# Supply chains and productivity

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IMD / Real learning Real impact

# Basic economics: supply chains and productivity

- Gains from trade traditionally taught as showing up in higher utility.
- If gains from trade are within the production process, then gains from trade show up as higher productivity.

- Gains from trade sources:
  - Standard comparative advantage.
  - Scale economies & more variety.
  - Agglomeration economies.
  - Knowhow sharing supply chain actors.

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# Baseline macro facts on supply chains.

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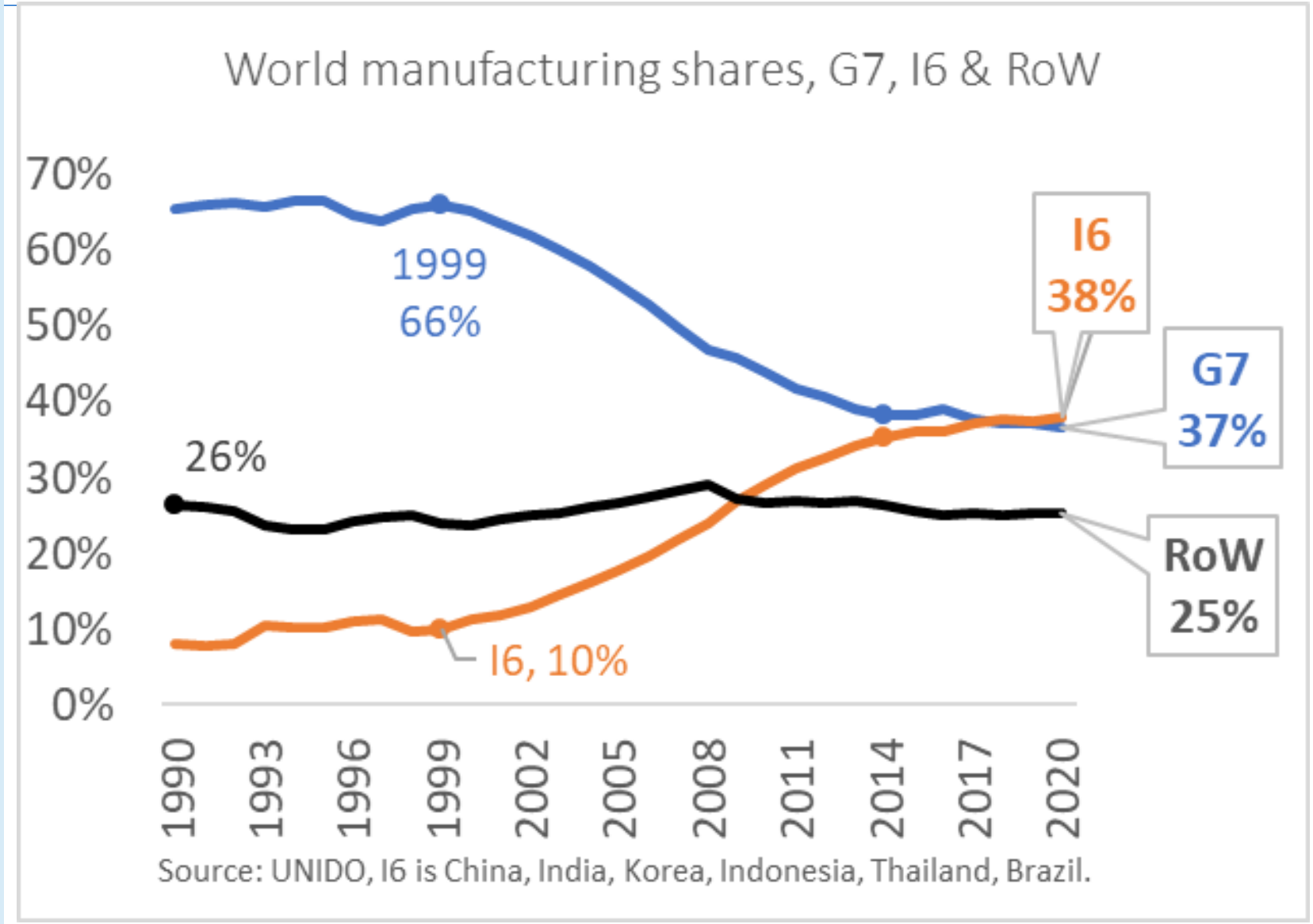
# G7 deindustrialized.

# Six Emerging Economies industrialized.

RoW, no change.




China, India, Korea, Indonesia, Thailand, Brazil

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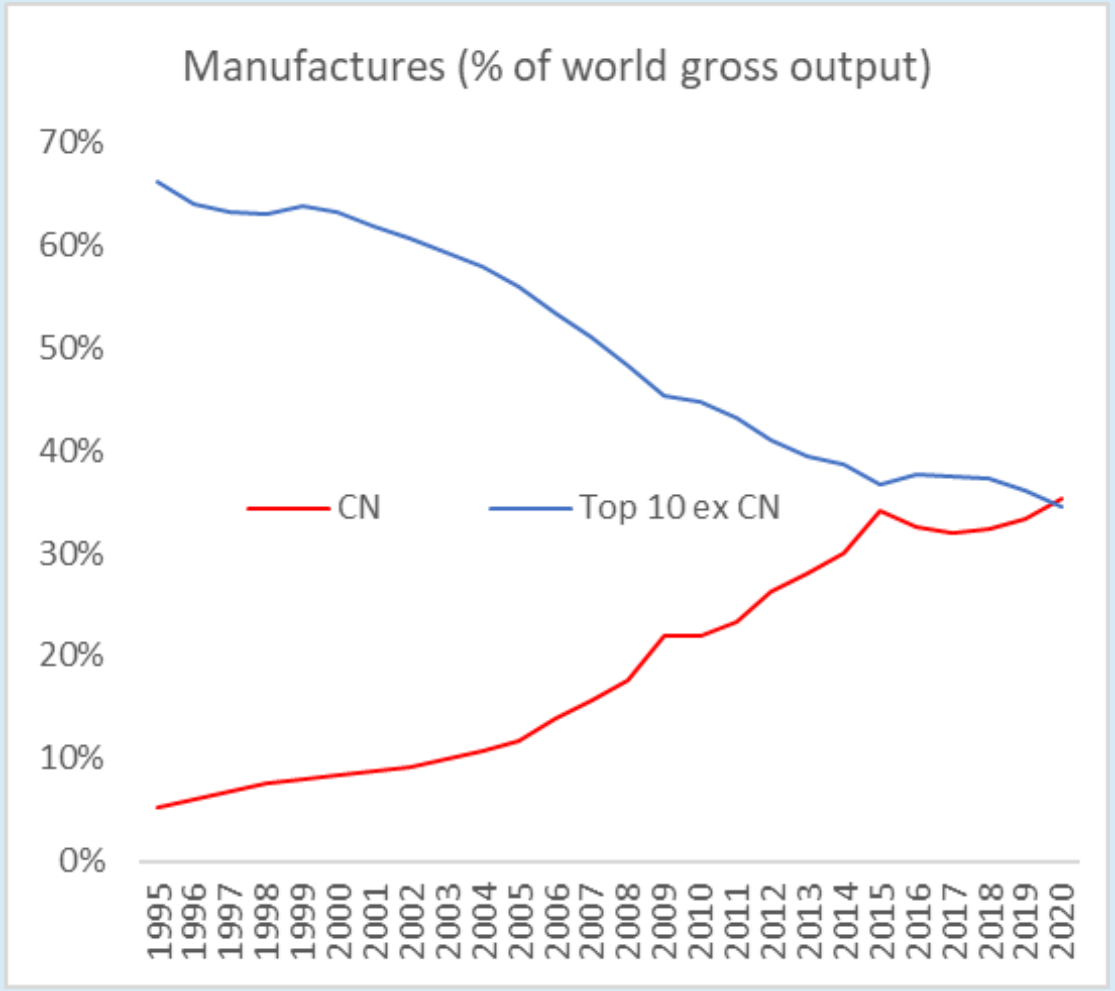
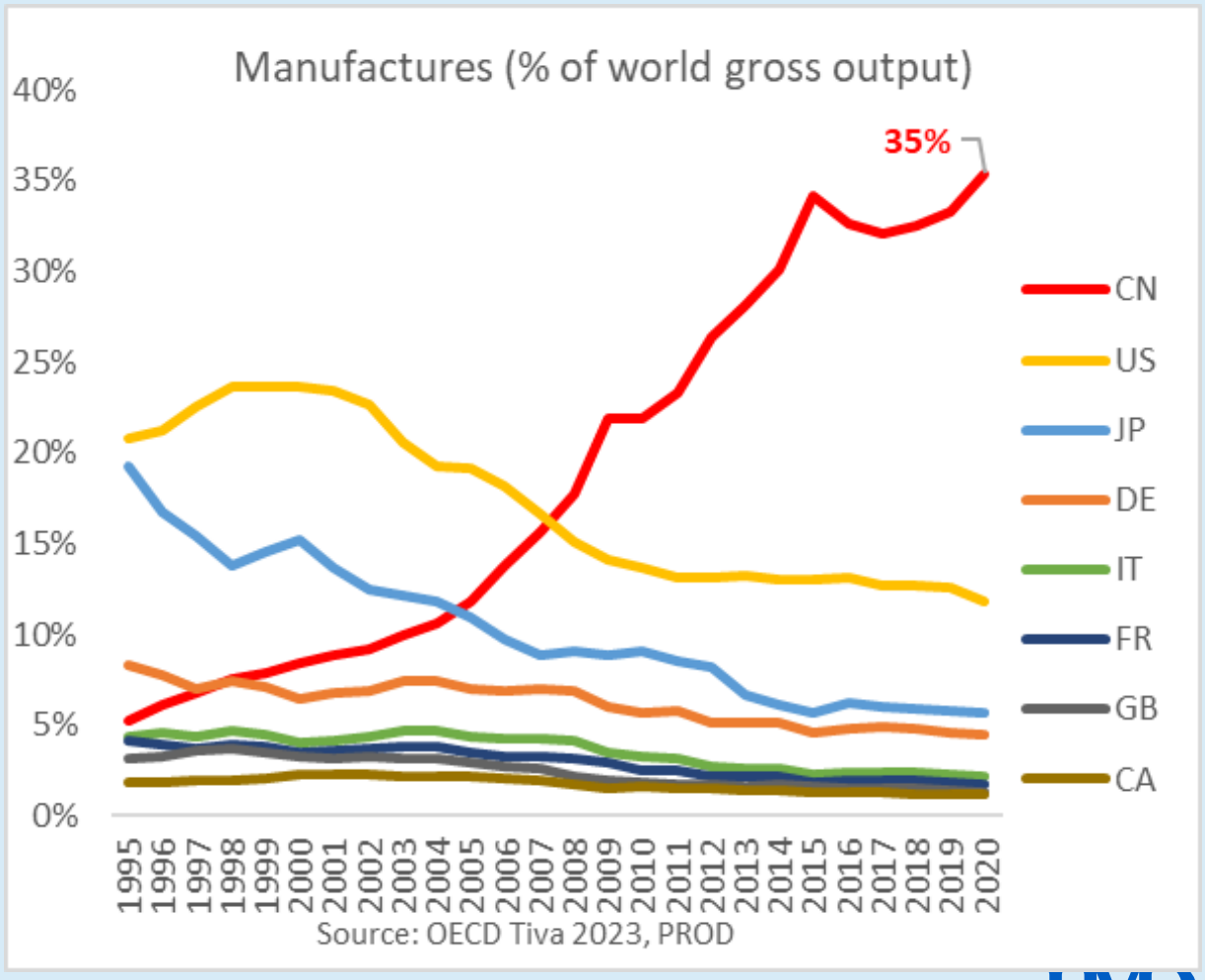
# CN dominants manufacturing: Gross output.

## CN vs other top-10.



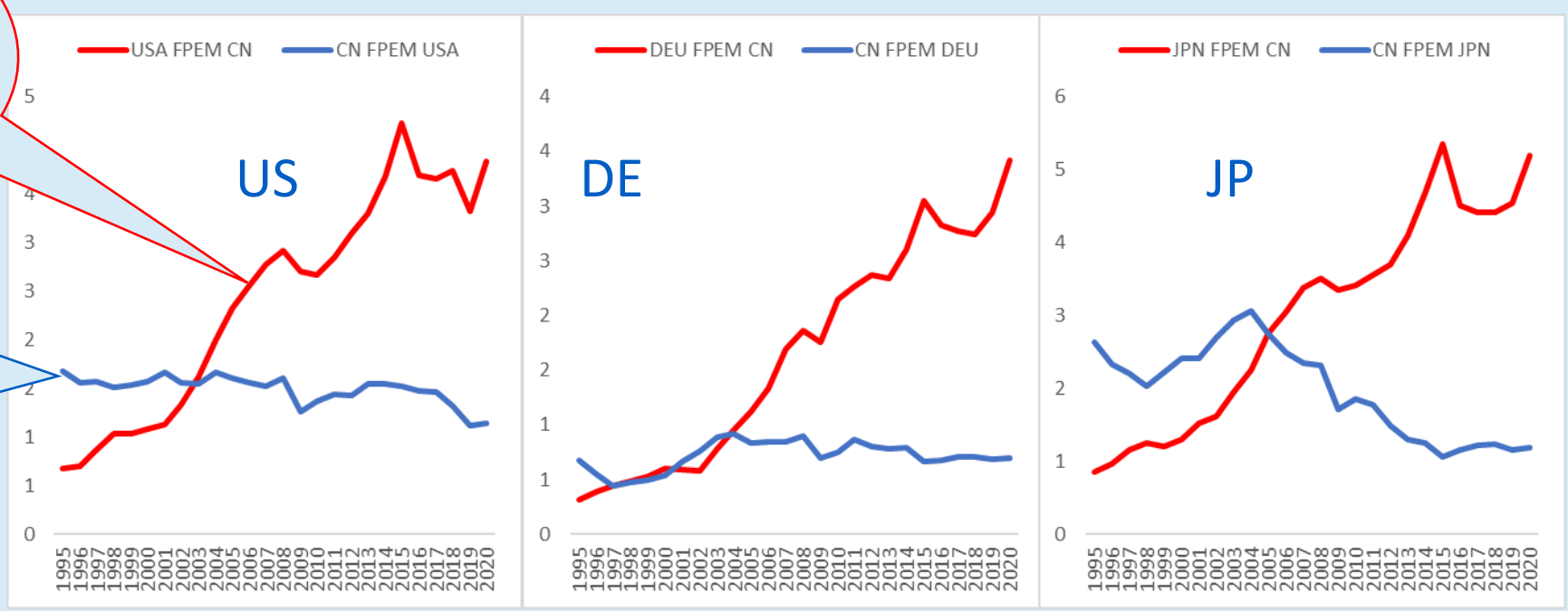

## CN vs G7.



# China dominates global supply chains: Intermediate vs final goods distinction.

Nation's reliance on China industrial inputs

China reliance on Nation's industrial inputs




For details see, Horses for Courses: Measuring Foreign Supply Chain Exposure, Richard Baldwin, Rebecca Freeman & Angelos Theodorakopoulos https://www.nber.org/papers/w30525

Source: Author's elaboration of OECD TiVA database 2023, left and right charts based on FPEM (total manufacturing)

FPEM is share of selling nation in buying nation's total purchases of industrial inputs from all sources.

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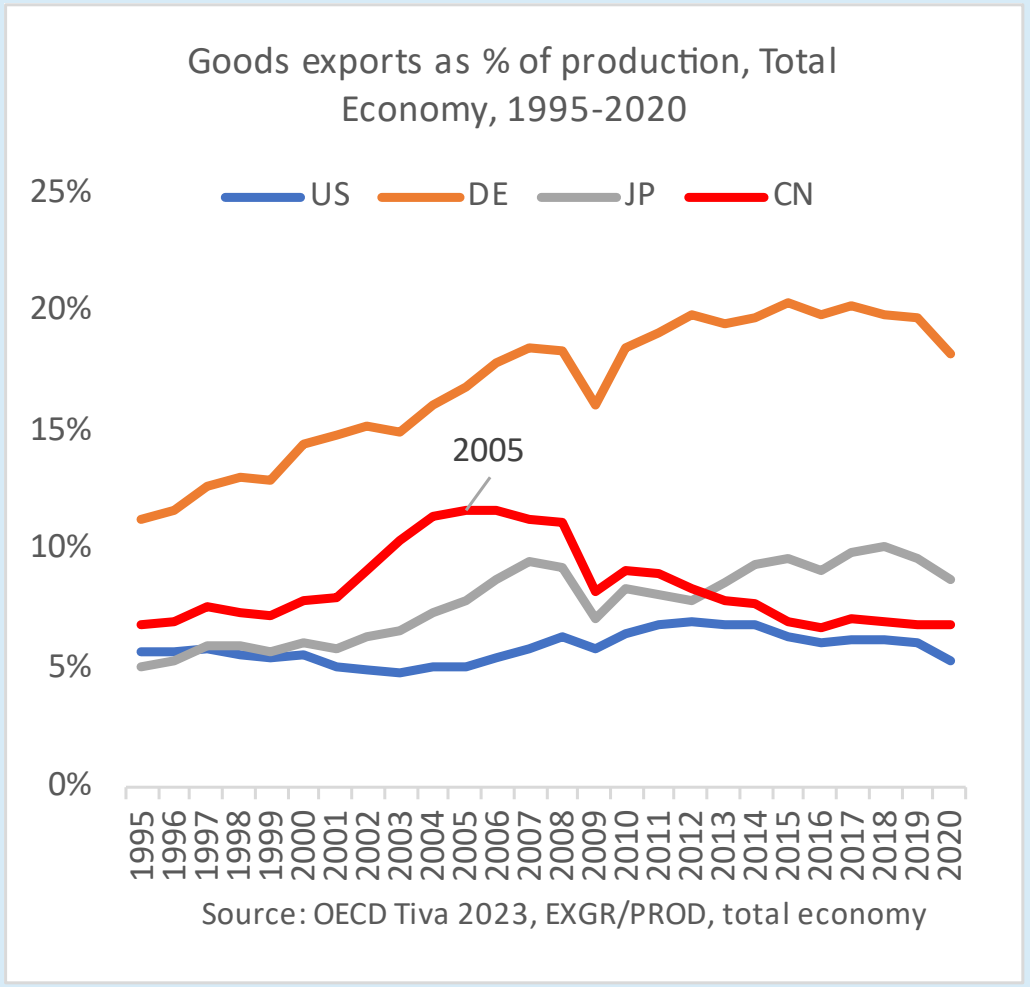
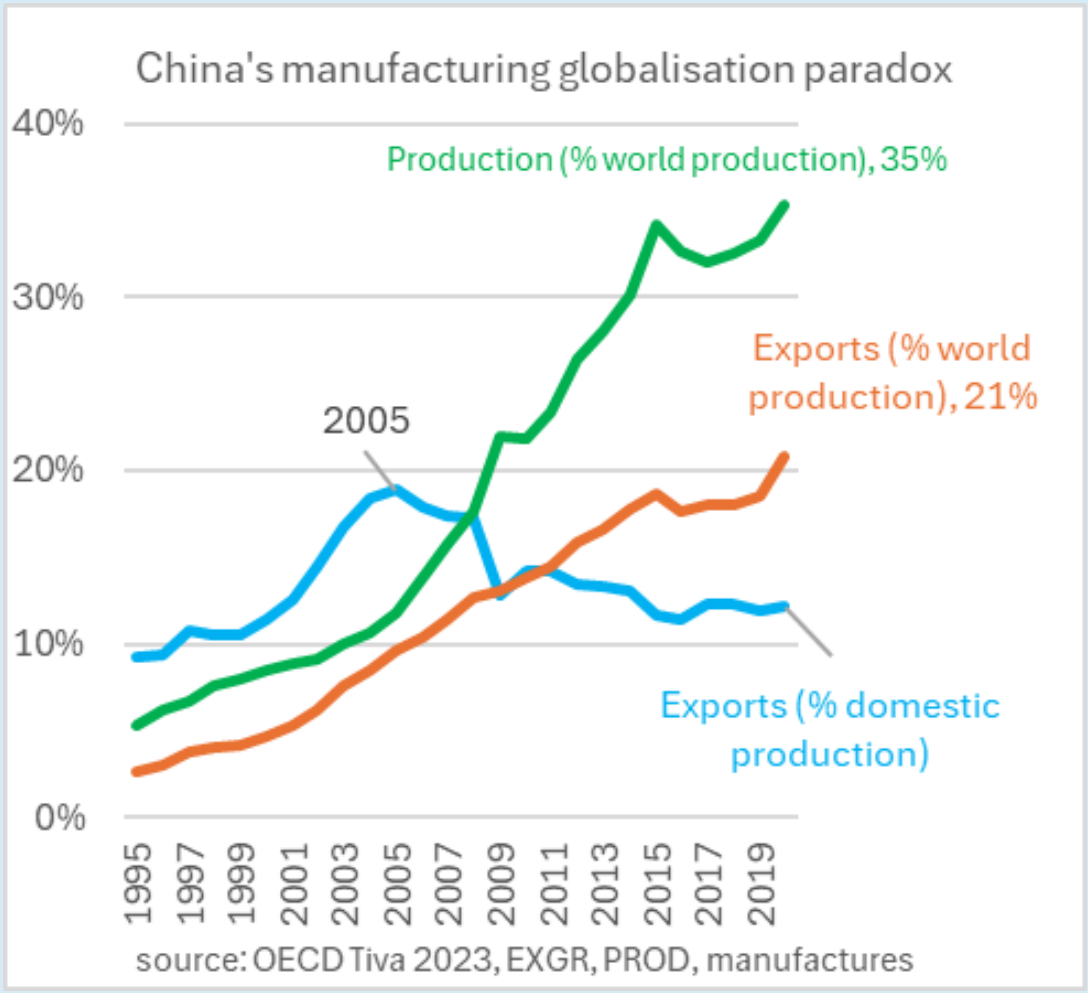
# China Paradox: Closing as it dominates.

