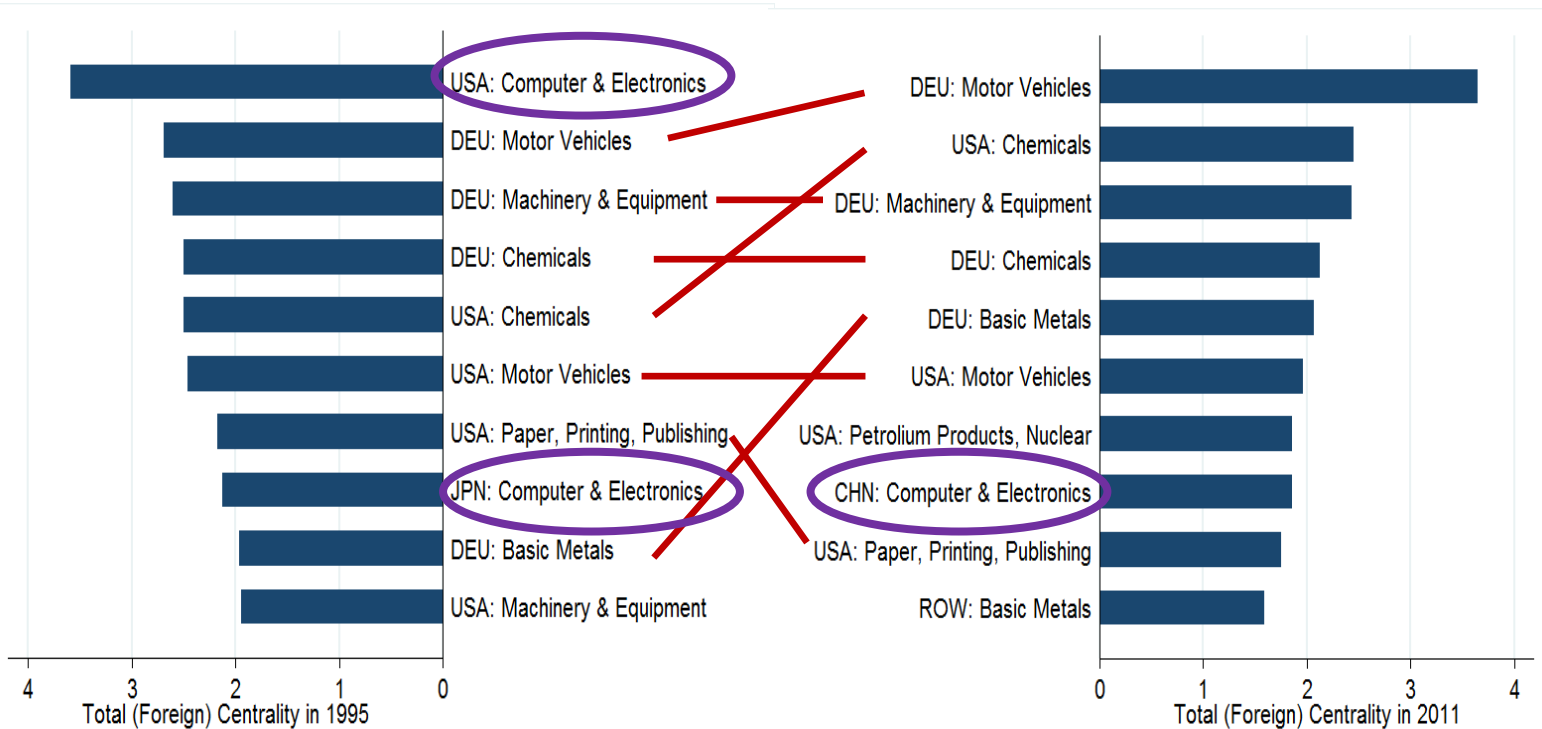




# Key Hubs: those who stay and those who go...

- At sector level many key hubs persist over time....
  - E.g. German and American motor vehicles
  - But large shifts in computer & electronics