## Total exports (% of domestic production).




## Resolution.

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How and why world manufacturing trade ratio peaked around 2008.

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# Why did manufacturing trade peak?

- Geopolitics?
- Global Value Chain revolution reverses?

My hypothesis:

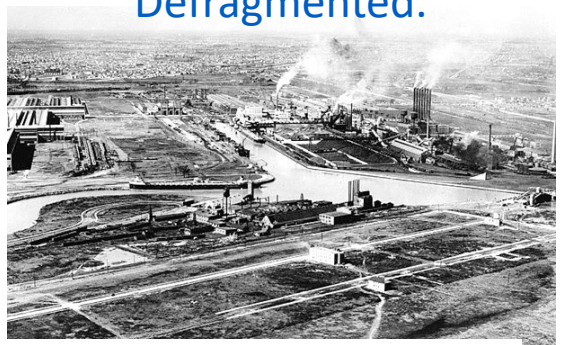
GVC Revolution in reverse.

1. Defragmentation.
2. Relocalisation.

Defragmentation of manufacturing processes due to IT.

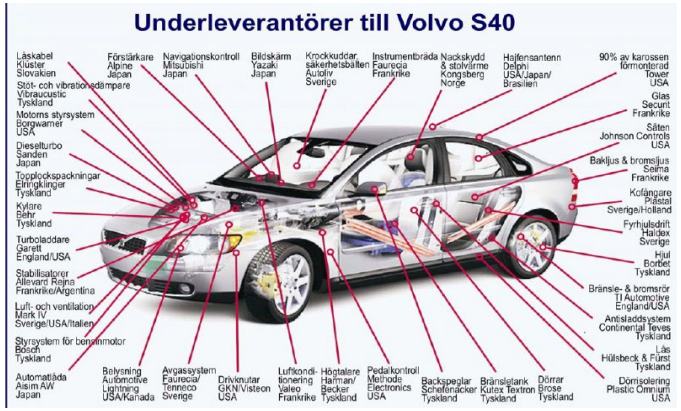
# How can we measure fragmentation?

## 19th century industry: Defragmented.

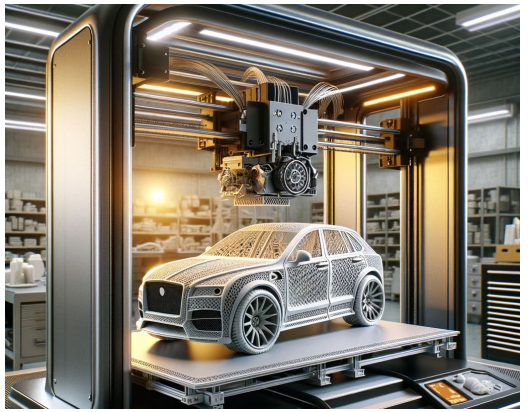


Source: River Rouge plant photo from Library of Congress.

## 20th century industry: Fragmented.




## Future industry: Defragmented.



## Global Fragmentation Ratio (GFR).

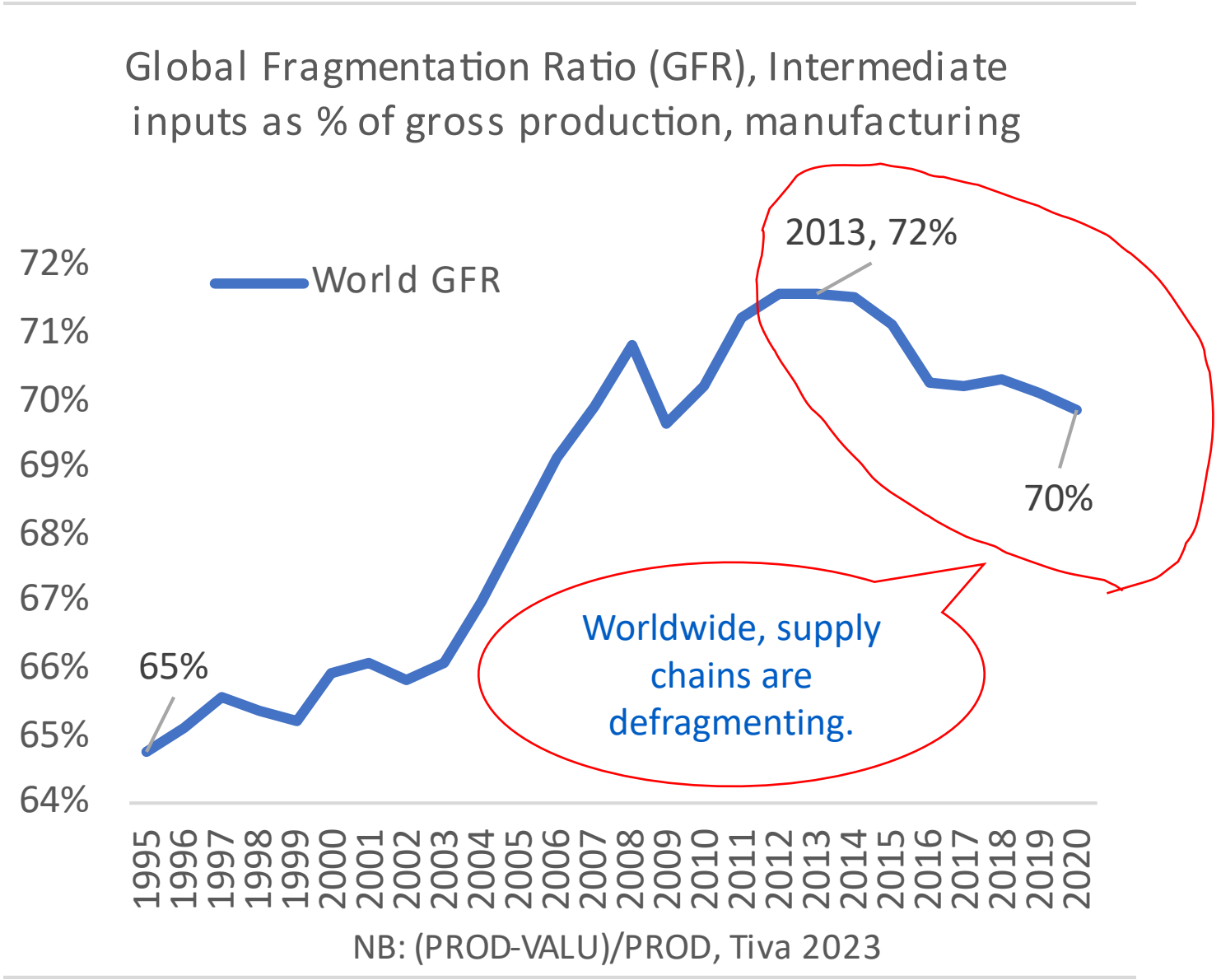
$$GFR = \frac{\text{Value of industrial intermediates}}{\text{Value of production}}$$

Measure of the production process, not internationalisation.

# Fragmentation Fact:

## 1995-2013: Fragmented.

## 2013-2020; Defragmented *(Way before Brexit or Trump).*

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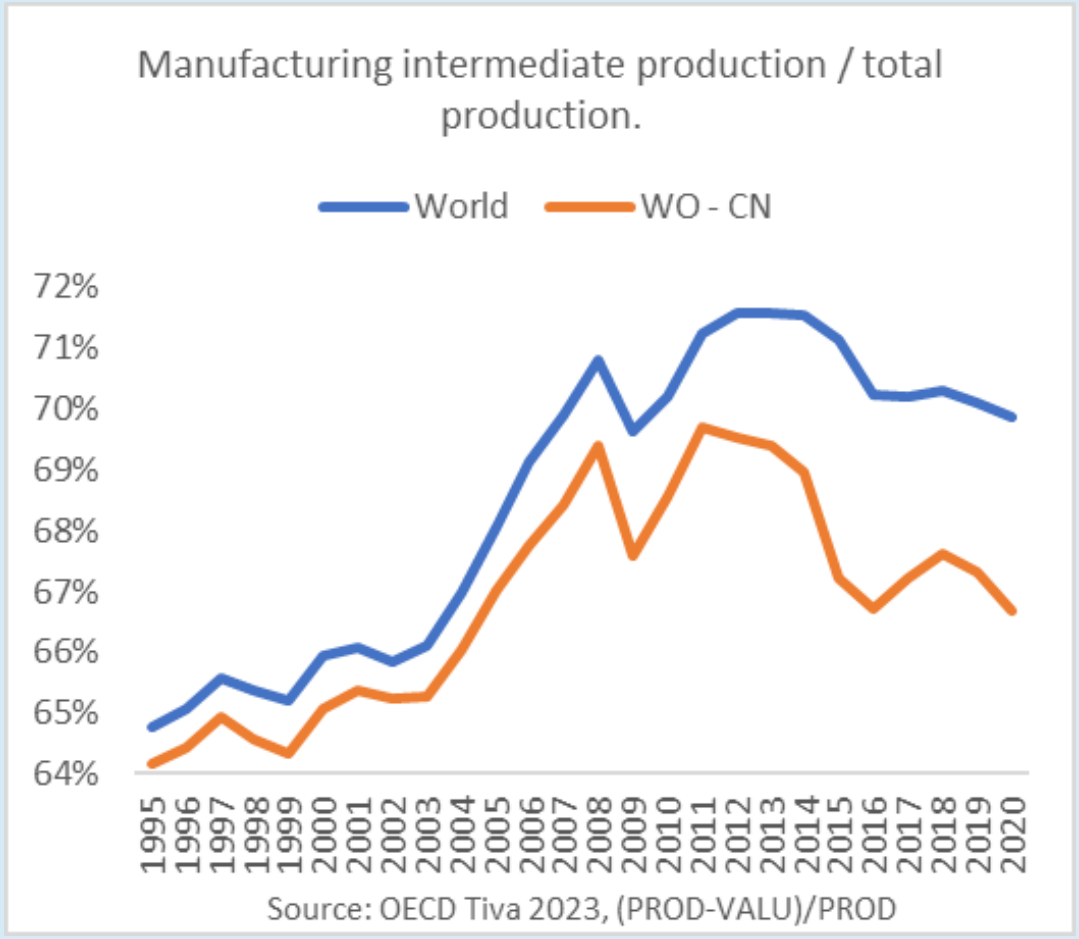
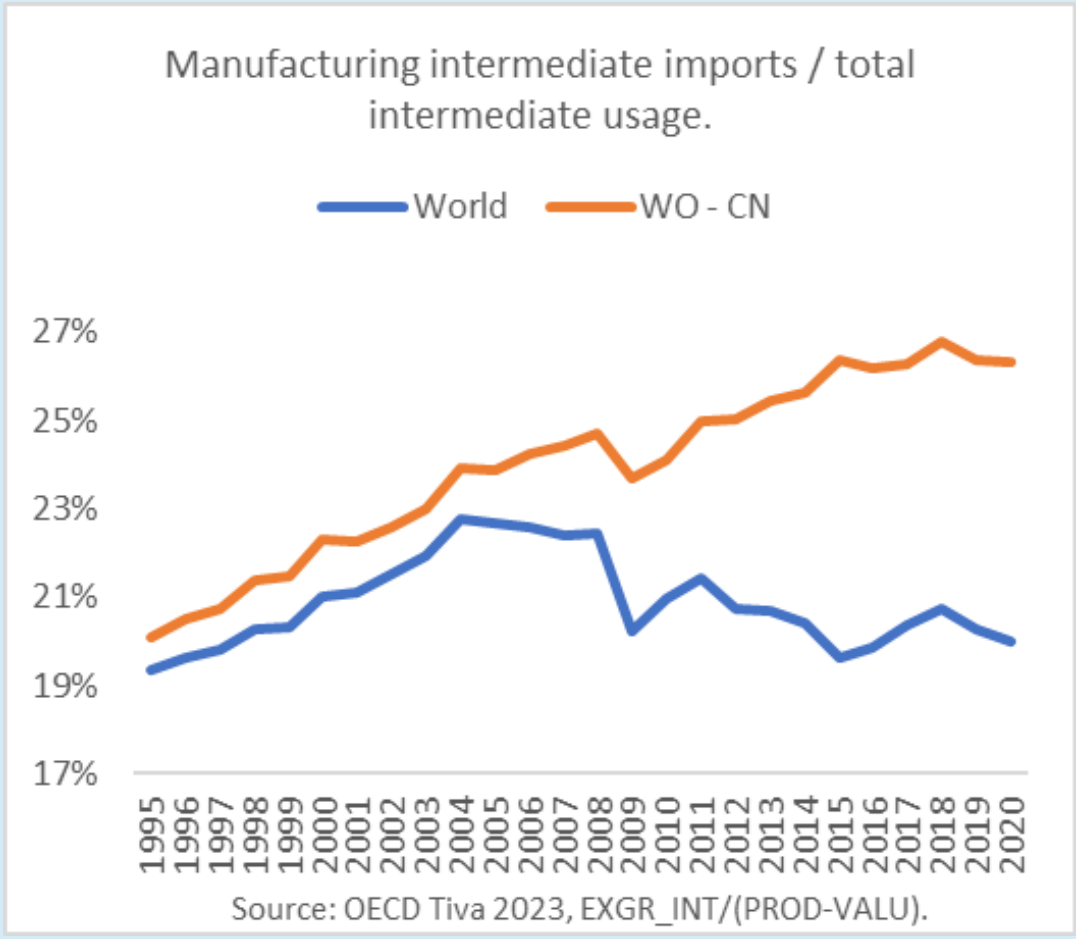
# China is very different since 2000s.

Supply chain fragmentation with & without CN.




- Supply chains localization with & without CN.




China is not defragmenting much (c.a. in them), but other major manufactures are since 2008 (US, JP, DE).

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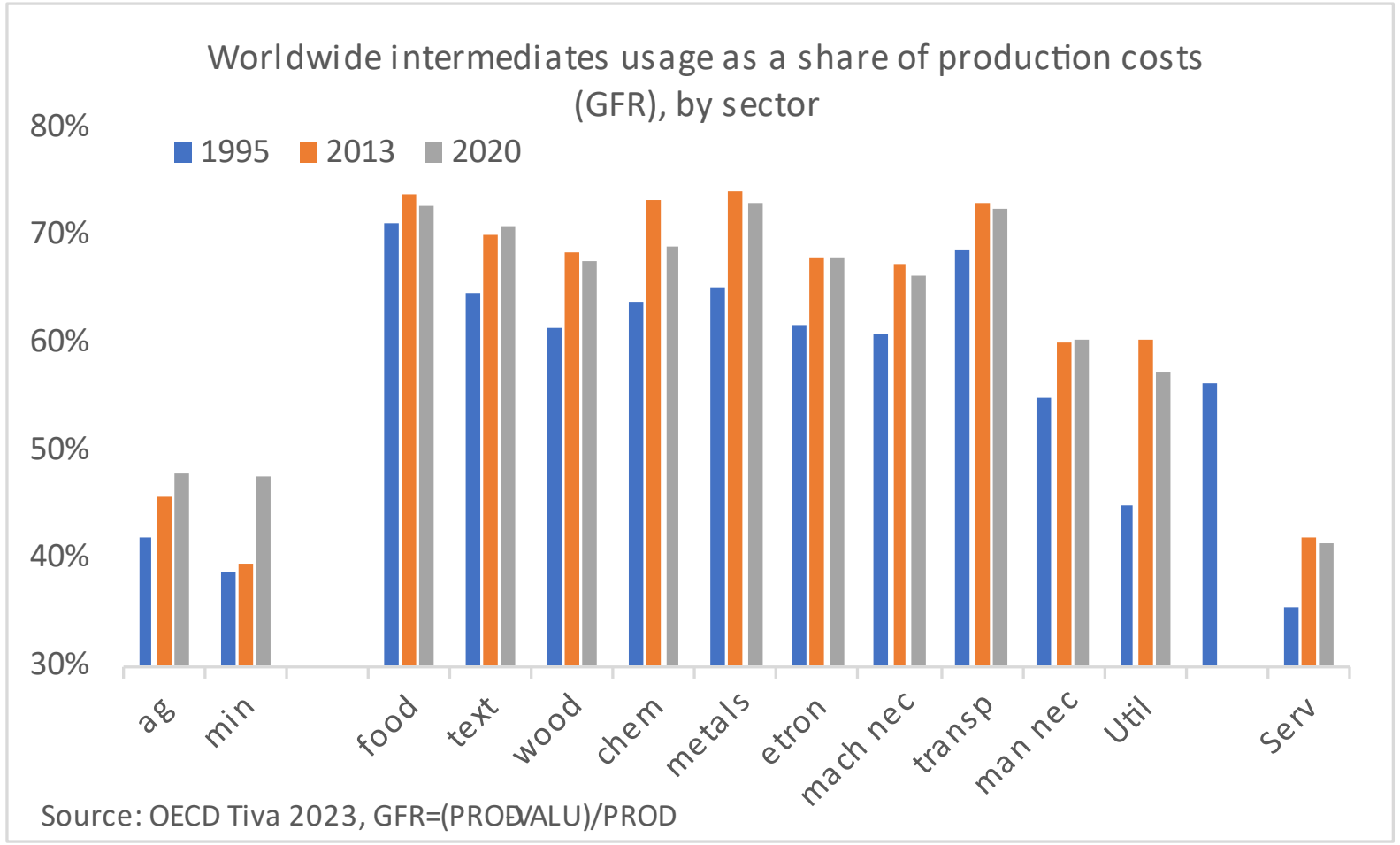
# Fragmentation by sector, 1995, 2013 & 2020

## World production

## GFR = intermediate inputs as % of production costs




GFR=Intermediates/gross output

Q: Why fragment & then defragment?

A: ITC revolution.

# ICT is a double edge sword: CT vs IT.

My hypothesis:

- Communication/coordination Tech (CT) lowers the marginal cost of coordinating more stages of production.
- Information Technology lowers the marginal benefit of having more (and more specialised) stages of production.
- CT fragments; IT defragments.
- CT came down faster at first (internet, broadband, email, cell phones, etc).
- Then IT came down faster (industrial automation).

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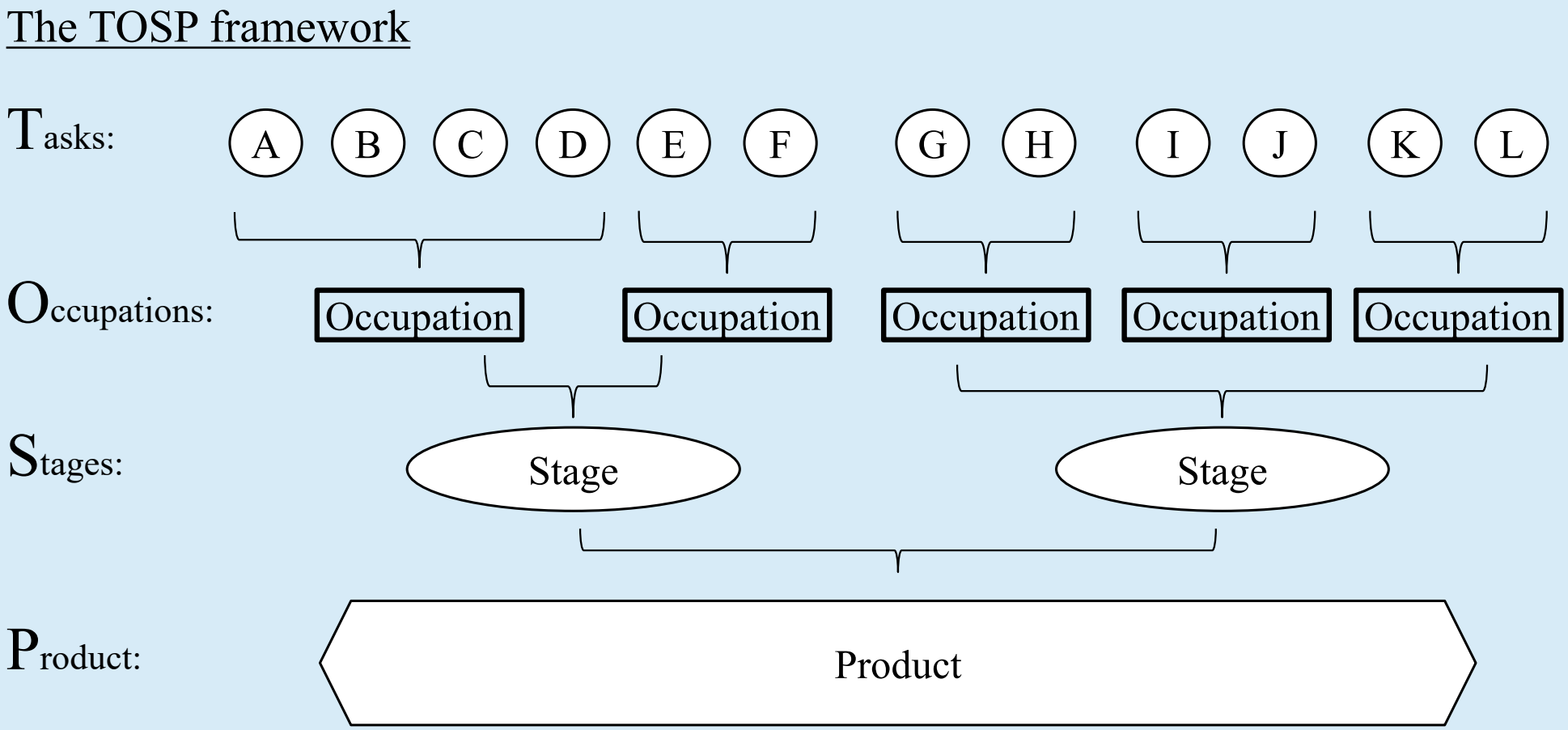
# How did CT fragment factories?

## Tasks, Occupations, Stages and Product (TOSP) framework.




Source: Baldwin (2012). Global Supply Chains: Why They Emerged, Why They Matter, and Where They Are Going, July https://www.asiaglobalinstitute.hku.hk/storage/app/media/pdf/richard-baldwin.pdf, also Figure 53 in Baldwin (2016).

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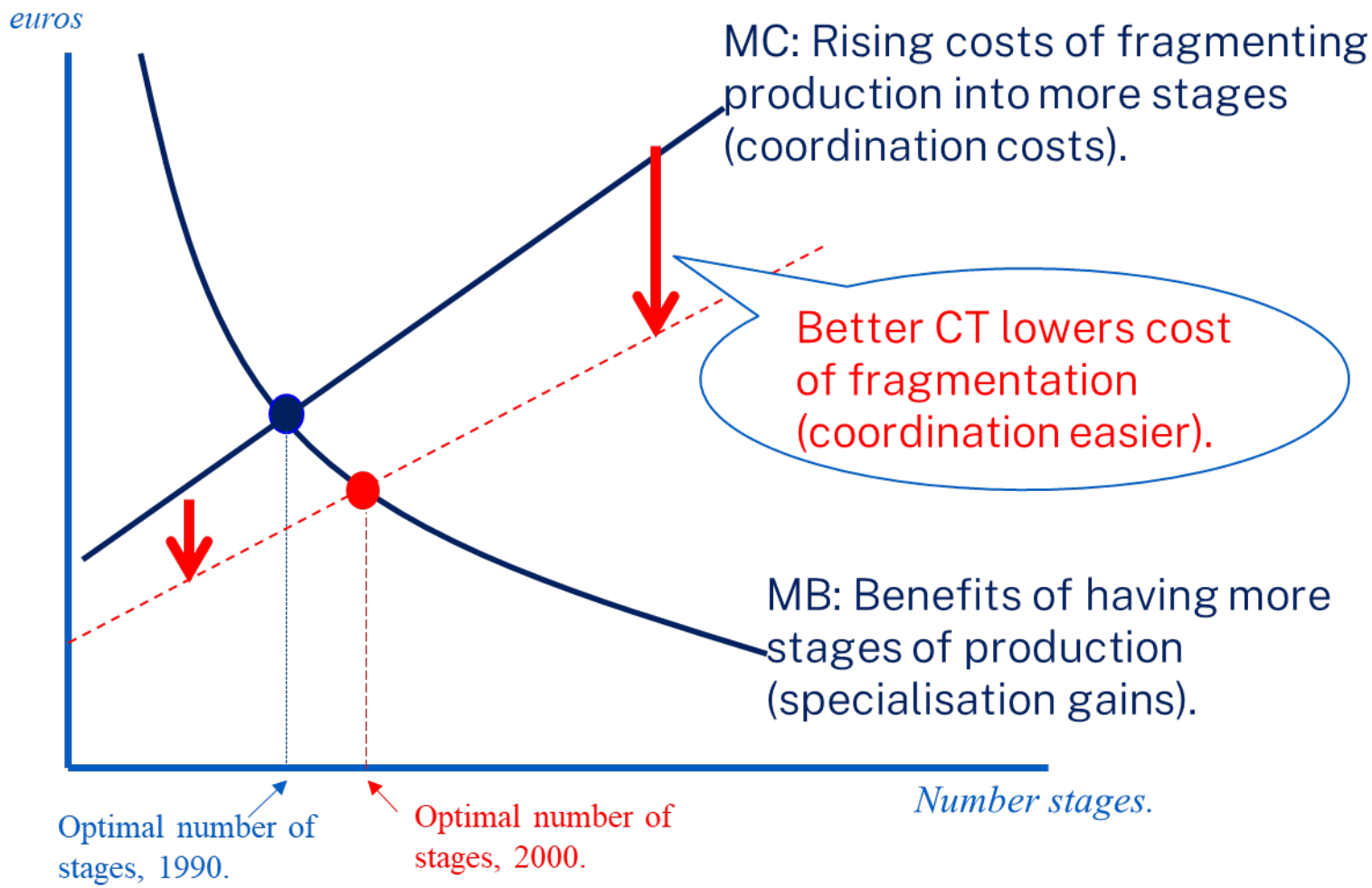
# How did CT fragment factories?

This is about production, not trade.

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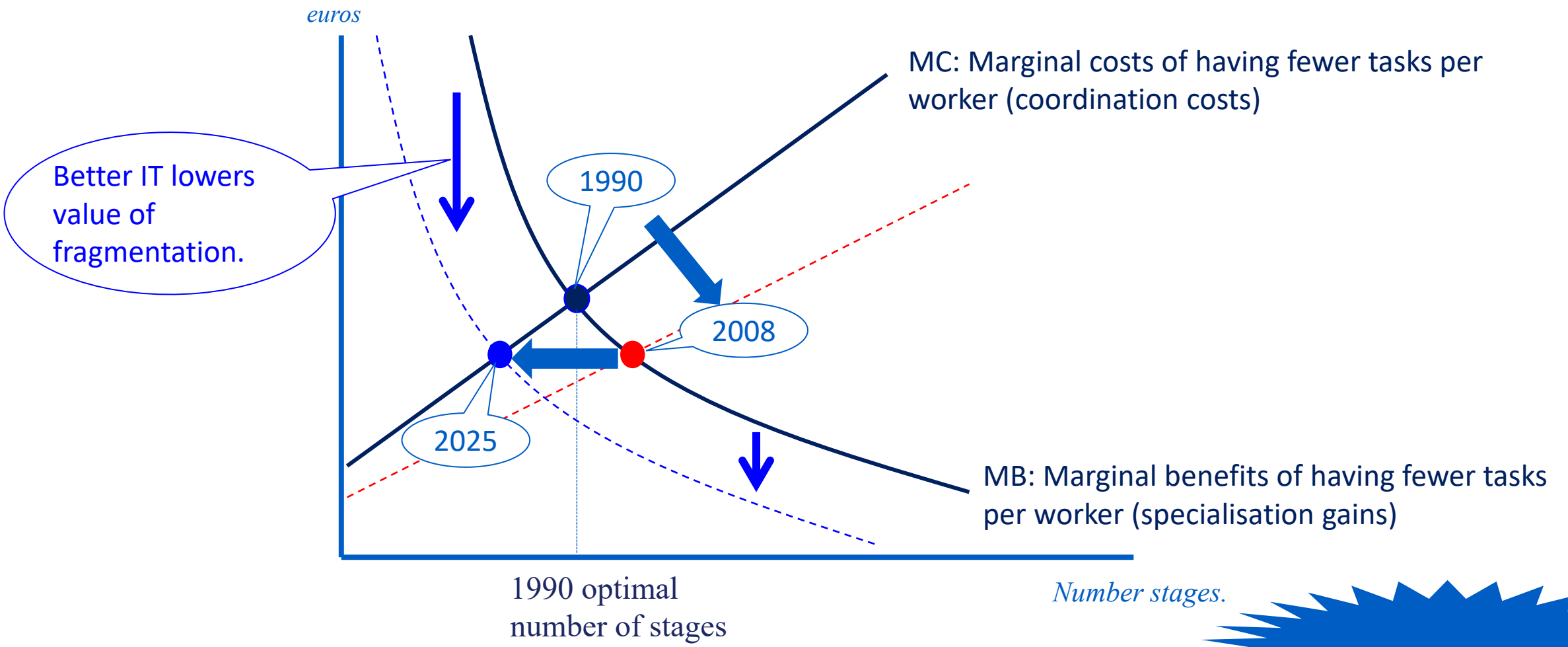
# How did IT defragment factories?




Source: Baldwin (2012). Global Supply Chains: Why They Emerged, Why They Matter, and Where They Are Going, July https://www.asiaglobalinstitute.hku.hk/storage/app/... baldwin.pdf, also Figure 53 in Baldwin (2016).

Relocalisation of industrial intermediate trade due to IT.

# How can we measure delocalisation & relocalisation?

$$\text{Delocalisation ratio} = \frac{\text{Value of imported intermediates}}{\text{Value of total intermediate usage in production}}$$

Measure of internationalisation, not the manufacturing process.

$$\text{GFR} = \frac{\text{Value of imported industrial intermediates}}{\text{Value of production}}$$

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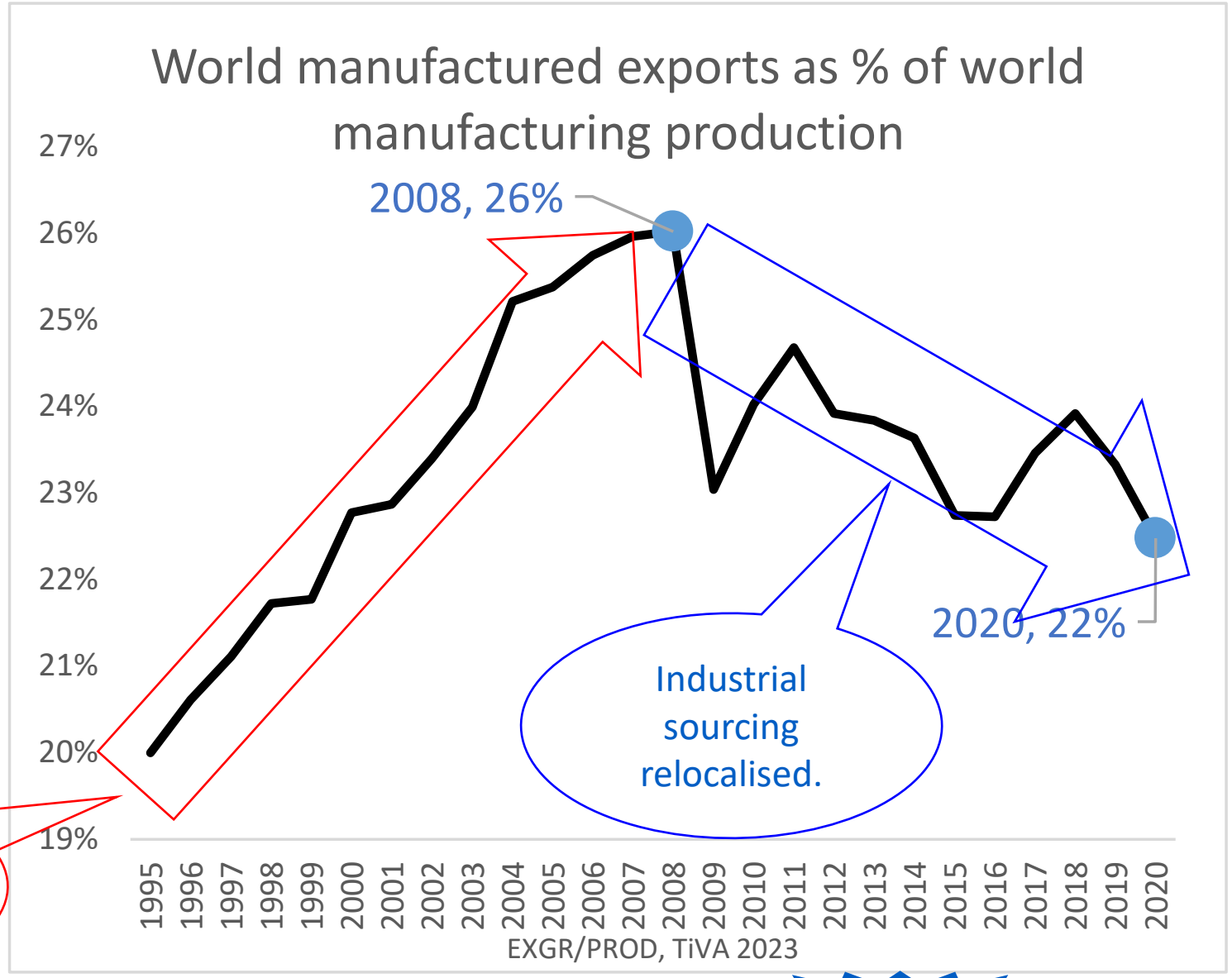
# Localisation Fact:

## Manufacturing supply chains delocalised but now are relocalising.

*(Way before Brexit or Trump).*




China matters big time.

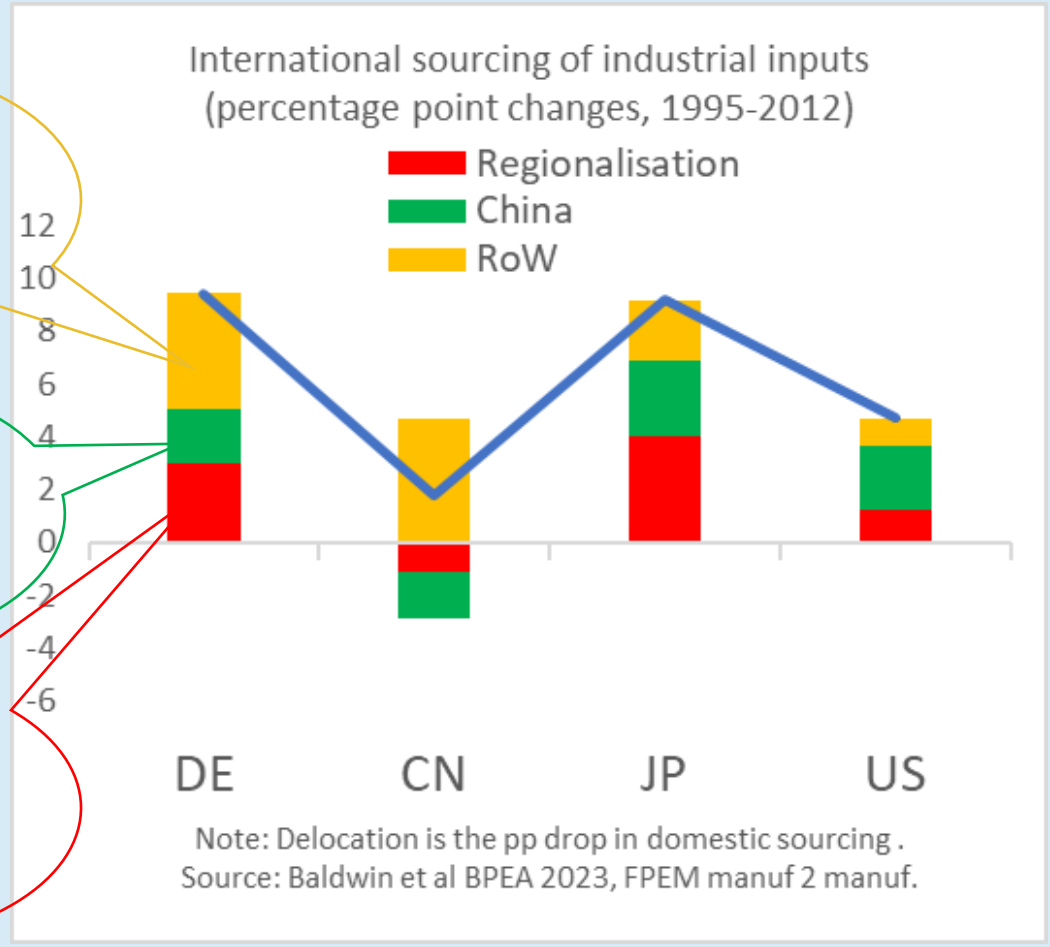
# Changes in Big4 International sourcing.
# De- & Re-localisation of supply chains:

## Delocalisation: 1995 to 2012. (pp)

More sourcing from RoW.

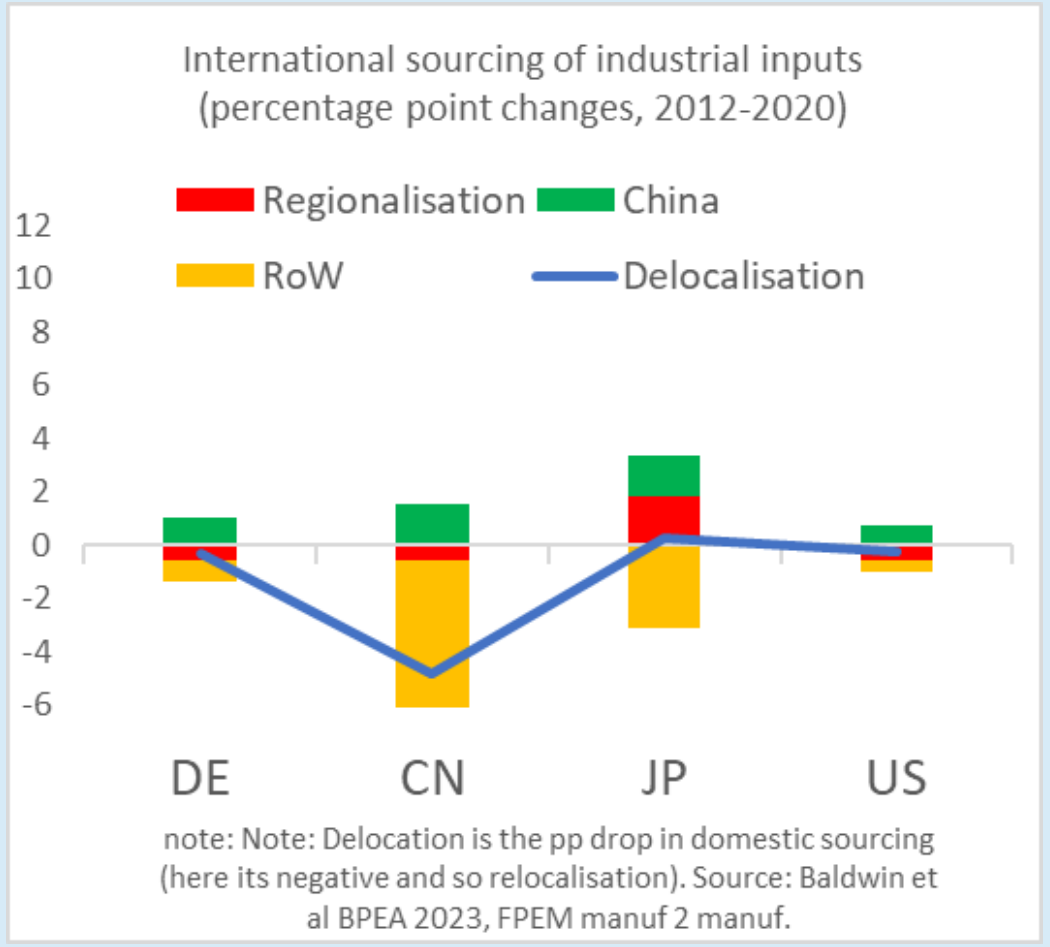
More sourcing from China.

More sourcing regionally (not home).




Note: Delocation is the pp drop in domestic sourcing .
Source: Baldwin et al BPEA 2023, FPEM manuf 2 manuf.

## Relocalisation: 2012 to 2020. (pp)



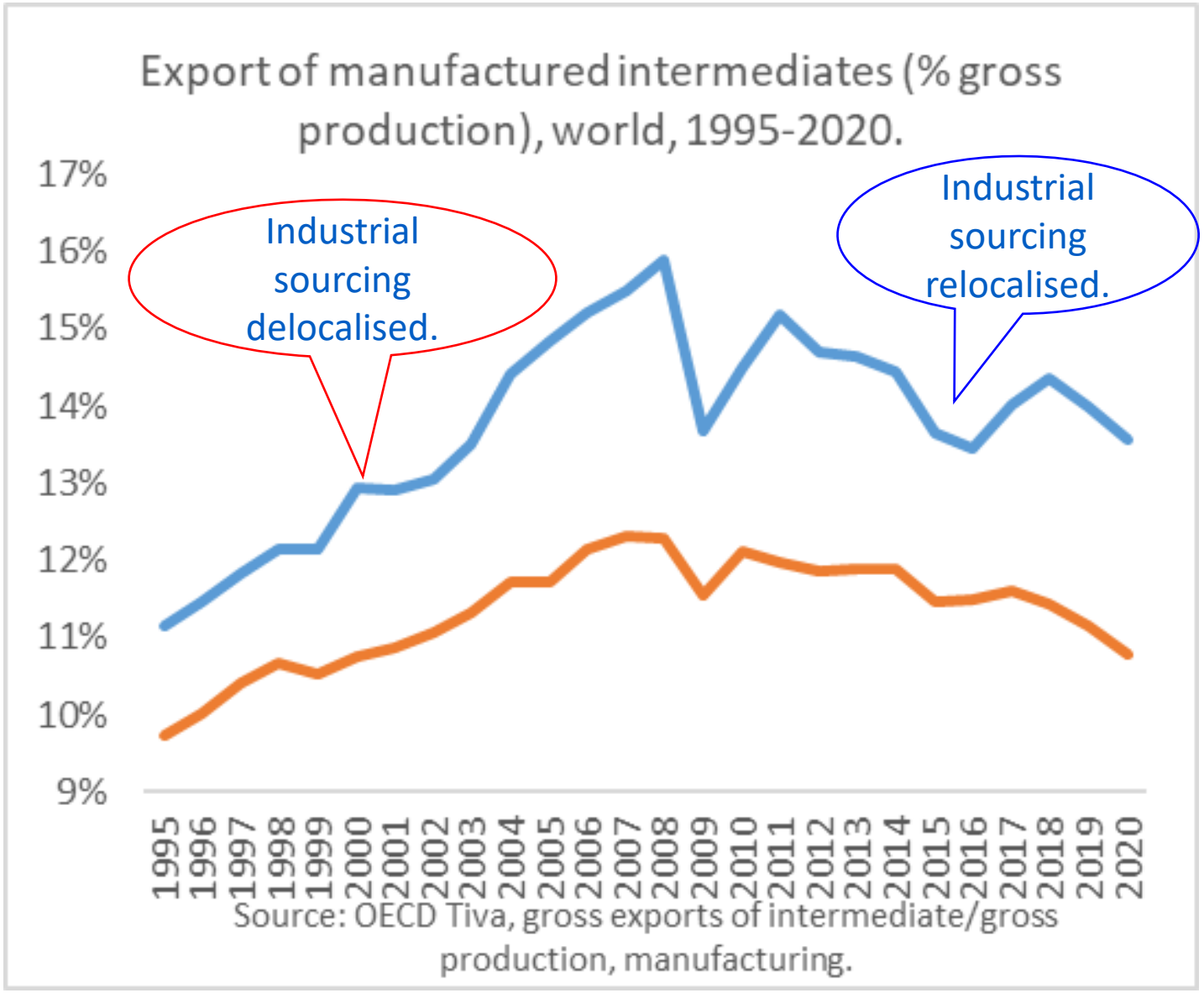

note: Note: Delocation is the pp drop in domestic sourcing (here its negative and so relocalisation). Source: Baldwin et al BPEA 2023, FPEM manuf 2 manuf.