**Top 10 most central manufacturing – 2011**



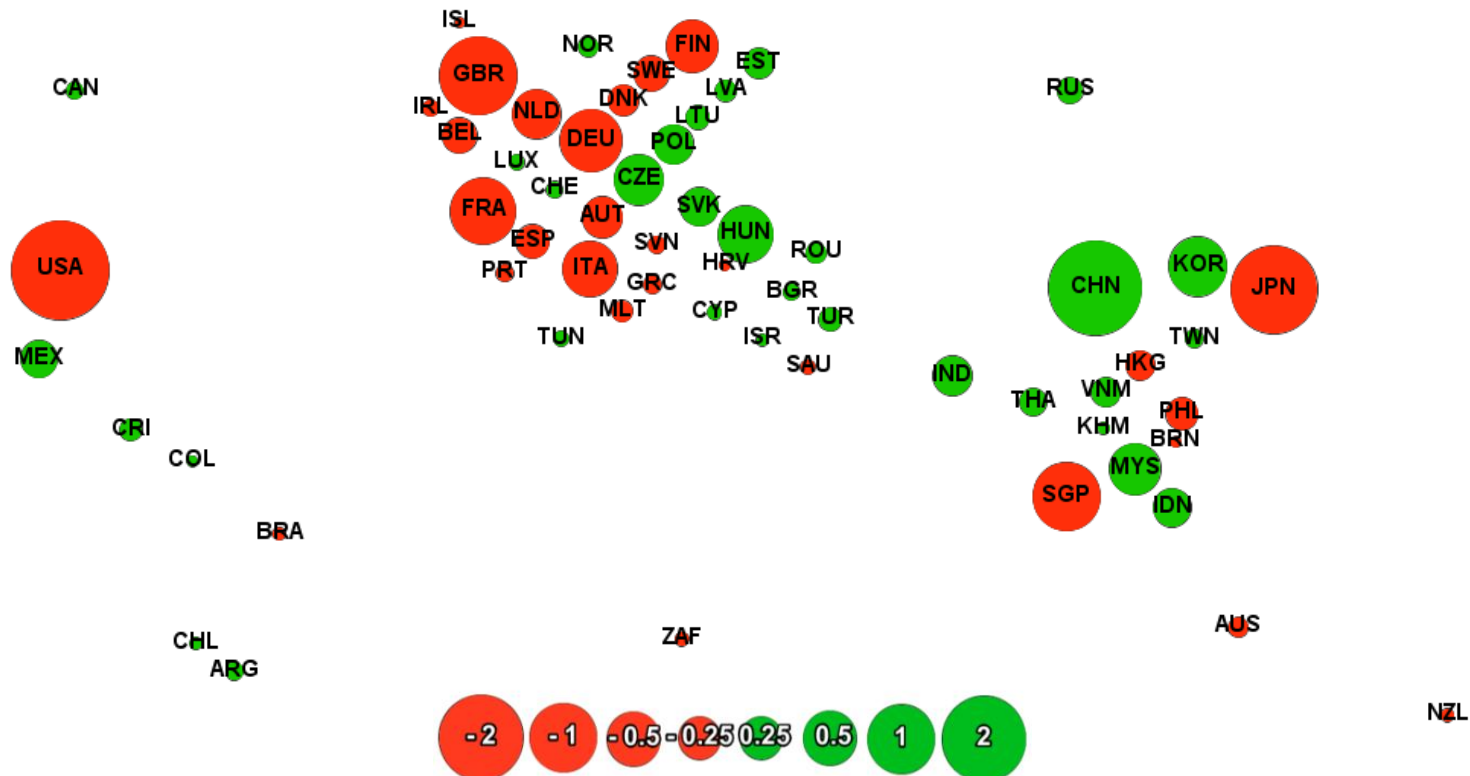




# A Shift eastwards in IT Manufacturing

- Large shifts in IT manufacturing over 1995-2011....
  - Rising importance of E. Europe & E. Asia
  - Declining centrality of old centres of production