Note: The indicator is FPEM (source's share of total usage of industrial inputs (0-100); see Baldwin, Freeman & Theodorakopoulos 2022 for details.
All data are for manufacturing usage of manufactured intermediates. The internet suffixes are used to abbreviate countries.

# Localisation Fact:

## Both final & intermediate manufactured goods.

*(Way before Brexit or Trump).*

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Q: Why delocalise & then relocalise?

A: ITC revolution.

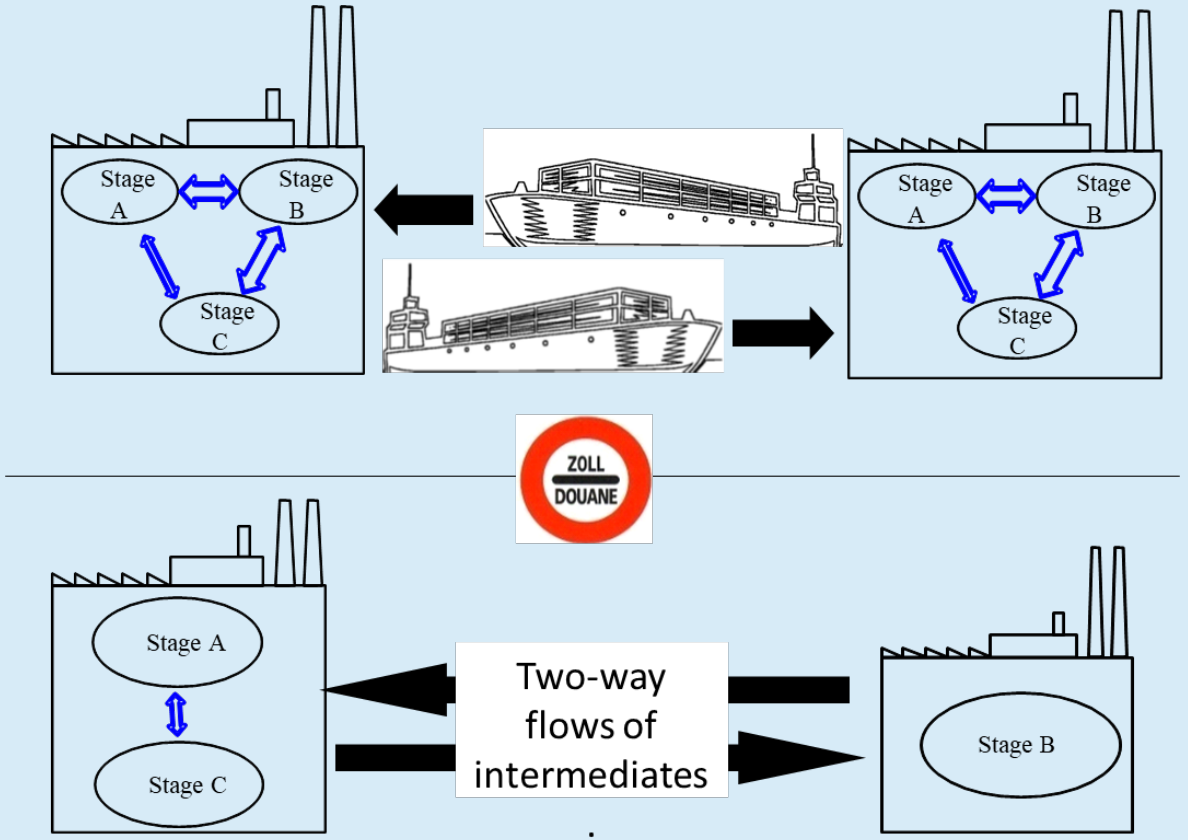
Q: Why relocalise intermediate goods?

A: Better IT.

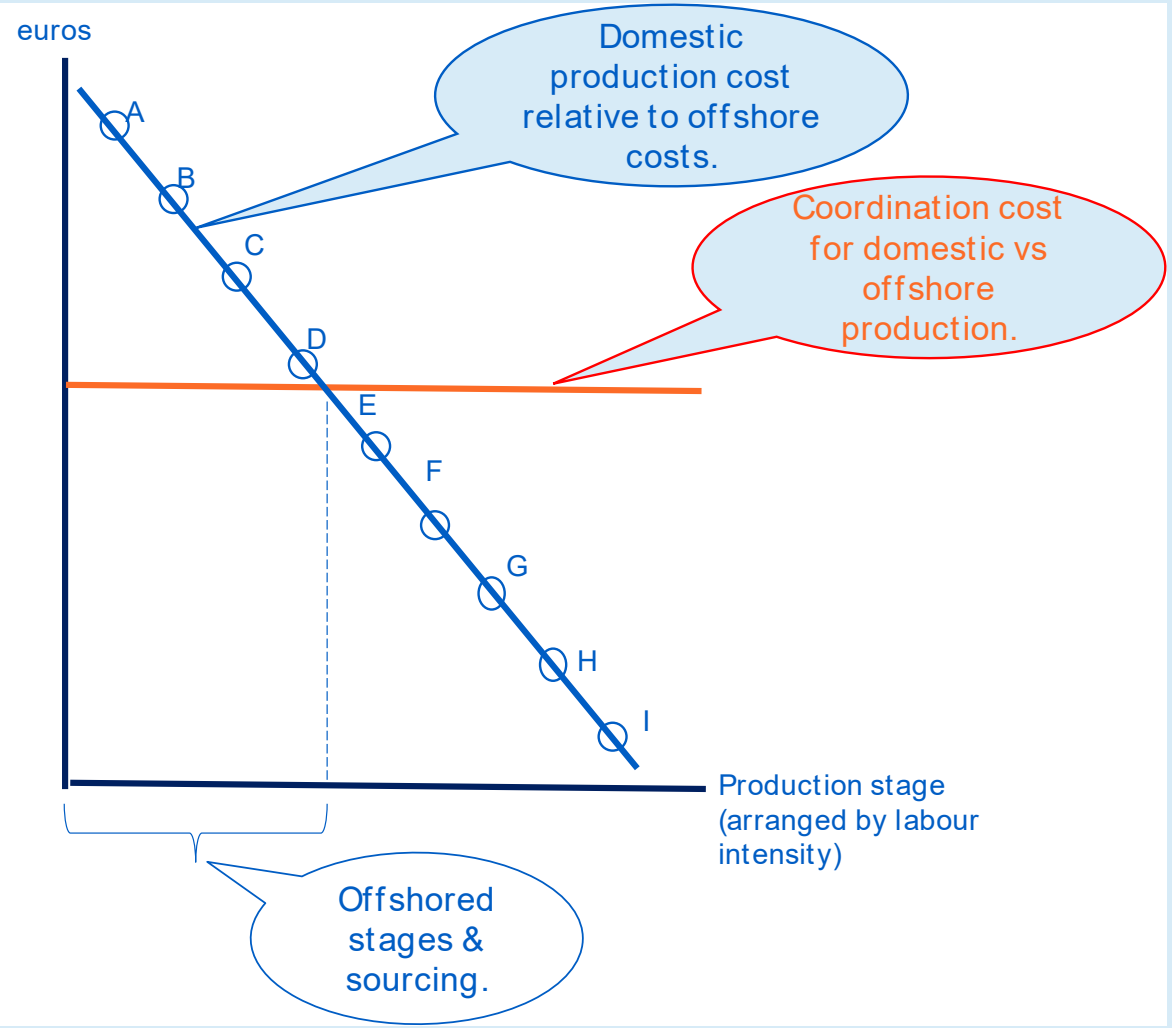
# Offshoring internationalises supply chains.

Economic logic flow:

- ITC made industrial offshoring feasible; vast wages differences made it profitable.
- Labour-intense stages were offshored to Emerging Economies.
- Trade happens when production & consumption are separated, so offshoring internationalised supply chains.



# Which stages are offshored?




- Trade-off:
- Relative cost of production at home vs offshore is compared to coordination cost of production at home vs offshore.
- Stages A-D are cheaper to source from offshore.

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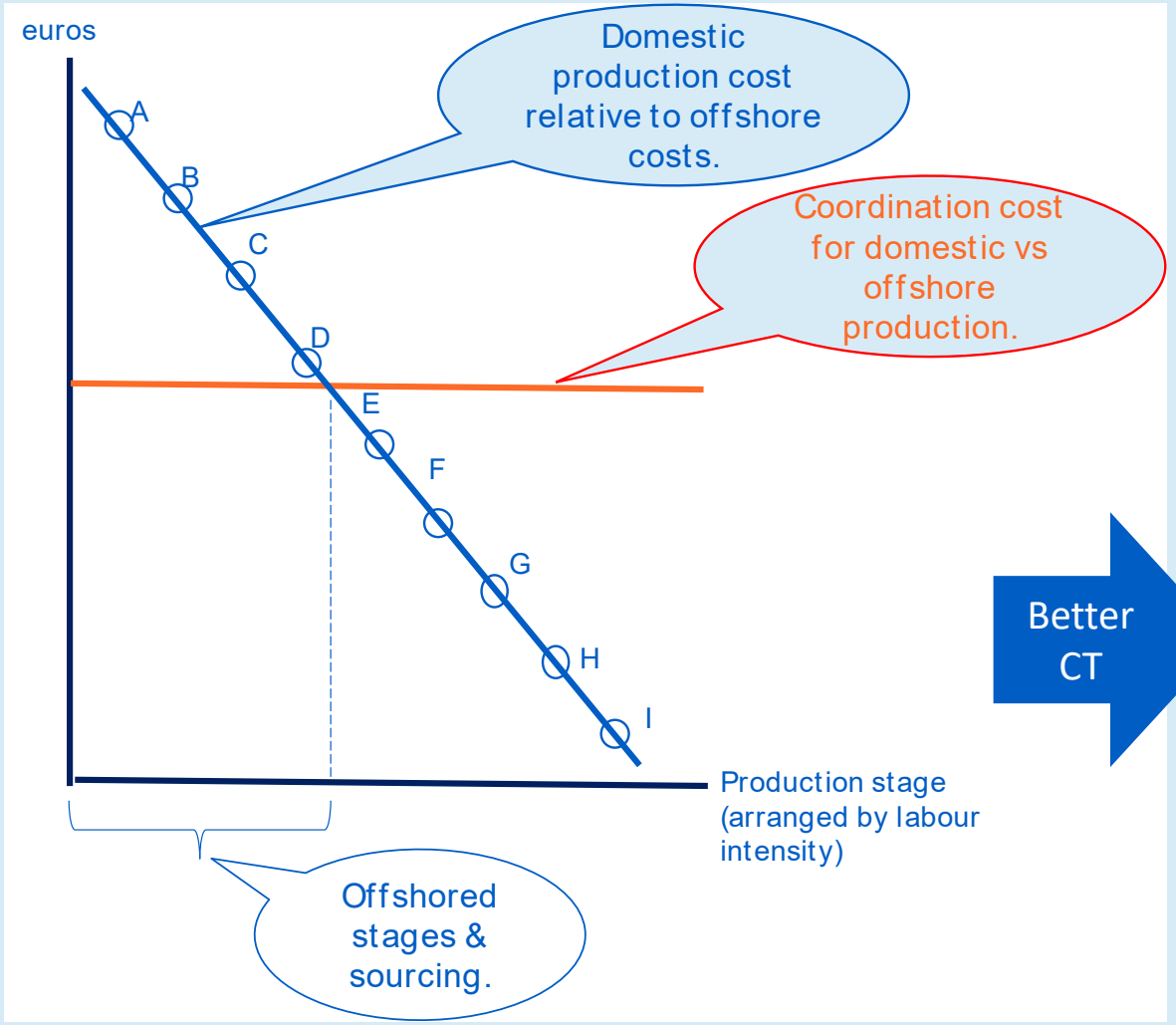
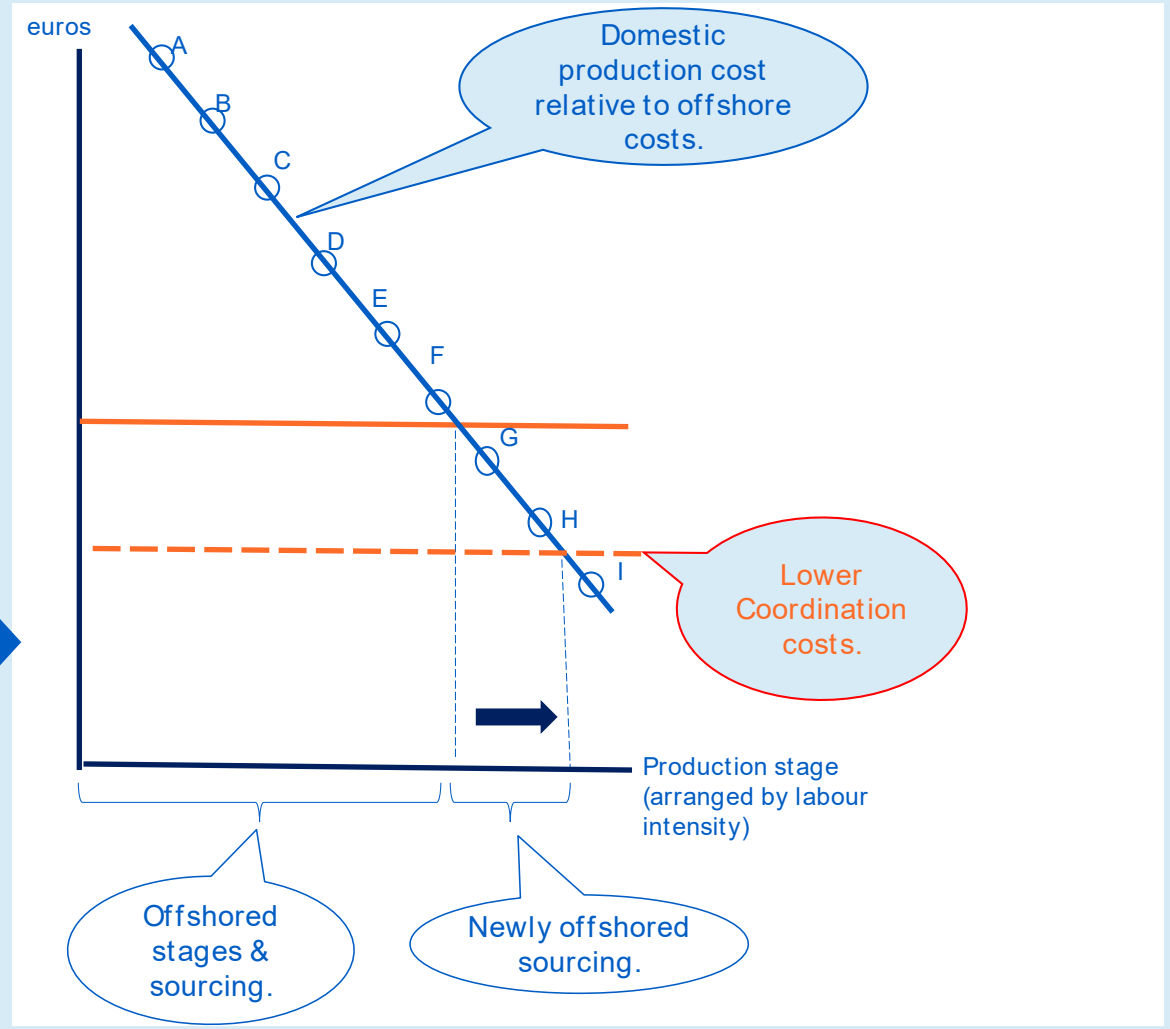
# Lower coordination costs (ICT) increases delocation of source & production.




Better CT

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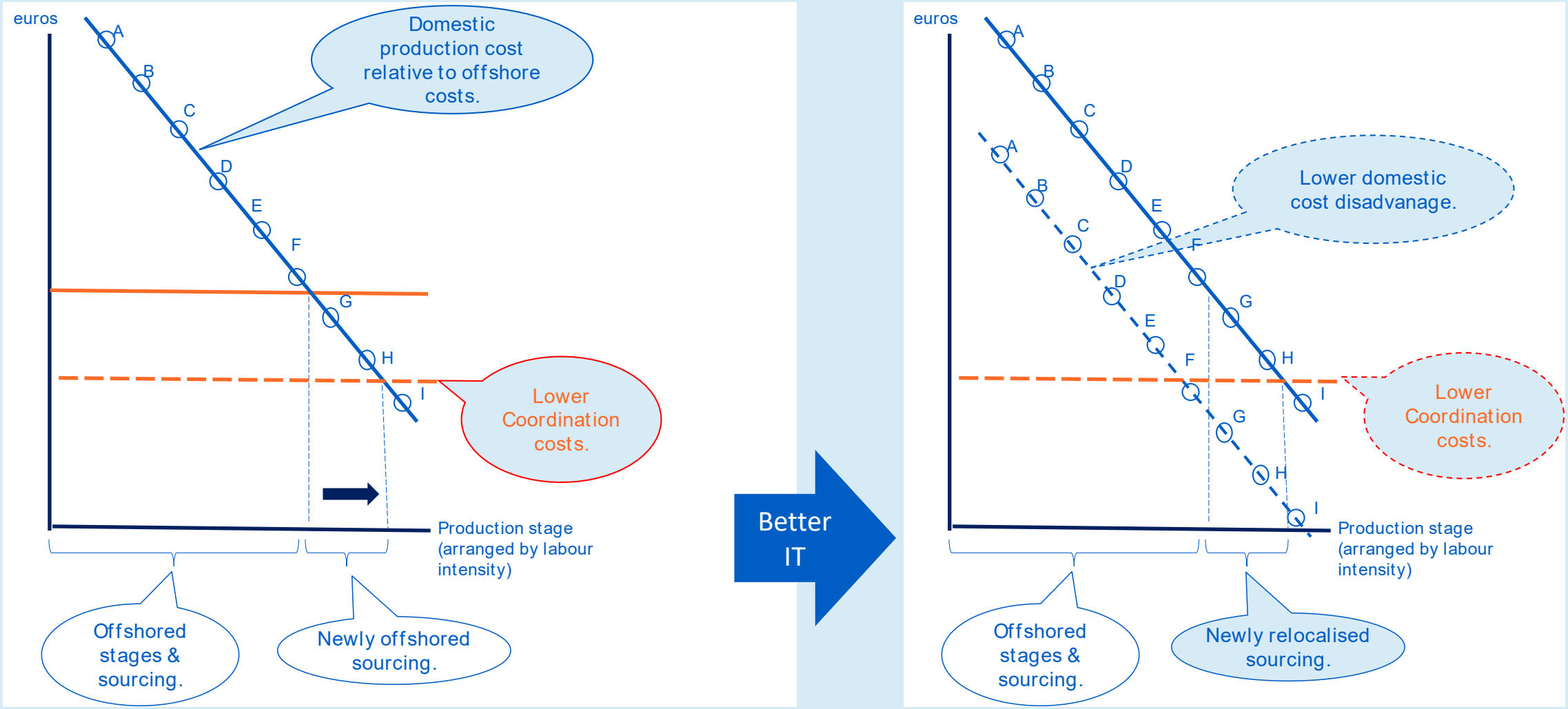
# Better IT automates labour out of manufacture & lowers benefit of offshoring leading to relocalisation.