## Computing & electronics manufacturing – $\Delta$ 1995-2011

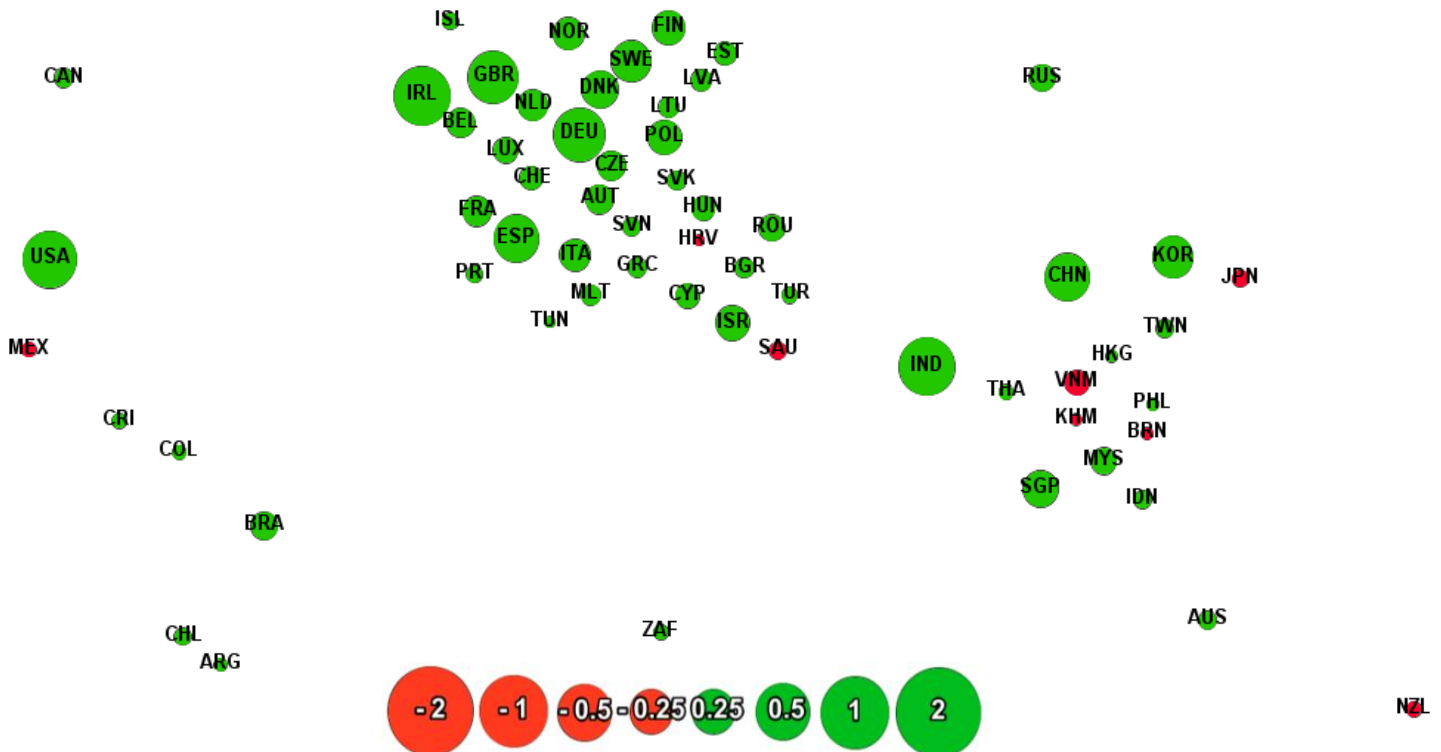




# IT services: increasingly central everywhere

- IT services are increasingly central to GVCs everywhere
  - Not just in developed economies
  - But also, many emerging economies, e.g. India, China