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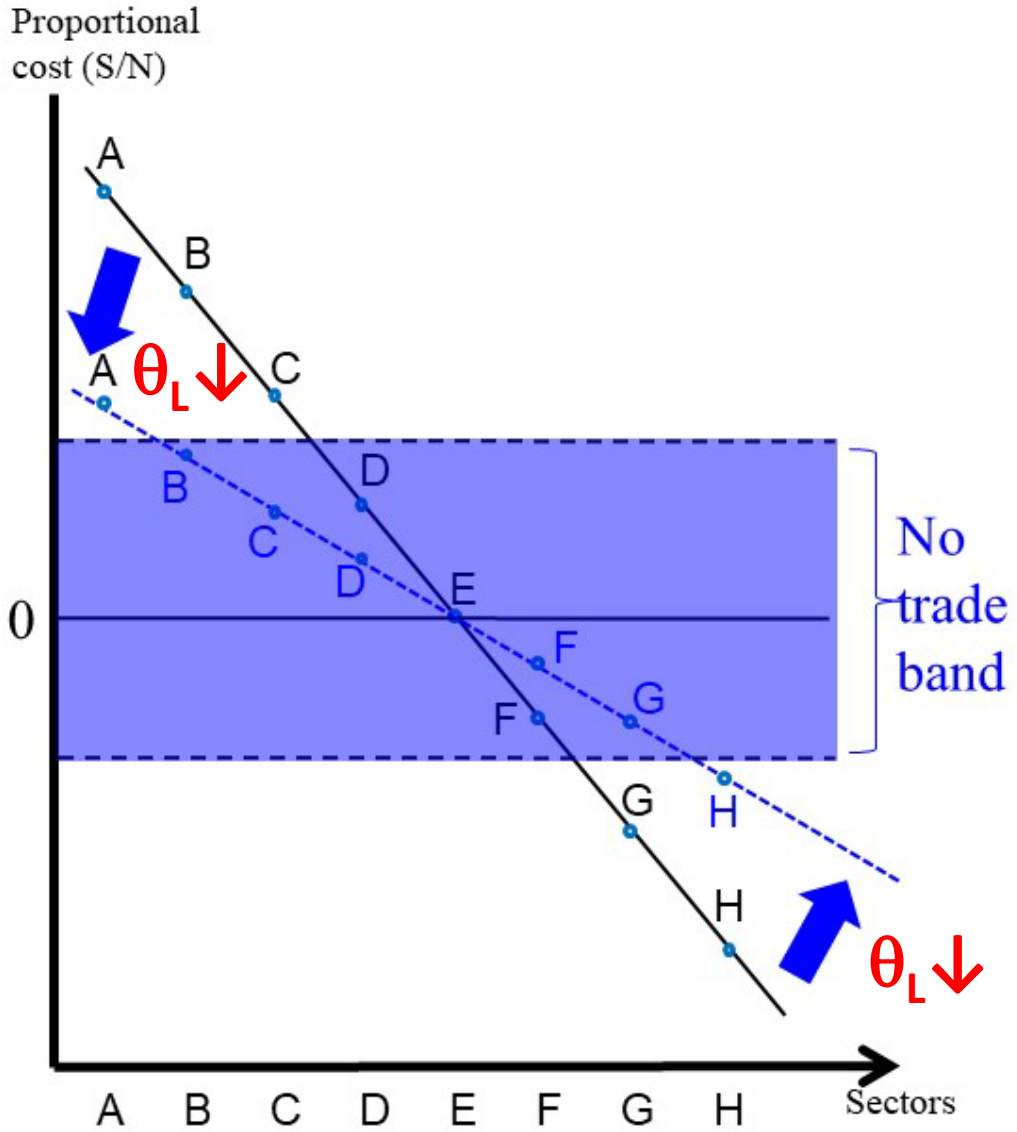
Q: Why relocalise final goods?

A: Better IT.

# Automation lowers labour cost share.

=> More final goods nontraded.

$$\frac{c_i^n - c_i^s}{c_i^n} = \theta_L \left(1 - \frac{w^s a_i^s}{w^n a_i^n}\right)$$



How and why world services trade ratio did not peak.

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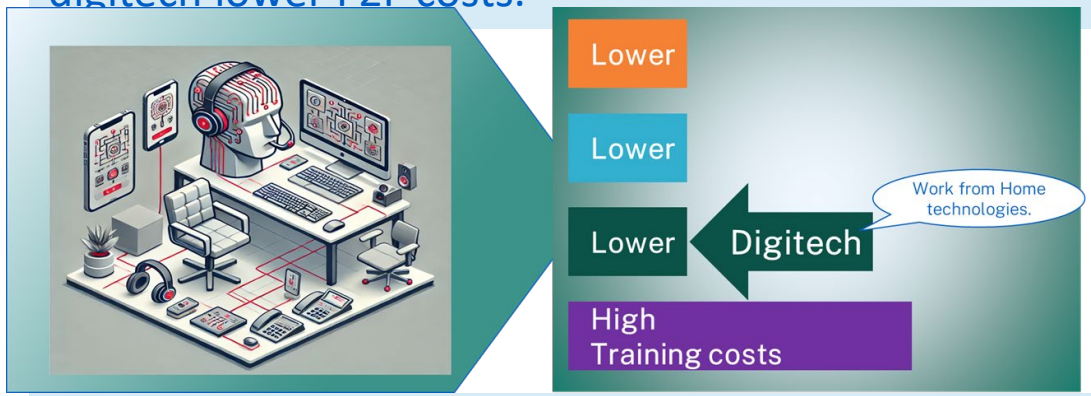
# Teleworking costs fall; Offices unbundle.

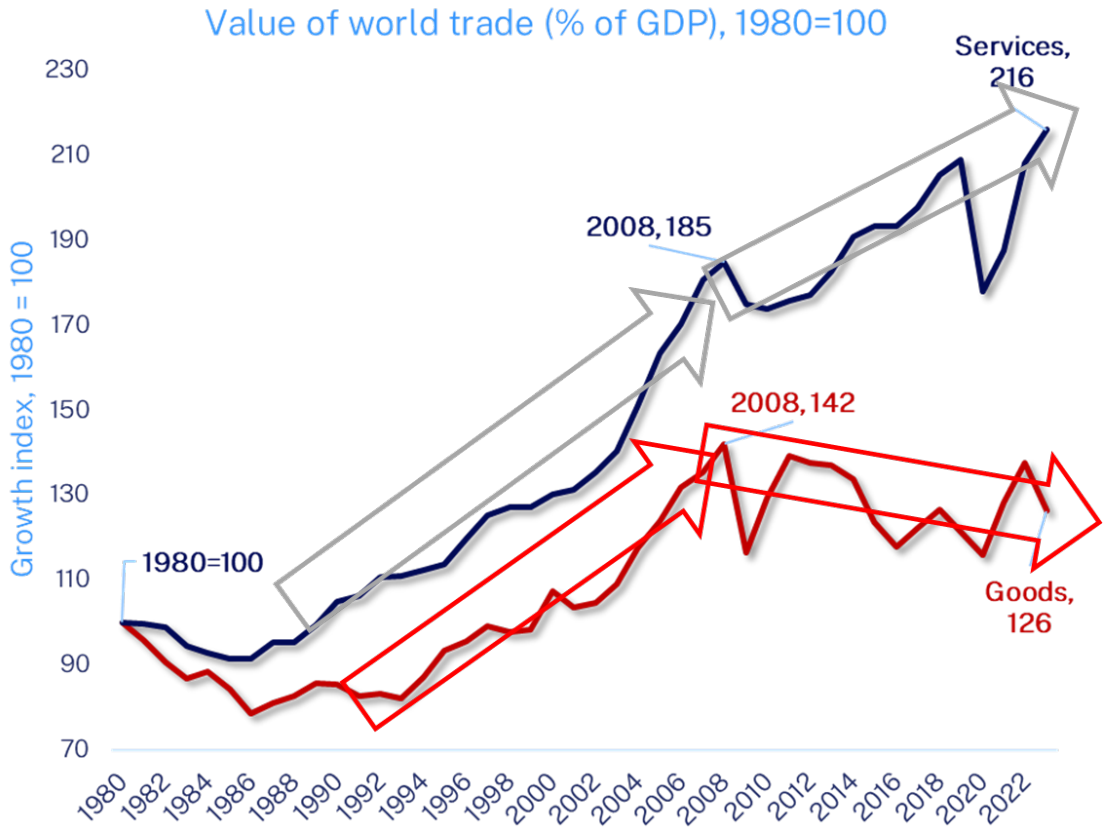
## Telework costs down > 3UB

digitech lower F2F costs.




Digitech made it feasible. Vast wage differences made it profitable.


## Resulting evolution of globalization.




*sources: WTO database (https://stats.wto.org/), World Bank (https://databank.worldbank.org/source/world-development-indicators#)*

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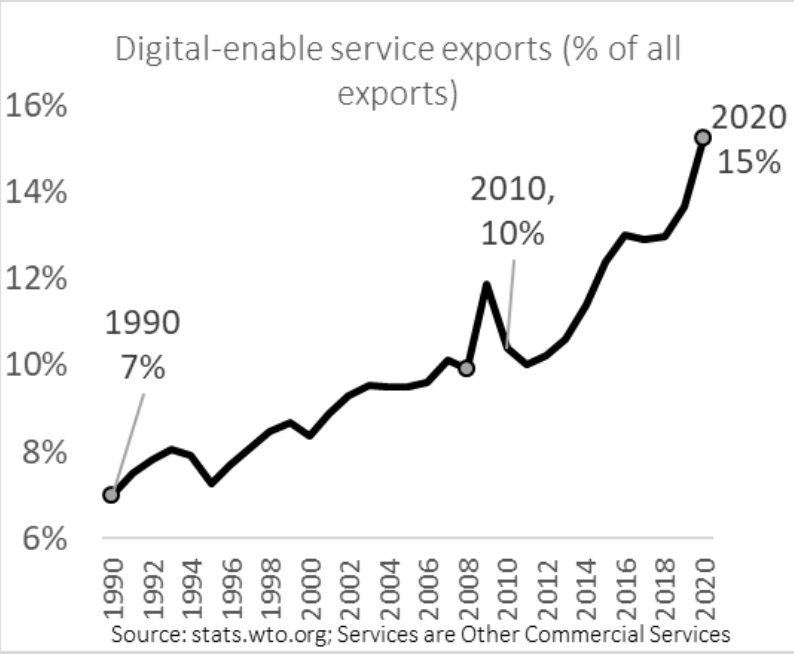
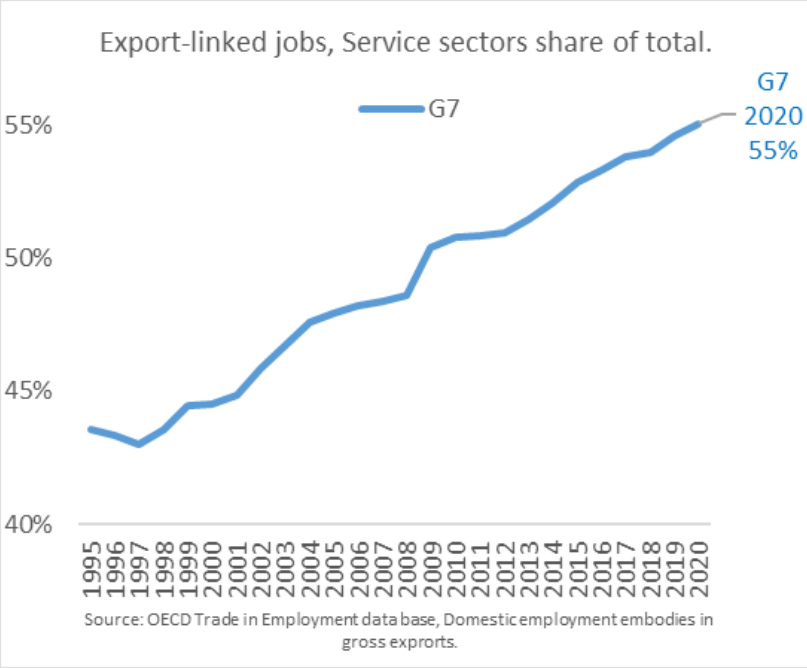
# Why service trade is more important than you think.

## X_ser/X (wo, gross).




## X_ser/X (wo, VA).


## X-linked jobs (ser/tot), wo.

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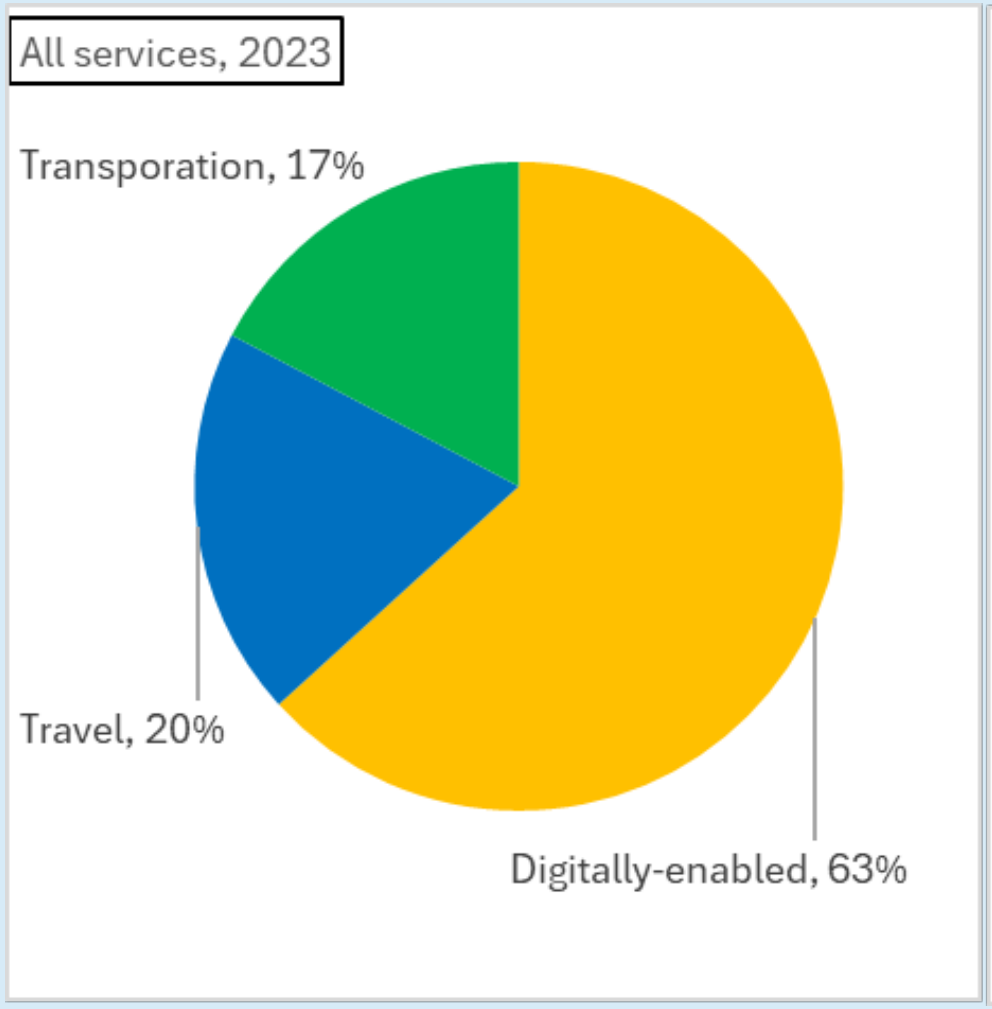
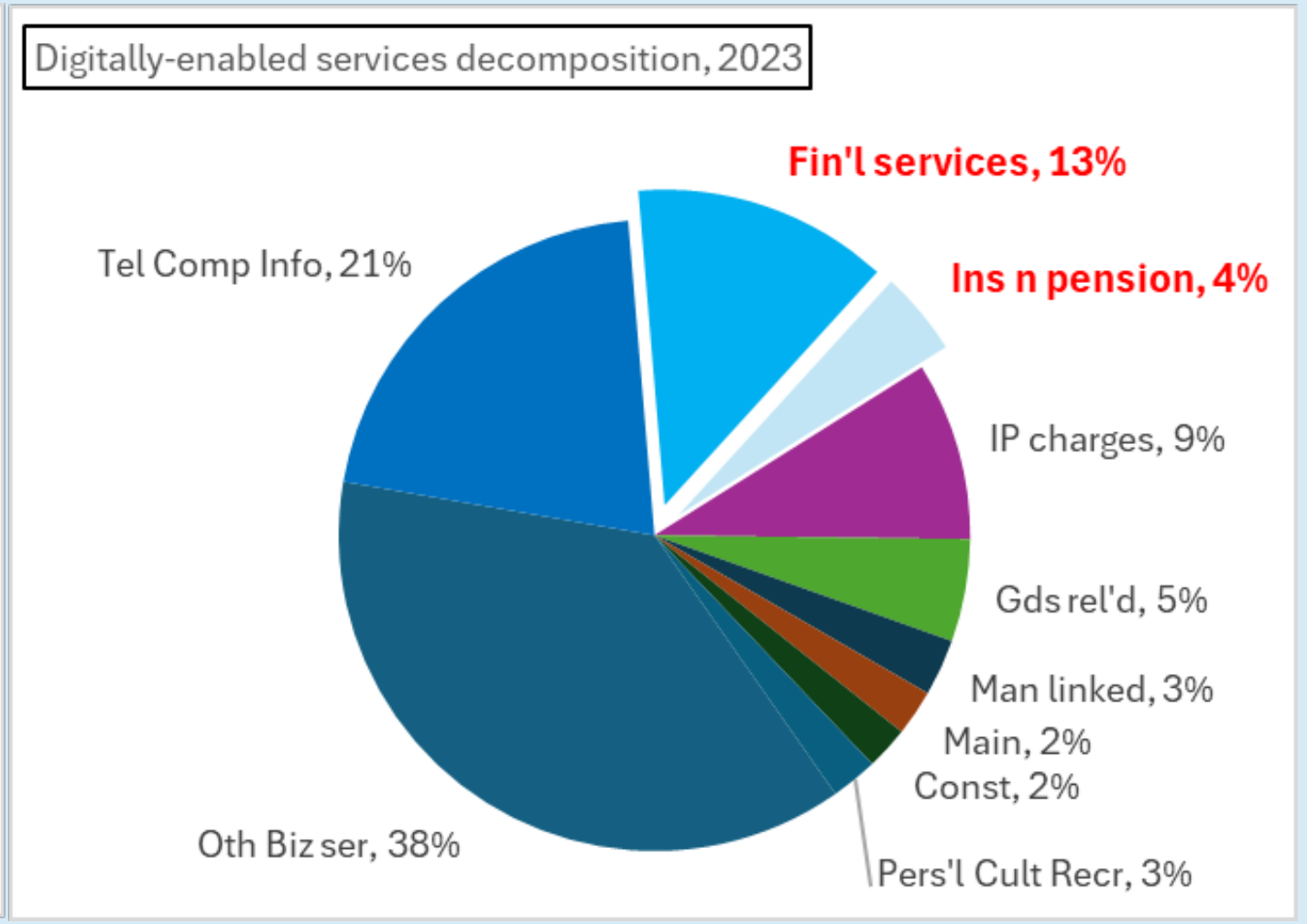
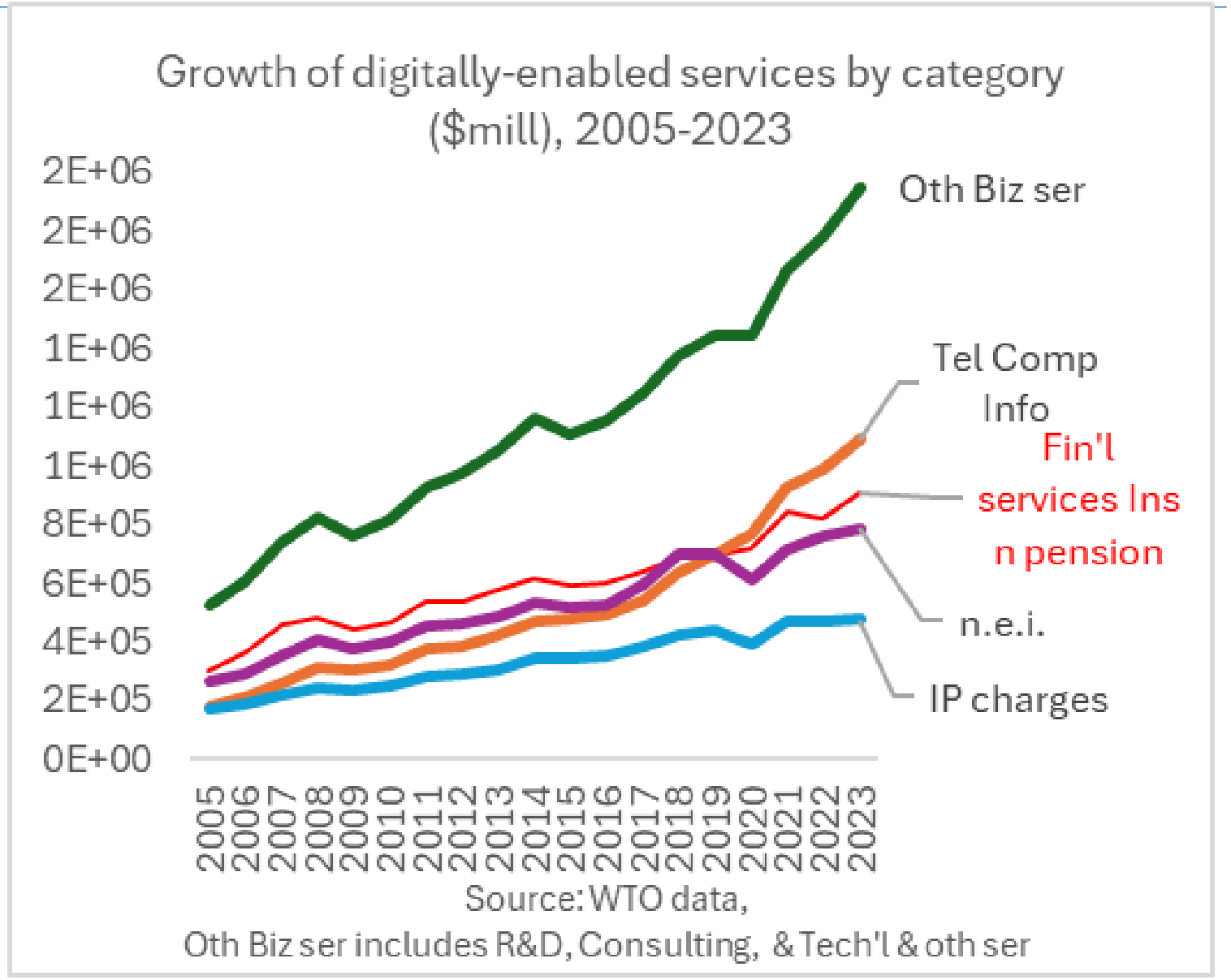
# What are digitally-enabled services?