IT services –  $\Delta$ 1995-2011

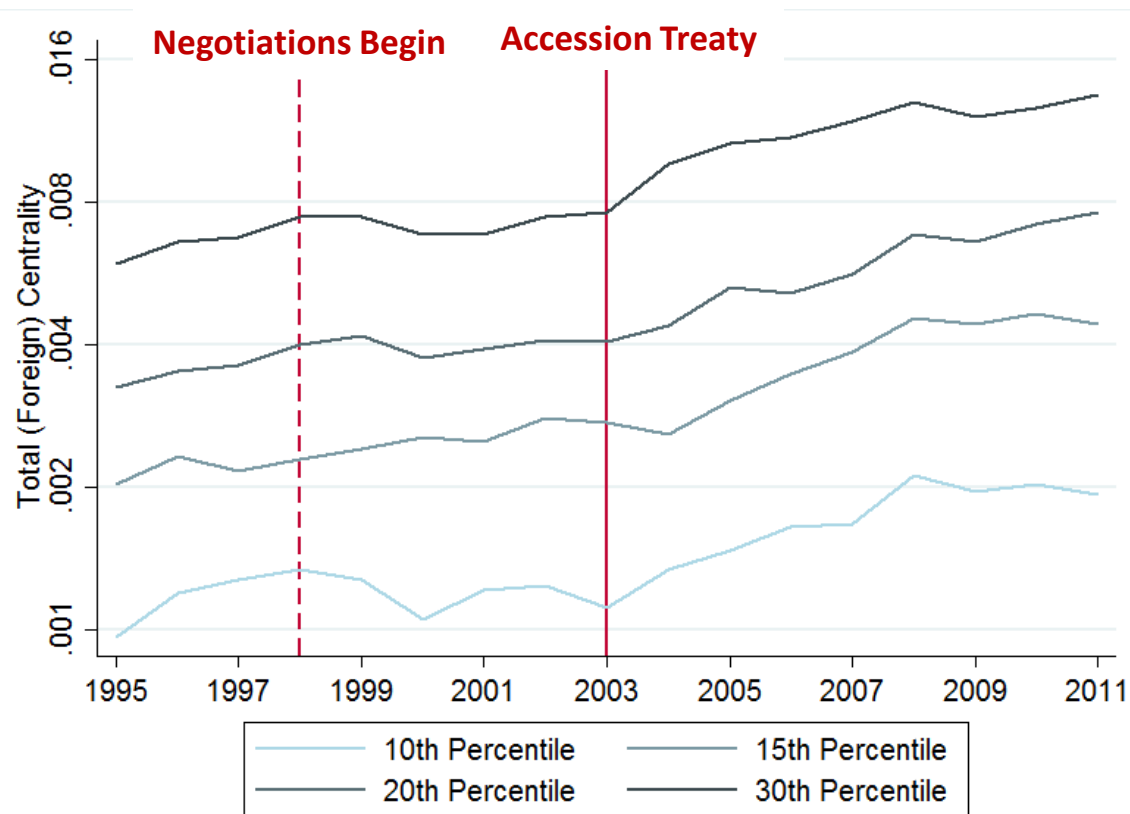




# ...is this because of EU enlargement?...maybe...

- Increasing centrality of periphery is driven by post-2004 EU Accession Countries

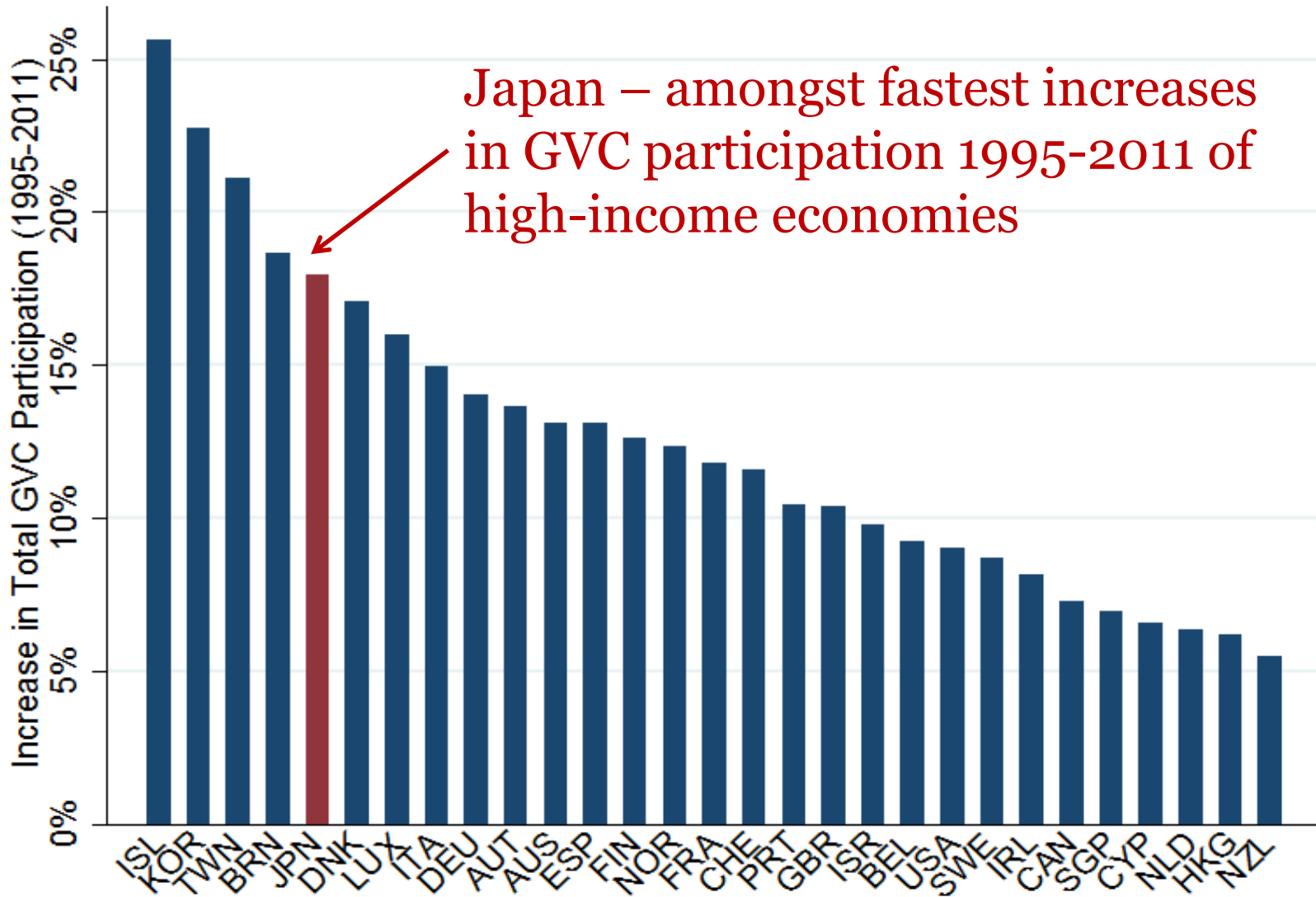
**2004 EU Accession Countries – country-industries**





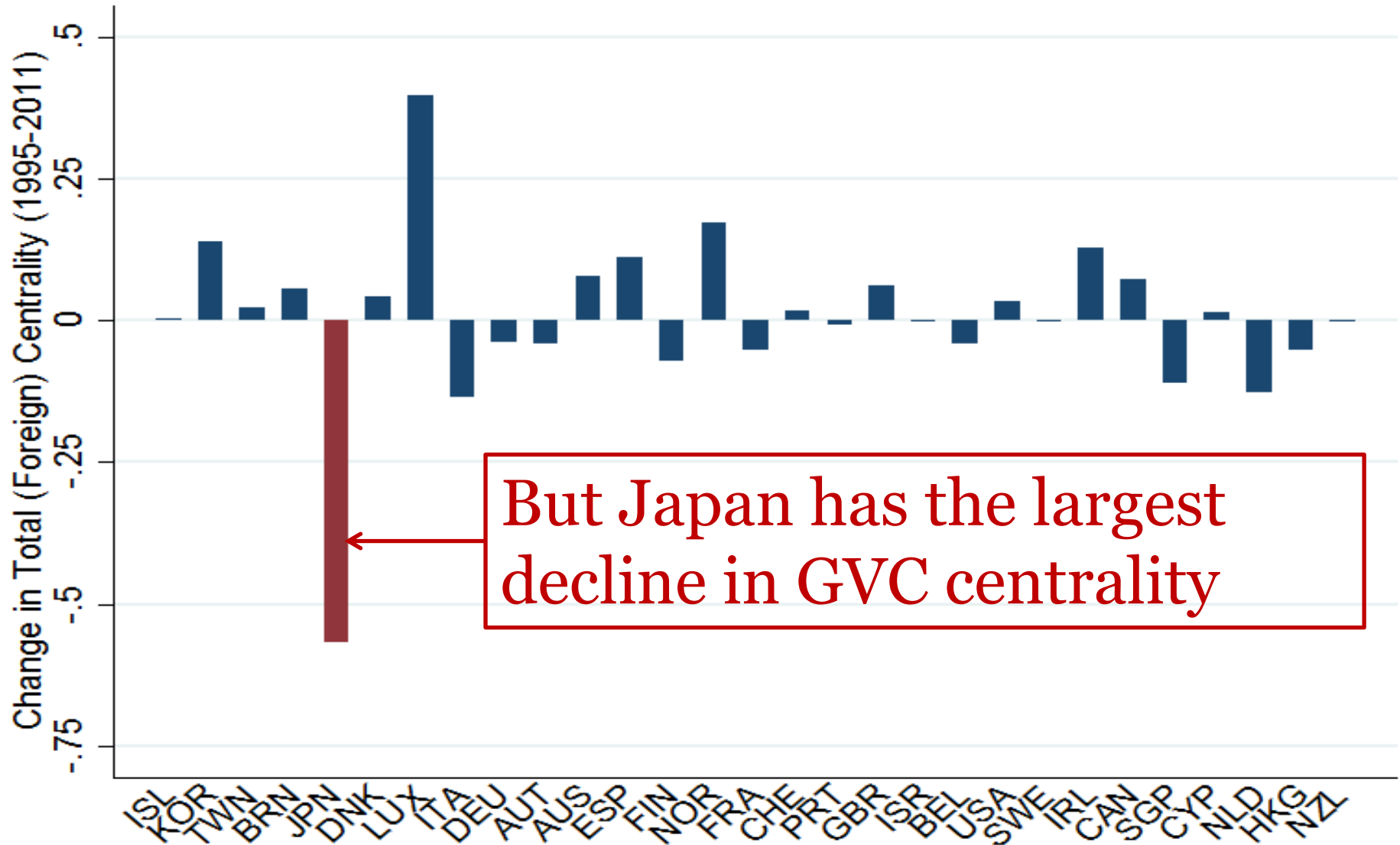
# Is this evidence really new?