# Growth of various categories of digitally enabled service exports.



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# What are intermediate services?

1. Intermediate services = B2B services
2. All the service tasks done in service sector, manufacturing sector, and primary sector that are not sold directly to customers.
3. For example: tasks done by occupations like bookkeepers, forensic accountants, CV screeners, administrative assistants, online client help staff, graphic designers, copyeditors, personal assistants, corporate travel agents, software engineers, lawyers checking contracts, financial analysts writing reports, etc.

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# FOTIS

Conjecture: The trends will continue. 4 facts & a conclusion.

1. Barriers to services exports are MUCH higher.
2. Barriers to intermediate service exports are technology-linked, not policy linked.
3. Digital tech is lowering service export barriers exponentially.
4. Demand is huge in rich nations; Capacity is huge in emerging markets

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# G7 protectionist pressure & CO2

- Border protection is difficult with services.
  - VAT collected on imported services by some nations.
- Regulation – especially privacy – could hinder intermediate service exports.
- NB: Trade in services is generally less carbon intensive that trade in goods.

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# Expect a global tidal wave of talent.

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The future of export-led development is intermediate services.

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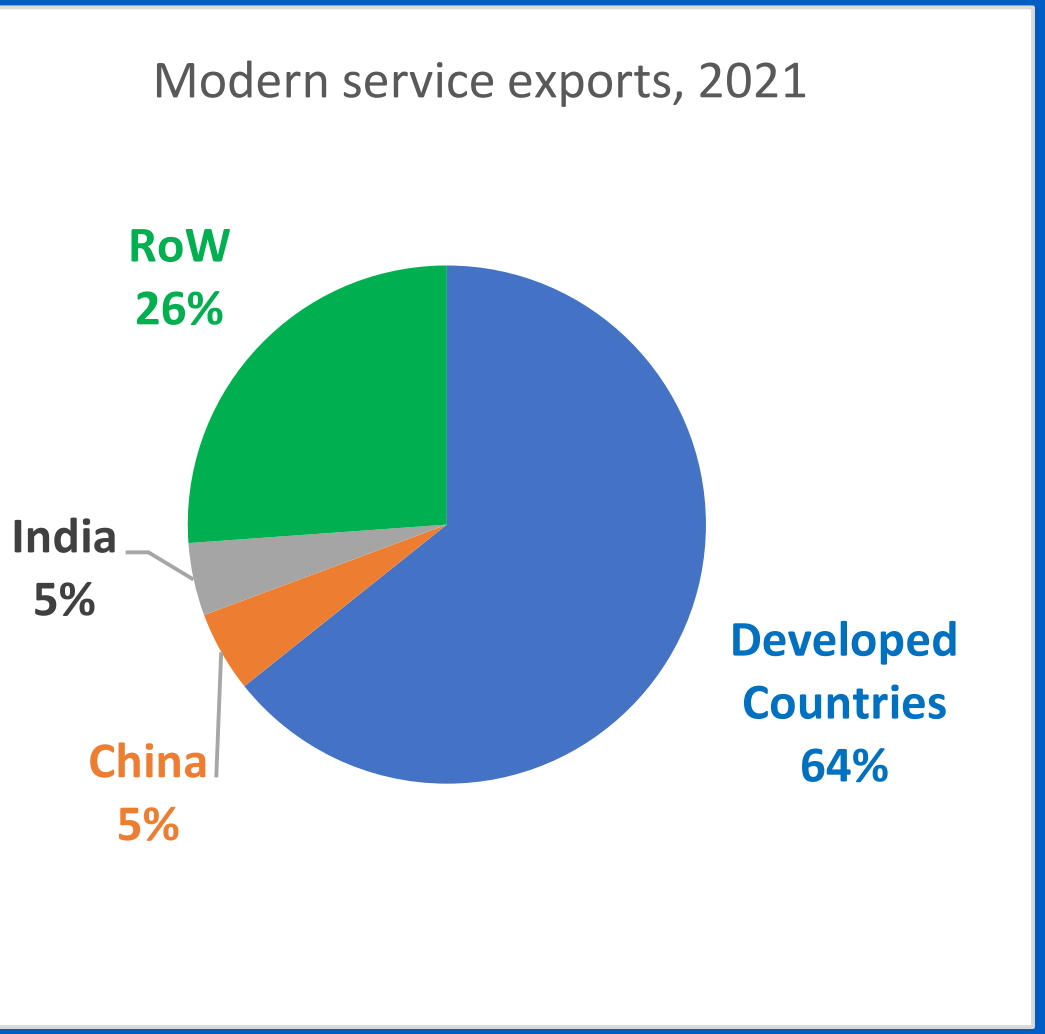
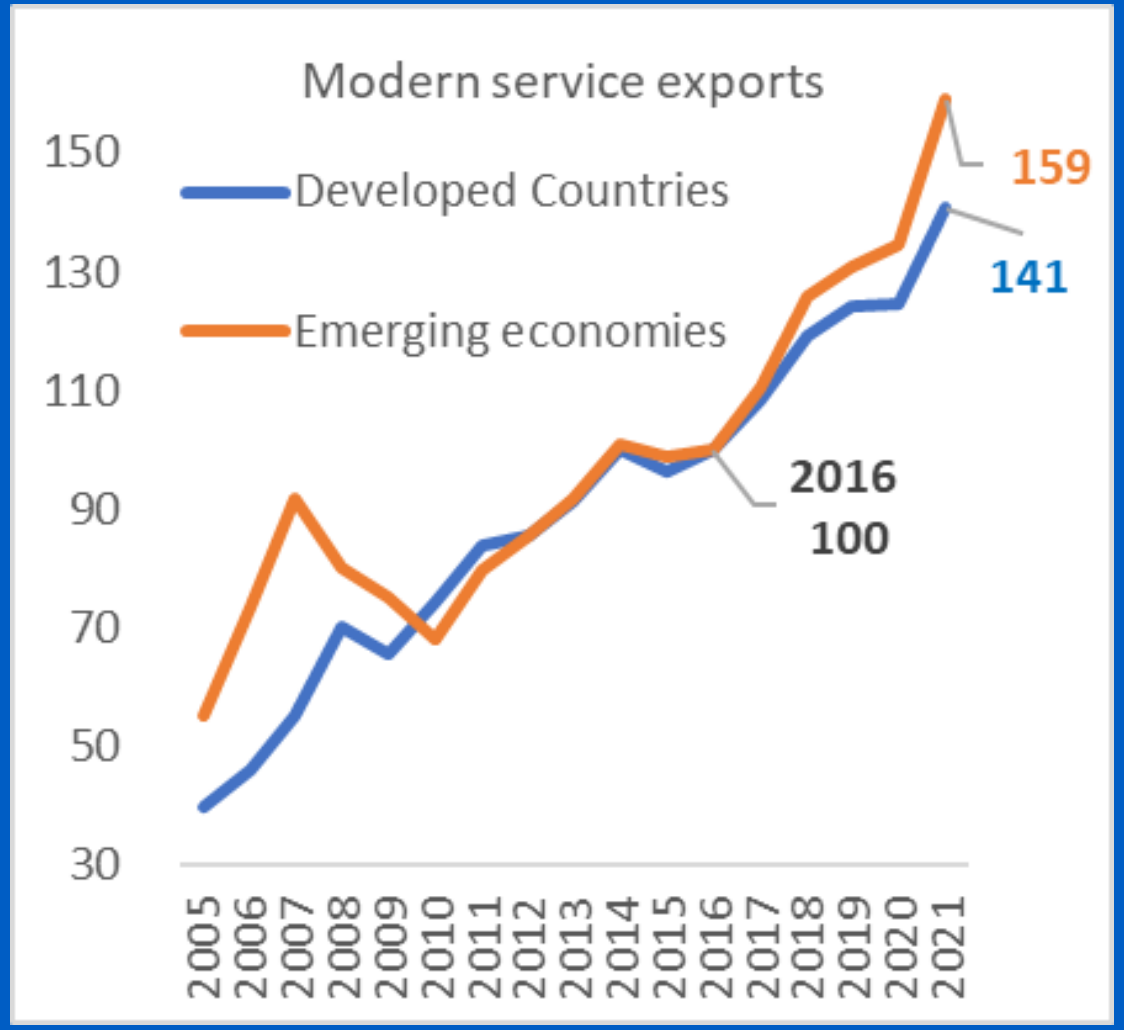
Emerging Economy share of service exports is low but growing fast.

# Digitally-enable service exports: Developing world share low but growing faster.




*Source: Authors' calculations based on trade data from WTO Stats.*

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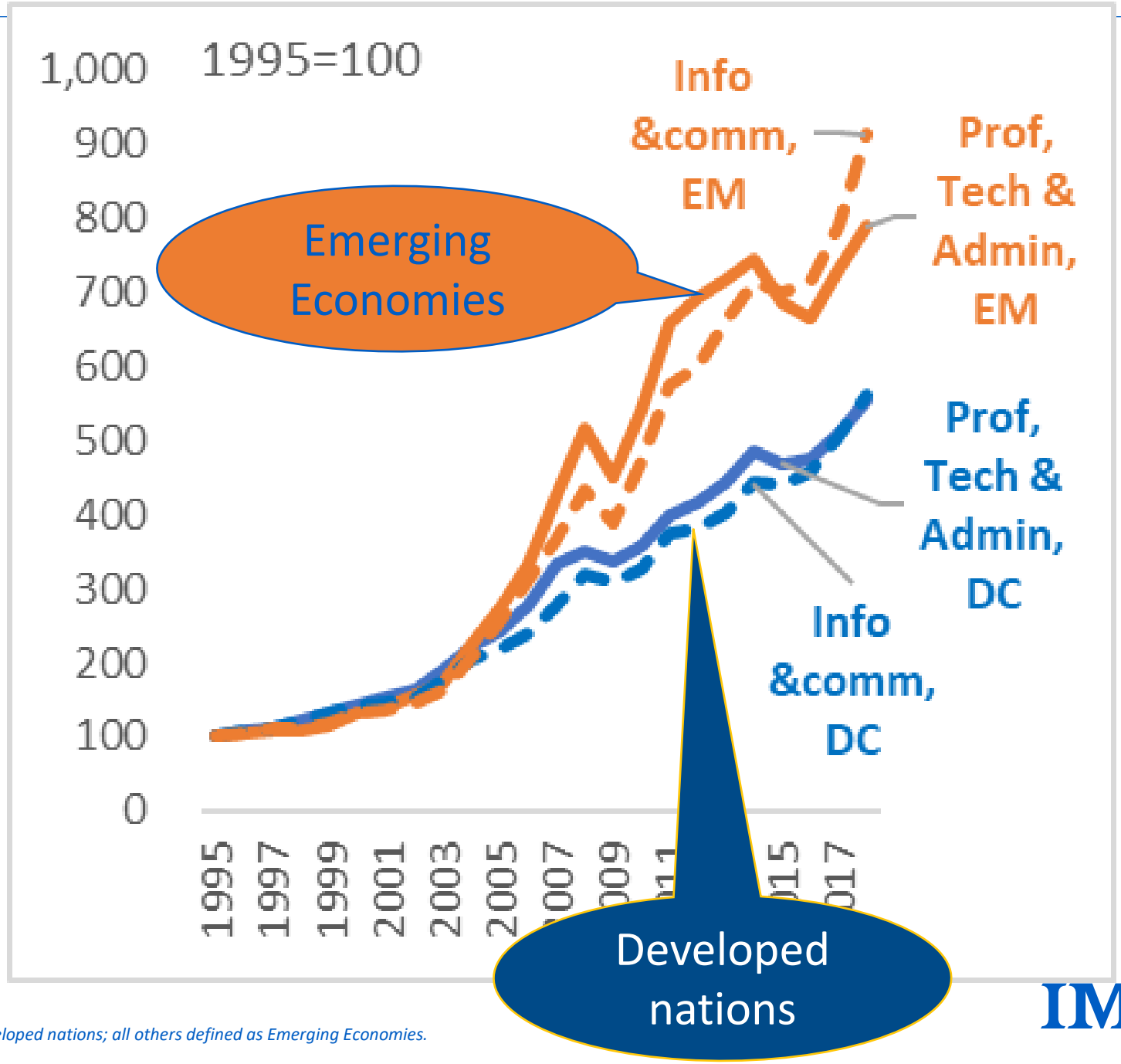
# Emerging Economy export growth edge: especially large in intermediate services.




*Source: Authors' calculations based on trade data from WTO Stats; UN definition of developed nations; all others defined as Emerging Economies.*

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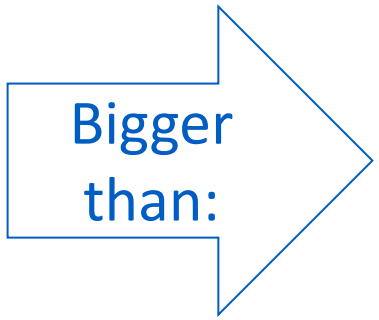
Manufacturing export-led growth is dead or dying.

Service export-led growth is thriving.

# What is export-led growth? Empirical definition.

Growth of domestic value-added embodied in exports (%).




Growth of domestic GDP (%).

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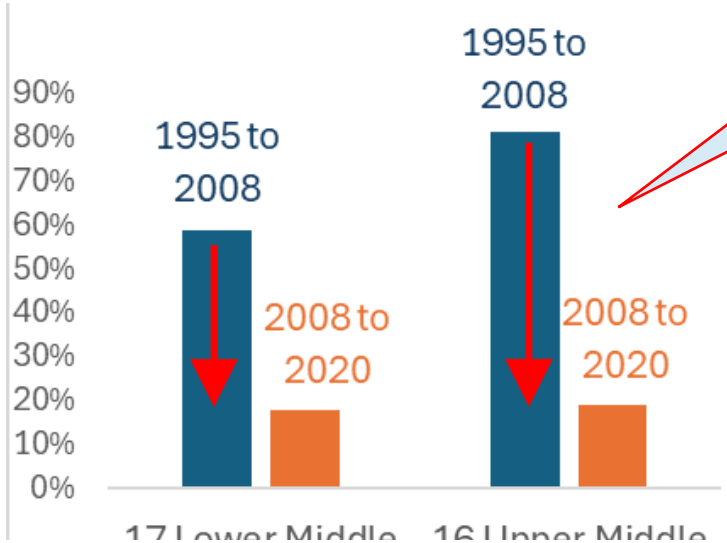
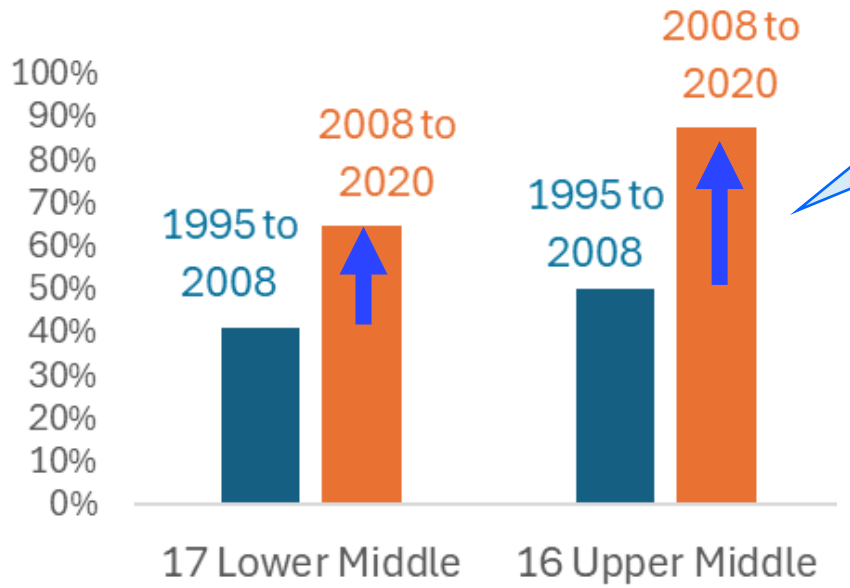
# Number of Emerging Economies with service- vs industry-export-led growth.




Manuf. export-led down.




Service export-led up.

*Source: OECD Tiva 2023. NB: Export-led, defined as value-added exports growing faster than GDP.*
*ICT-Enabled* = Information and communication, Financial and insurance activities & Other business sector services



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# Different structural transformation.

1. Think “Service-export-led”, not “Industry-export-led” development.
2. Think India, not China.
   ”Bangalores galore.”
3. Think cities, services, and training, not factories, industrial equipment, and technology.
4. New development theory needed.

a) Probably will be an extension of urban growth theory, like Myrdal model of cumulative causality.

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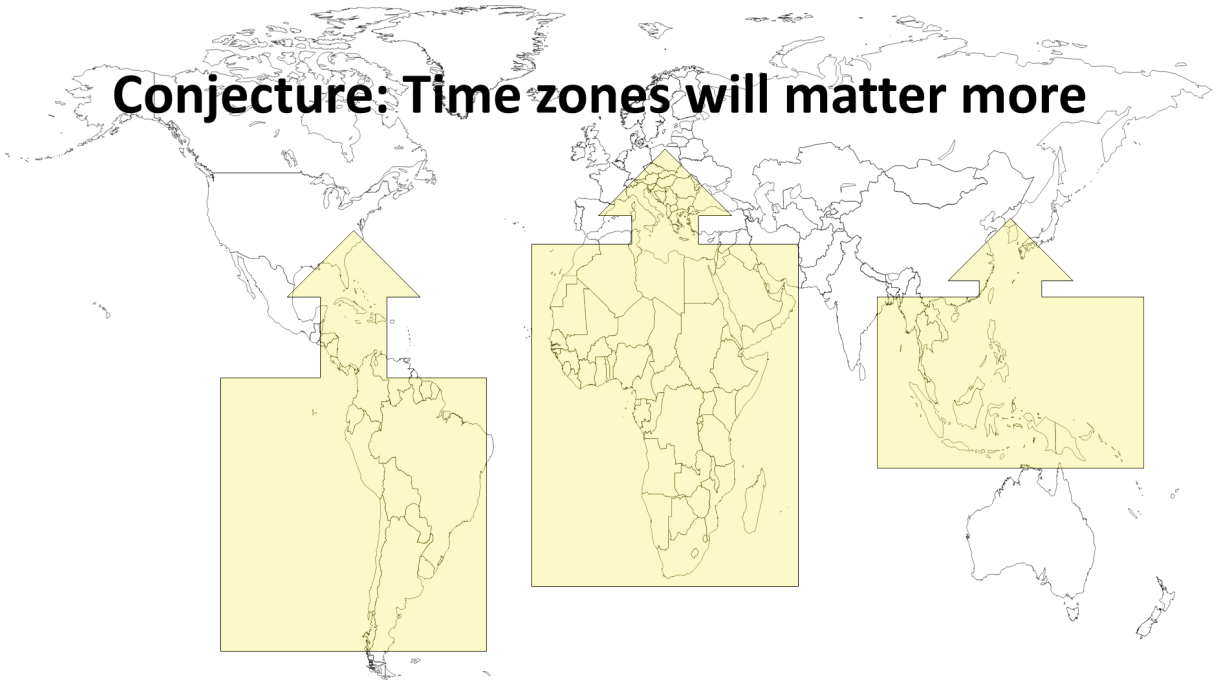
- Impact on emerging market economies.

- Service-led development will supplant industry-led development.
  - Except in Emerging Economies near US, China, Japan, Germany.
- Emerging Market miracle will continue & spread geographically.
  - Africa & South America beyond commodities.