## GVC centrality is more than participation





# GVC centrality is more than participation





# How does centrality impact firm productivity?

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We measure two components:

1. Centrality (regardless who is connected)
  2. Composition of buyers / supplier networks (regardless of centrality)
    - Average productivity (centrality weighted) of buyers / suppliers
- **Firm Data: Productivity (MFP) from cross-country ORBIS**
    - Manufacturing (excl Petroleum), Business Services (excl Finance, Real Estate)
    - Mainly medium and large firms (mean=350, median=46 employees)
    - Mainly high income economies (90% of firms)
  - **Centrality Data: Calculated from OECD ICIO 2015 edition**
    - 1995-2011 annual data



# Baseline results – all firms & countries

Over all firms in our data:

- GVC centrality / influence is uncorrelated with firm productivity
- But average (centrality weighted) productivity growth of buyer networks (via forward linkages) is correlated with firm productivity growth

	<b>Total</b>	<b>Forward</b>	<b>Backward</b>
<b>Centrality</b>	0.065 (0.090)	0.024 (0.044)	-0.020 (0.161)
<b>Average Productivity (Centrality Weighted) of Buyers / Suppliers</b>	0.493*** (0.133)	0.757*** (0.236)	0.066 (0.087)
Observations	2,013,223	2,013,223	2,013,223

All regressions include Year Fixed Effects, Firm Fixed Effects, Firm Size and Industry Controls



# But “average” firm results mask role in firm catch-up

- Centrality & productivity growth of buyers/supplier networks correlated with productivity growth of non-frontier or smaller firms
- But weakens with proximity to the frontier or firm size

		<b>Frontier vs Non-Frontier</b>		
		Total	Forward	Backward
	<b>Centrality</b>	1.406** (0.644)	0.561 (0.380)	1.763*** (0.644)
	<b>Centrality * Initial Productivity</b>	-0.121** (0.056)	-0.048 (0.033)	-0.156*** (0.053)
	<b>Average Productivity (Centrality Weighted) of Buyers / Suppliers</b>	5.914*** (0.691)	6.209*** (0.633)	4.672*** (0.647)
	<b>Average Productivity of Buyers / Suppliers * Initial Productivity</b>	-0.495*** (0.059)	-0.497*** (0.056)	-0.426*** (0.056)
	Observations	2,013,223	2,013,223	2,013,223