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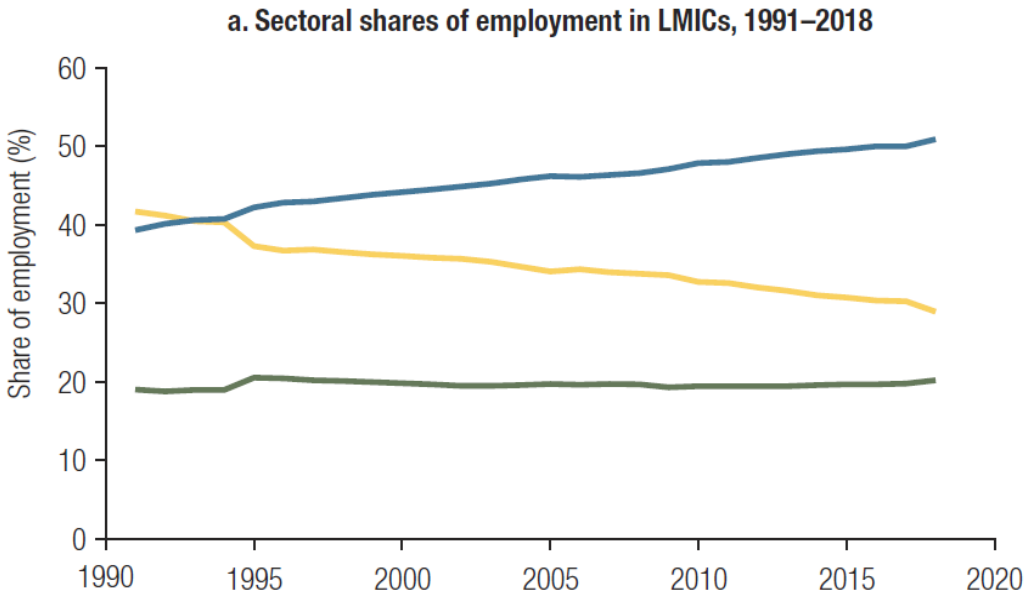
# Service-led development is happening

Fact: LMIC workers are leaving the farm for service jobs, not manufacturing jobs



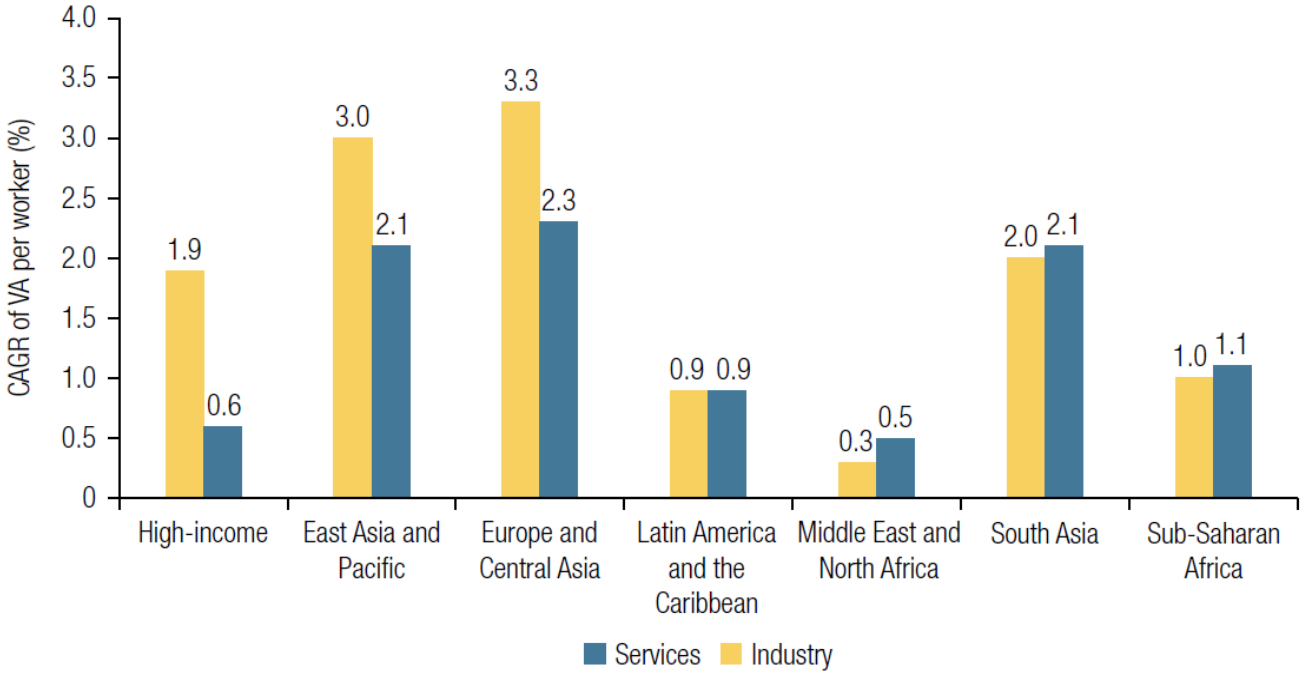

**At Your Service?**
The Promise of Services-Led Development

Naygar, Hallward-Driemeier & Davies (2021)

Fact: Service jobs have higher TFP growth than industry in in most LMIC economies

**Typically Exceeding That of HICs**

*Growth in value added per worker in LMICs, by broad sector and relative to high-income countries, 1995–2018*




*Source:* Calculations based on World Development Indicators database.

*Note:* Value-added (VA) data are in constant prices. "Low- and middle-income countries" (LMICs), by World Bank income group classifications, had 1994 gross national income (GNI) of less than US$8,955. "High-income countries" (HICs) had GNI exceeding US$8,955 in 1994. Data for the "industry" sector include not only manufacturing but also mining, utilities, and construction. CAGR = compound annual growth rate.

# END

Thank you for participating.

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AFTER THIS:
Slides for Q&A (just in case)
Not to be presented.

# GFRs 1995, 2013 & 2020, Top-20 manufactures

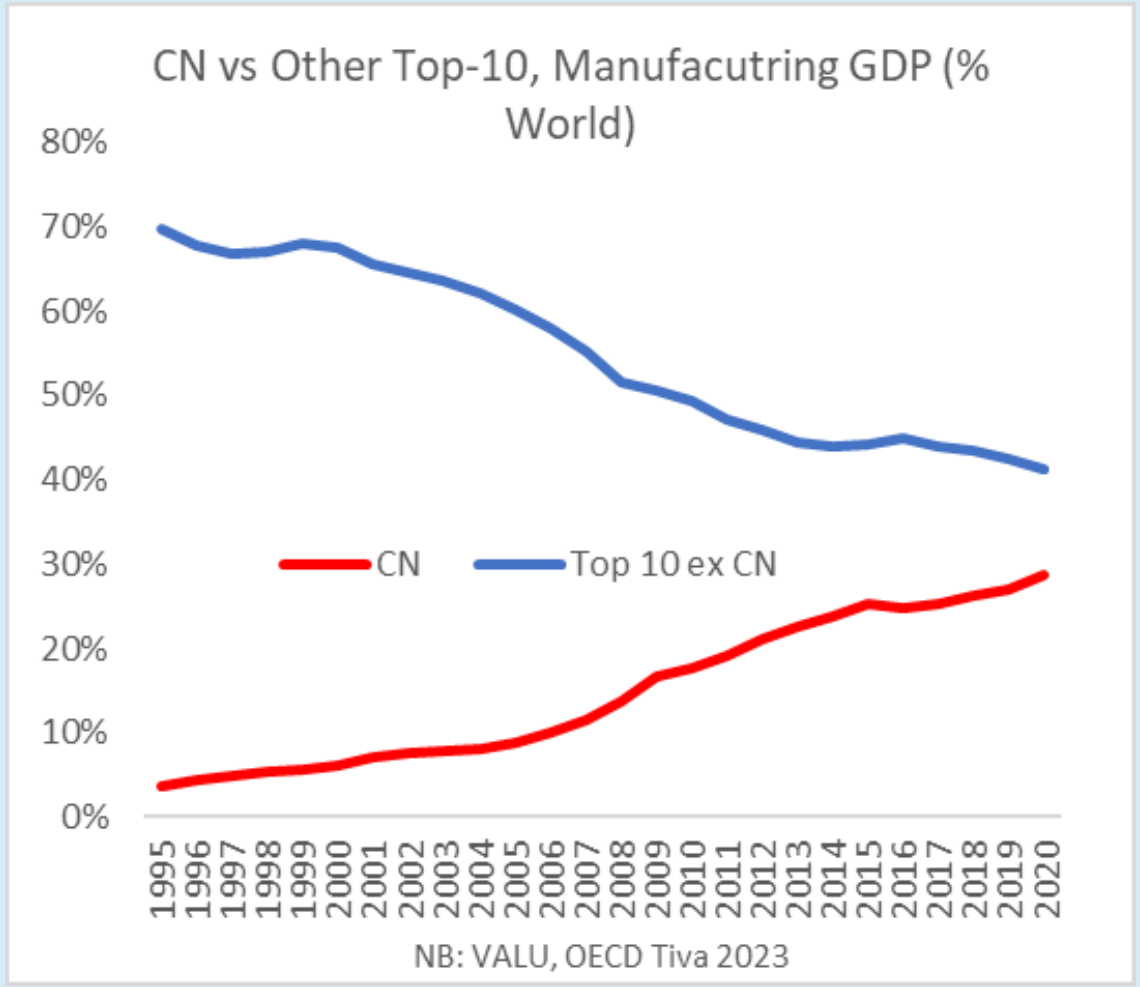
| | Global Fragmentation Ratio | | | Change (% points) | |
|---|---|---|---|---|---|
| | 1995 | 2013 | 2020 | 2013-1995 | 2020-2013 |
| CN | 75% | 77% | 76% | 1.7% | -1.5% |
| US | 64% | 66% | 59% | 1.8% | -7.0% |
| JP | 59% | 65% | 62% | 6.0% | -3.1% |
| DE | 61% | 67% | 64% | 5.6% | -2.9% |
| IN | 75% | 77% | 75% | 2.9% | -2.3% |
| KO | 71% | 75% | 71% | 4.0% | -3.3% |
| IT | 68% | 74% | 71% | 5.5% | -3.0% |
| FR | 64% | 69% | 67% | 4.3% | -1.4% |
| TW | 72% | 75% | 72% | 2.4% | -3.4% |
| BR | 67% | 76% | 75% | 9.5% | -1.0% |
| RU | 69% | 70% | 70% | 1.6% | -0.5% |
| MX | 68% | 72% | 69% | 3.3% | -2.9% |
| UK | 61% | 63% | 61% | 2.2% | -2.4% |
| ID | 55% | 60% | 62% | 5.3% | 1.4% |
| CA | 66% | 70% | 70% | 4.1% | -0.4% |
| ES | 69% | 73% | 71% | 4.2% | -1.6% |
| TH | 73% | 78% | 75% | 5.2% | -2.6% |
| TK | 57% | 68% | 68% | 11.5% | -0.1% |
| VN | 73% | 77% | 80% | 4.4% | 3.4% |
| CH | 64% | 64% | 65% | 0.3% | 0.4% |

Note: Global Fragmentation Ratio is the cost share of intermediates in manufacturing.