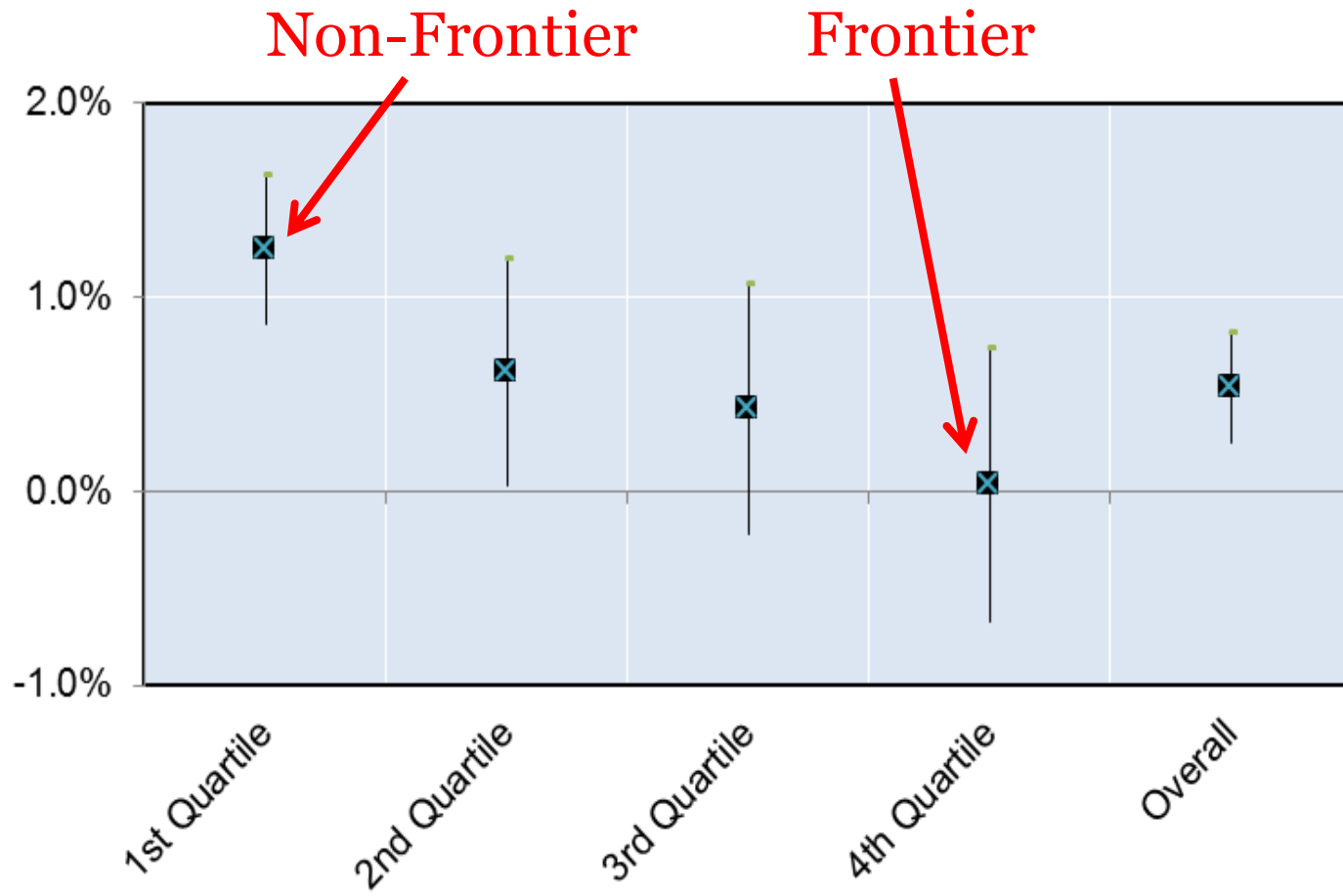
All regressions include Year Fixed Effects, Firm Fixed Effects, Firm Size and Industry Controls





# Faster productivity growth further from frontier

- Approx. 1% non-frontier firm MFP growth per annum for mean productivity growth foreign buyers / suppliers





# Potential role in the catch-up of economies

- Becoming more influential/central in GVCs matters for catch-up of Post-04 EU members and small countries
- But for other European or larger countries it is the composition of buyer/supplier networks that matter

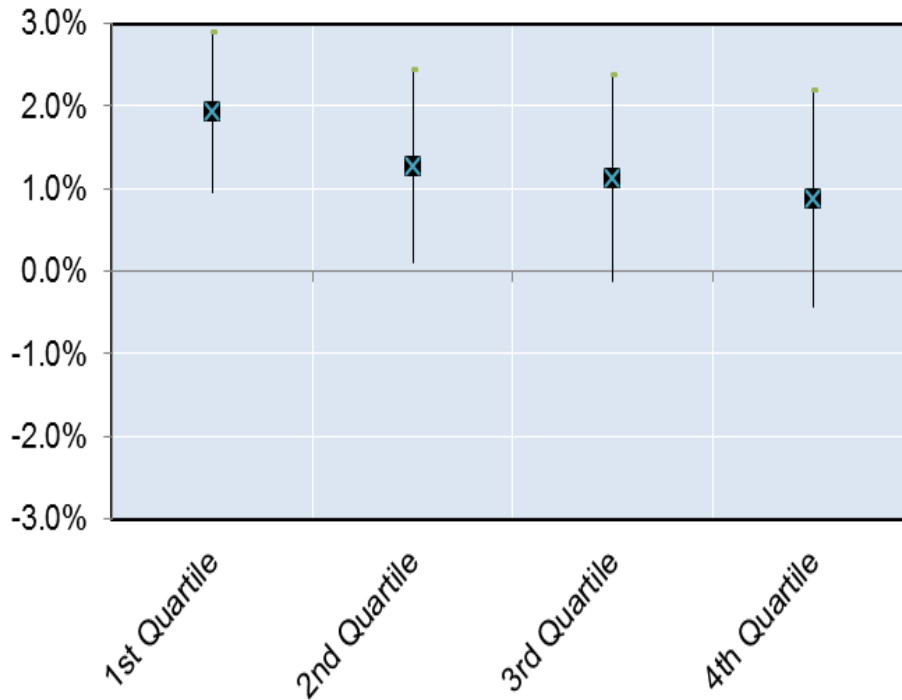
	Post-2004 EU Accession Countries			Other Factory Europe Countries		
	Total	Forward	Backward	Total	Forward	Backward
<b>Centrality</b>	<b>5.722***</b> (2.089)	2.621 (1.875)	<b>4.295***</b> (1.274)	0.004 (0.055)	0.033 (0.032)	-0.083* (0.046)
<b>Average Productivity (Centrality Weighted) of Buyers / Suppliers</b>	0.177 (0.331)	0.378 (0.459)	-0.358 (0.267)	<b>0.398***</b> (0.122)	<b>0.366***</b> (0.119)	0.133 (0.086)
Observations	150,808	150,808	150,808	1,765,433	1,765,433	1,765,433
All regressions include Year Fixed Effects, Firm Fixed Effects, Firm Size and Industry Controls						