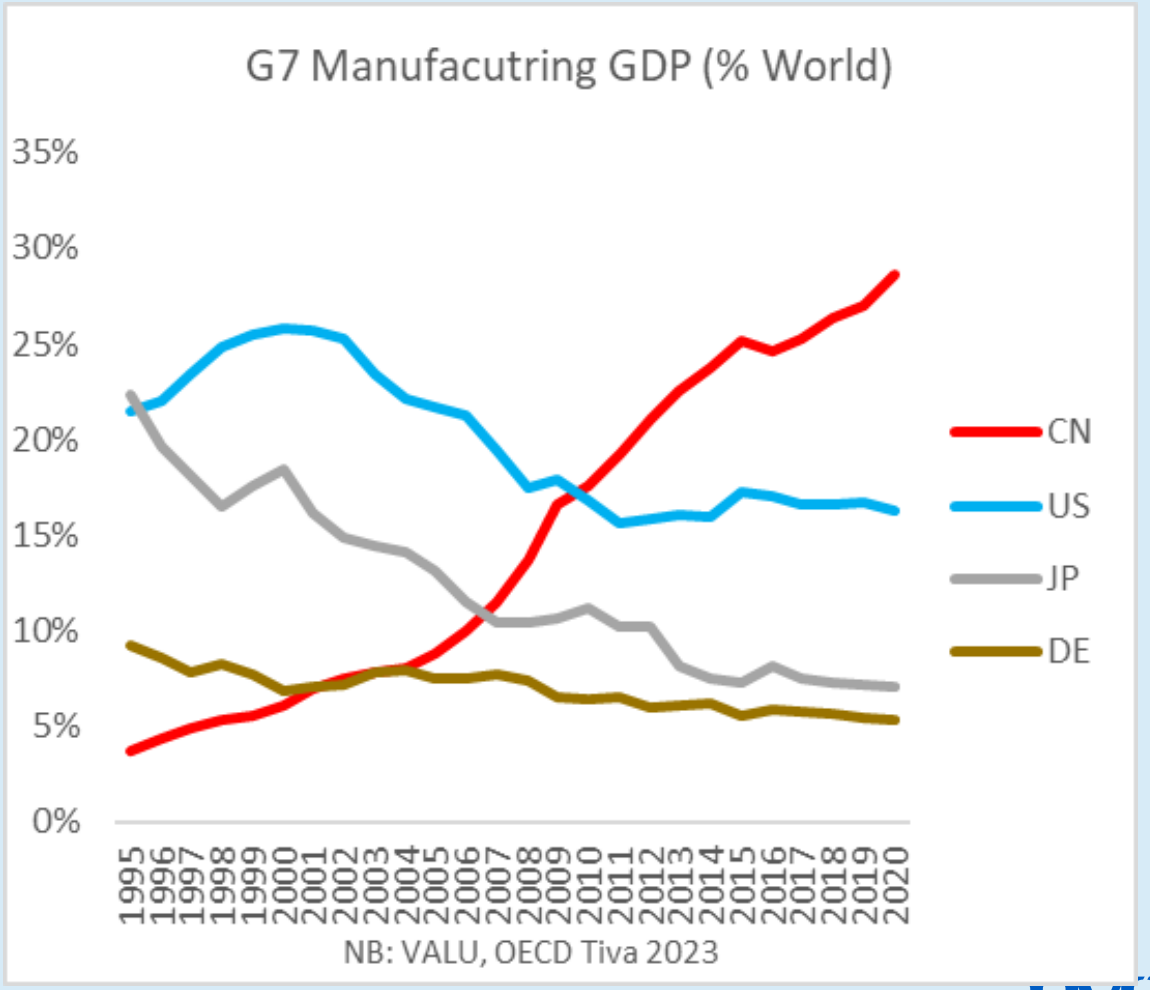
GFR=Intermediates/gross output

# CN dominants manufacturing: GDP

## CN vs other top-10.

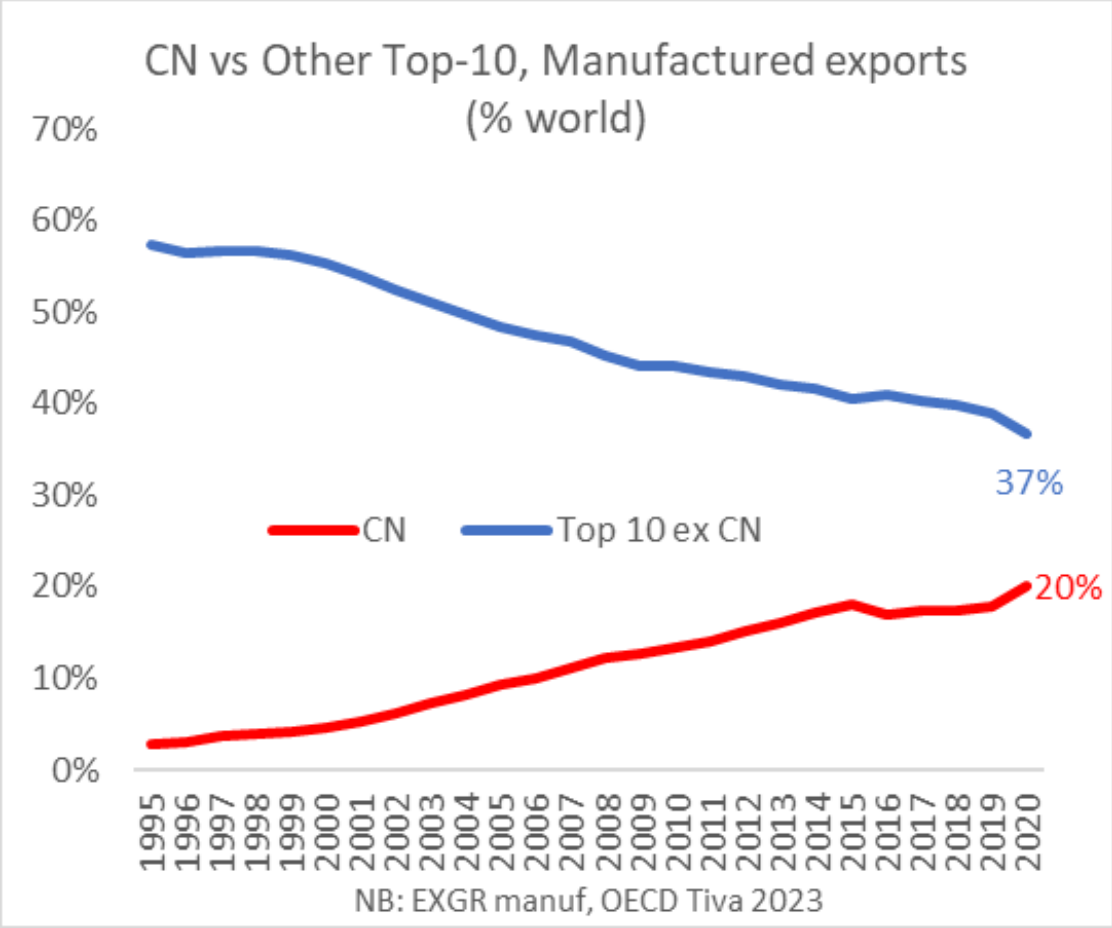



## CN vs US, JP, DE.

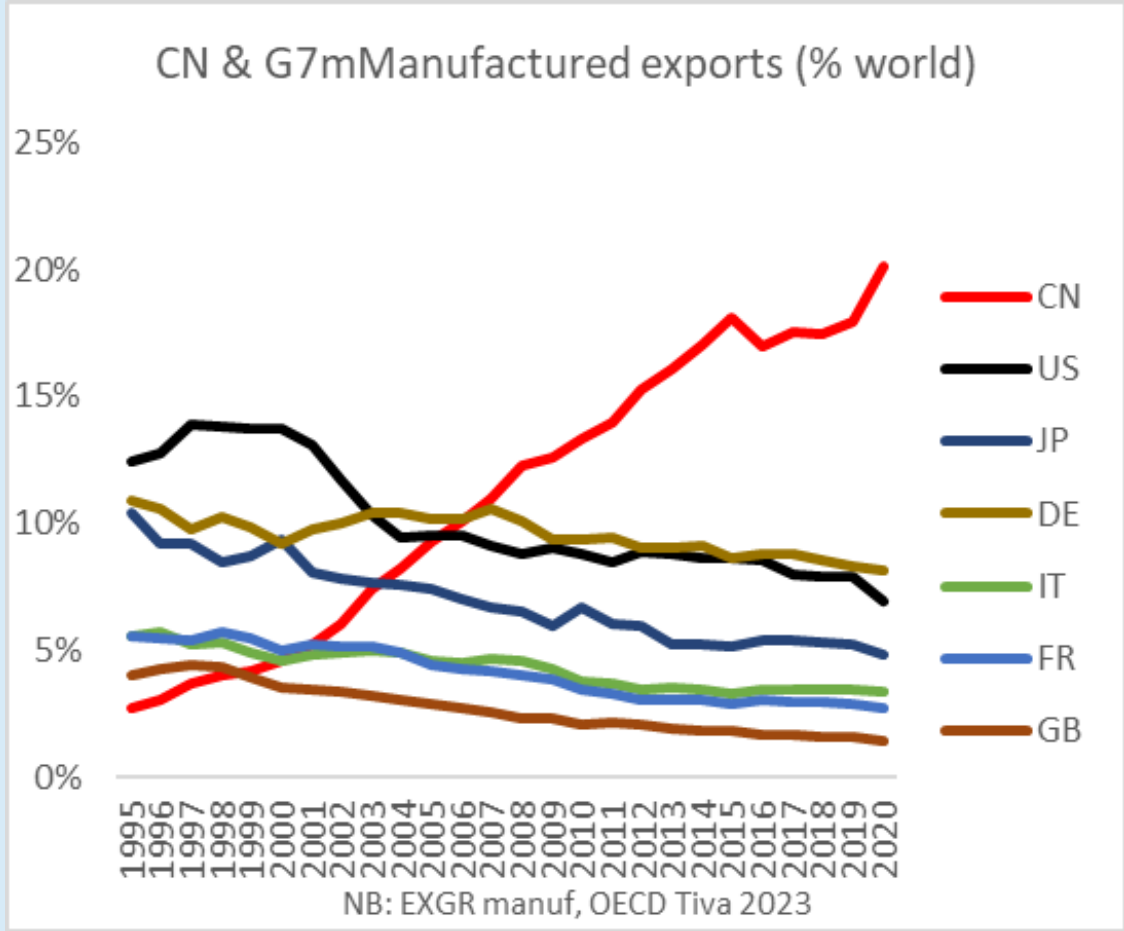


# CN dominants manufacturing: Exports.

## CN vs other top-10.




## CN vs G7.

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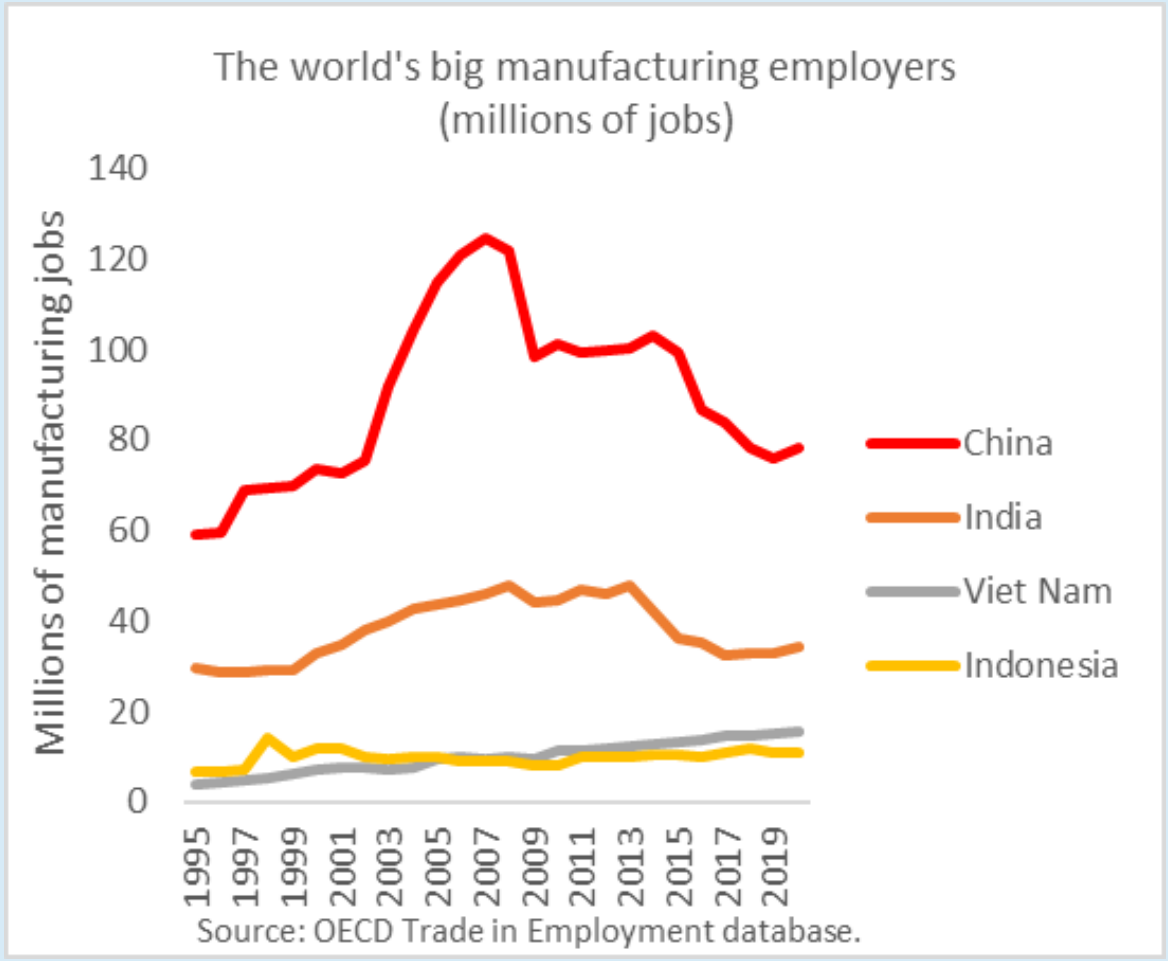
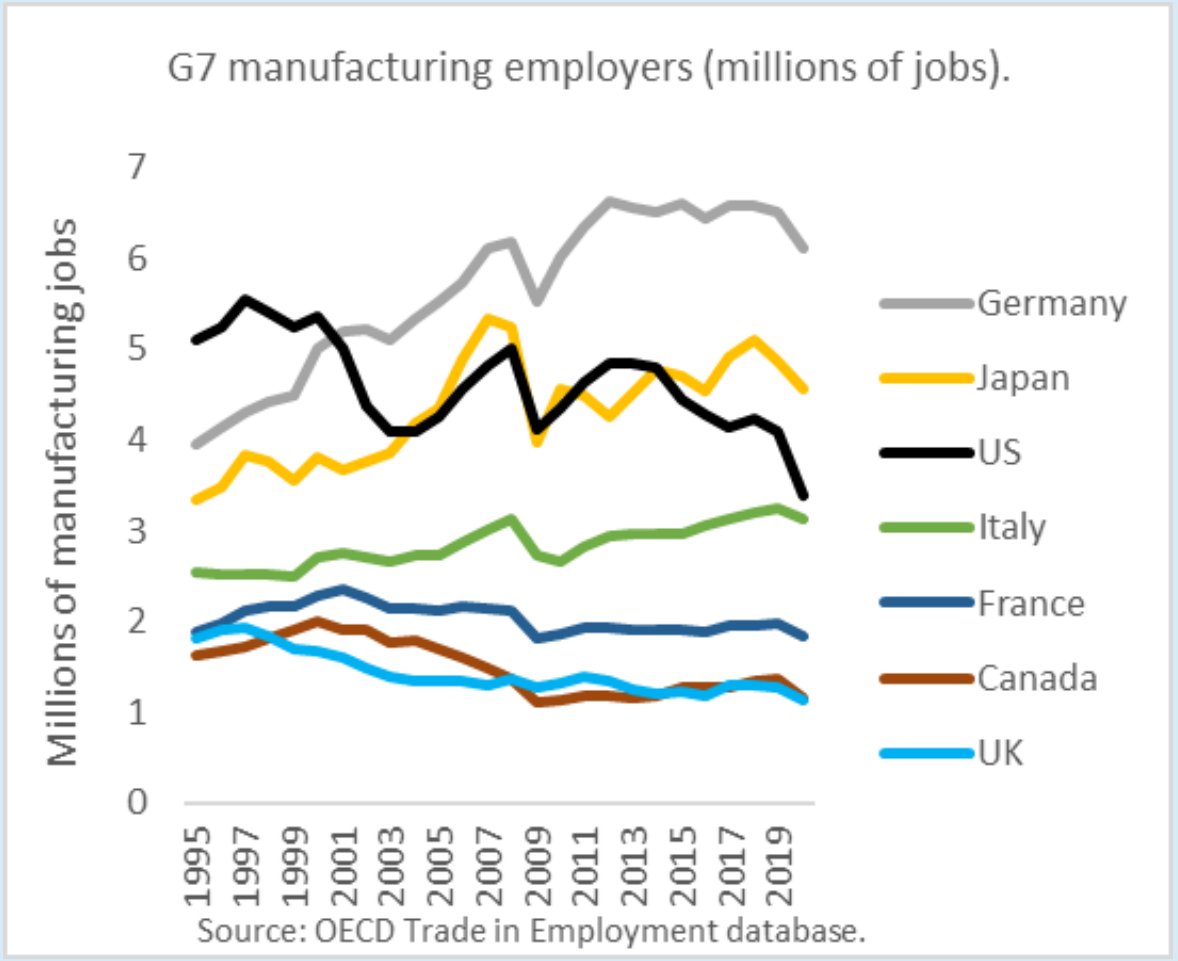
# CN dominants manufacturing: Jobs.

## CN vs other top-10.




## CN vs G7.

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# FACT: North-North dominates intermediate services trade but South flows growing faster

| % of world intermediate services trade between North and South | | | | |
|---|---|---|---|---|
| | 2018 | | 1995 vs. 2018 (pp) | |
| | High-income | Rest of world | High-income | Rest of world |
| **High-income** | 50% | 23% | -14pp | 4pp |
| **Rest of world** | 15% | 13% | 2pp | 8pp |

**Source: Authors' computations based on data from OECD 2021 ICIO Tables (OECD 2021). Notes: High-income refers to all countries in the OECD ICIO tables which are classified by the World Bank as high-income countries. Rest of world refers to all countries in the OECD ICIO tables which are classified as other than high-income countries (including the Rest of World aggregate).**

# FACT: Barriers to trade in services are much higher than barriers to trade in goods

1. Benz and Jaax 2022, Economics Letters.
2. So high that many economists view services as ‘non traded’

# FACT: Most barriers to trade in intermediate services are technology-linked, not policy linked

1. Most service barriers are regulatory, not tariffs
2. OECD's 'Services Trade Restrictiveness Index' shows regulation for 'final services' like professional services
3. Almost no regulation on intermediate services like back-office jobs, copyediting, CV screening, HR, marketing, IT services, cybersecurity, etc

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# FACT: Digitech is lowering barriers to intermediate services at an explosive pace.

1. Digitech is making remote workers less remote
2. Machine translation is melting language barriers
3. Covid-19 adjusted pushed firms and workers to the frontiers of remote technology and organisation

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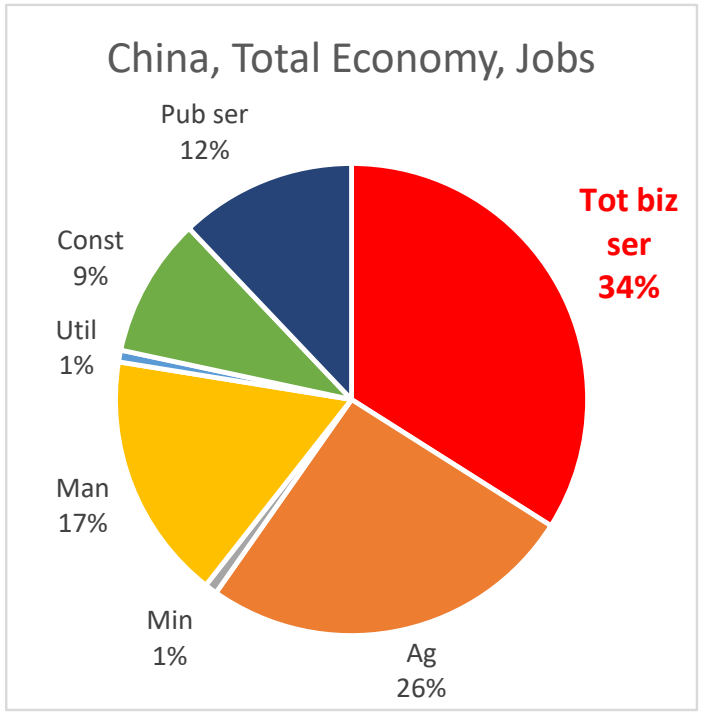
# FACT: Demand for intermediate services is huge in rich nation

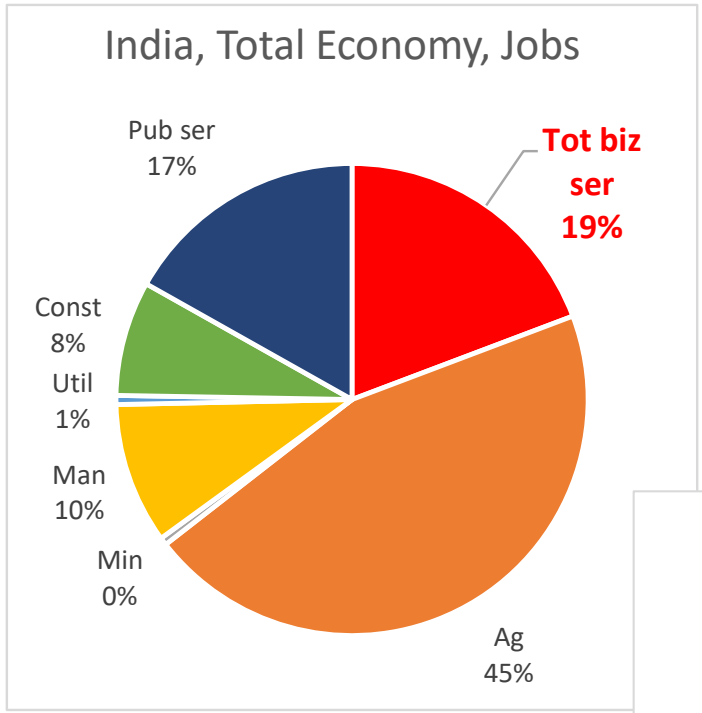
**Table 2: Intermediate services and manufacturing in the French economy, 2018**

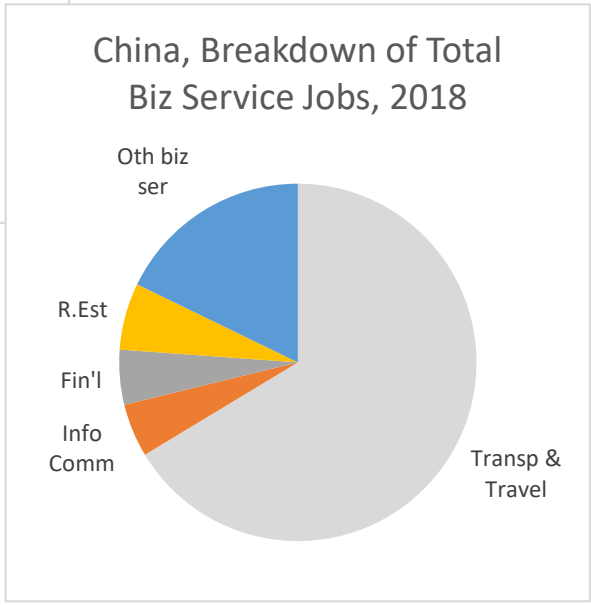
| Sector | Services intermediates | Manufacturing intermediates | Imported services inputs | Imported manufacturing inputs | Sector share of total gross output |
|---|---|---|---|---|---|
| Service | 32% | 5% | 4% | 2% | 68% |
| Manufacturing | 24% | 25% | 4% | 13% | 26% |
| Primary | 28% | 17% | 3% | 5% | 6% |
| Total economy | **30%** | **11%** | 4% | 5% | 100% |

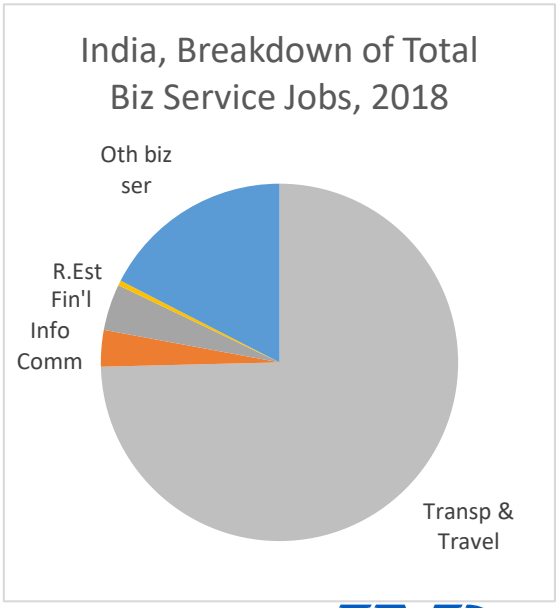
**Source: Authors' calculations based on underlying data from 2021 edition of OECD ICIO Tables. Note: Table appears as Table 1 in Baldwin (2022c).**

# FACT: Supply of workers is big in EMs




Source: OECD's Trade in Employment dataset.

# Wages differences are vast.

US vs Colombian wages in teleworkable occupations.

| ISCO Title | Wage ratio |
|---|---|
| Managers | 14.6 |
| Professionals | 9.4 |
| Technicians and associate professionals | 13.9 |
| Clerks | 11.8 |
| Service workers and shop and market sales workers | 12.9 |
| Craft and related trades workers | 12.6 |
| Primary industries | 11.6 |
| Weighted average (ISCO 1D level) | 11.8 |
| Median | 17.6 |

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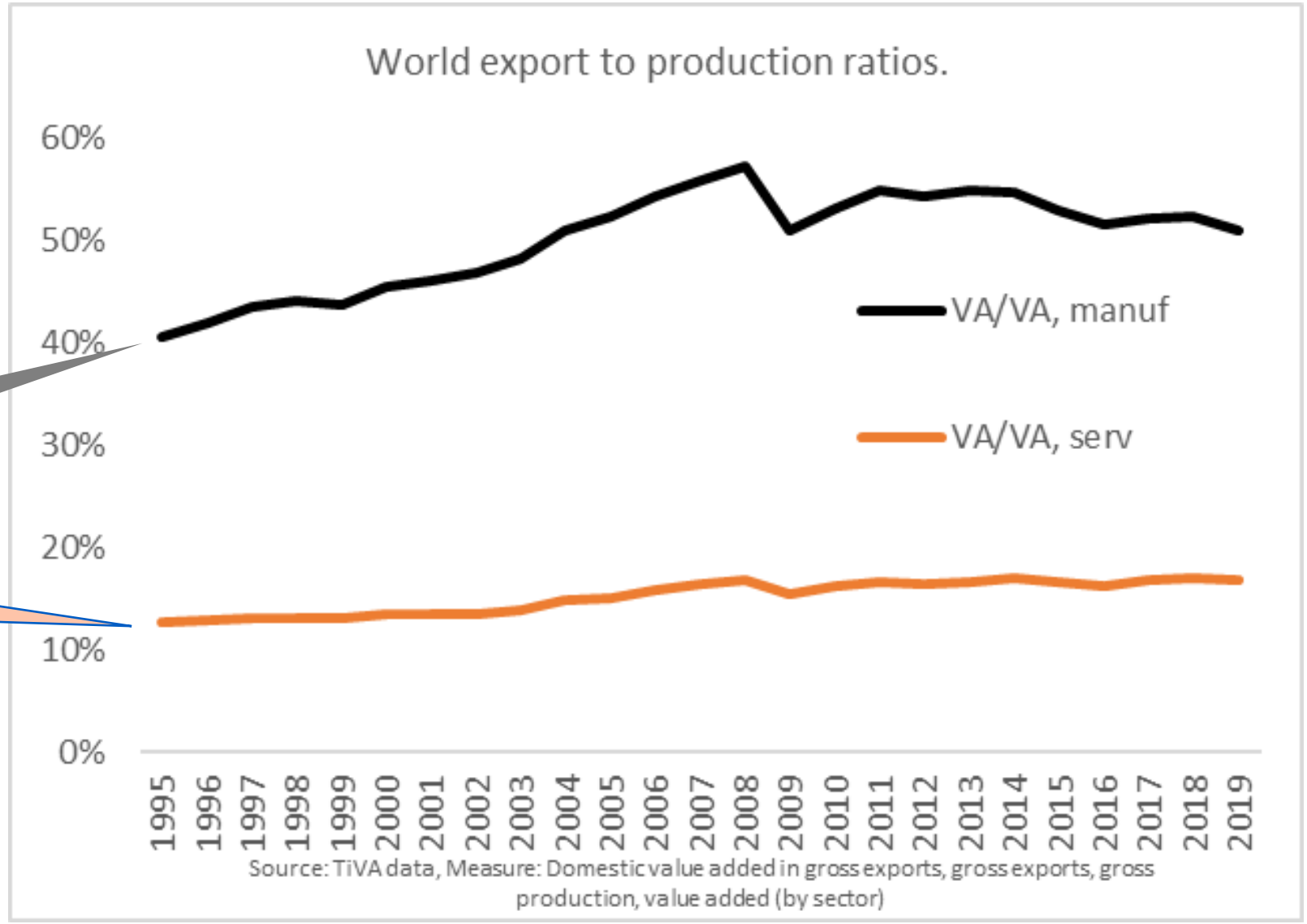
# More room for arbitrage in services.

Openness ratios for manufacturing.

Openness ratios for services.



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Geopolitics is threatening to disrupt international supply chains.

Reshoring, Near-shoring, Friend-shoring, China4China, EU4EU, US4US, etc.

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# Root cause analysis.

| | | |
|---|---|---|
| Consequences. |  | Geopolitical shocks/risks. |
| Main Problem. | | Geopolitical tensions. |
| Root causes. | | 3+ 3 facts. |



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# Why are today’s geopolitics so complex?

Cold War =
checkers.

US superpower =
Bingo.


3D chess =
today’s G-zero world..



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# What changed? Root causes: 3+3 Facts.

1. G7 global economic clout diminished.
2. US middleclass backlash; US dropped global economic leadership.
3. US still military/security hegemony & banking/financial/dollar dominance.

1. China becomes sole manufacturing superpower; critical to global supply chains.
2. China economic growth slows.
3. China sheds its panda costume; dragon emerges.

# Economic & security power vacuum partly filled by regional powers.

- EU & UK in Europe.
- China in far east;
- Russia & Turkey in the near east;
- Saudi, Israel & Iran in middle east, etc..
- India in South Asia.

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# Trump Tariff Show, Season 2? 3 quick conjectures.

From November 2024.

1. US-CN: Bad but boring.
   Season 2, same characters & storyboard.
2. US-EU: Probably much worse.
   EU far more vulnerable to US 2024, than 2016.
   Will Trump coerce EU into joining anti-CN tariffs?
   EU-CN already fighting.
3. US-CN-EU-JP tariffs are good for non CN-emerging economies.

Today.

- The 2 April tariff tornado could change many assumptions.
- Dirty 15: Team Comply & Team Defy.
  - Comply will change tariffs and domestic policies that will have 3rd country effects.
  - Defy will retaliate with 3rd country effects.
- Non-D15 may benefit even more in US, EU, CN, JP.



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# What's next with Trump & Trade?

- US President has essentially declared war on comparative advantage, especially when it comes to manufactured goods.
- Goals are vague but include:
  - Rebalance US trade deficit.
  - Reshore manufacturing.
  - Create middle class jobs in industry.
- He believes tariffs will do all these things, but they can't.
- Tariffs can't fix the deficit.
- Given China's dominance in supply chains, US manufacturing cannot return to its former glory.
  - Biden's approach might have worked for semiconductors, etc.
- In any case, reshored manufacturing will involve few jobs.

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# Team Defy & Team Comply.

- Trump's April tariffs will hit all big trading nations.
  - US tariffs rising substantially on most imports (Exceptions? Targets?)
- Some will fold, and lower tariffs on US goods.
- Some will defy and retaliate.

- Mostly higher tariffs but some lower tariffs.

Conjecture:

- US tariff aggression will become a unifying force in the RoW.
- Reactions unclear; lots of uncertainty ahead.
- Supply chain managers will tend to react depending upon tariffs, but on the whole, supply chains will tend to re-localise, re-regionalise.
- Lower productivity in manufacturing processes worldwide.
- China is probably least affected as it is the least dependent on imported industrial inputs.

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