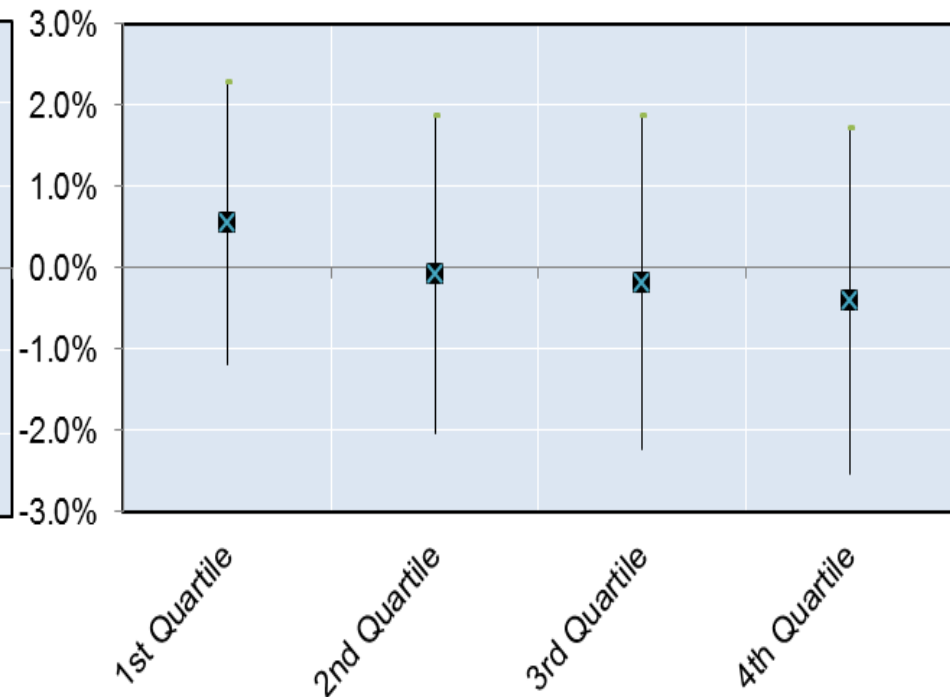
# Can policy play a role?

- Productivity spillovers to non-frontier firms are stronger in more flexible labour markets

## Flexible Employment Regulations



## Rigid Employment Regulations





# Key findings & policy implications

- Large changes in the structure of GVCs (e.g. computer & electronics, IT services)
- Potential for policy to influence centrality – EU accession
- Centrality & composition of buyer/supplier networks play a role in catch-up of non-frontier or smaller firms
  - With stronger diffusion in flexible labour markets
- Centrality in GVCs matters for smaller/post-04 EU countries vs composition of networks for other countries.
- Suggesting there is no one-size-fits-all policy
  - Policies that support GVC integration are important for smaller / non-frontier firms or smaller / EU accession economies.
  - But for firms overall in larger/higher income economies, what matters is formation of highly productive foreign buyer/supplier networks
    - Skills & upgrading, but also information barriers & matching (digital platforms?)



**Thank you!**