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CompNet

Trade and Competitiveness: GVC Productivity Transmission

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Motivation

- Competitiveness is again at the center of the policy debate;
- The EU Commission tasked Mario Draghi with a report on the future of European competitiveness;
- "*Because Europe will do "whatever it takes" to keep its competitive edge.*", 2023 State of the Union Address by President von der Leyen;
- Well-functioning Global Value Chains (GVC) are crucial to a competitive economic system;
- Ensuring that productivity diffuses throughout European GVC achieves two (apparently) conflicting goals:
    - Escalating European competitiveness
    - Furthering convergence within the block

Existing Literature

Bartelsman et al. (2008) pioneered the study of GVC productivity transmission.
For UK firms, productivity impact of global frontier less than that of national frontier.
The productivity "pull" of the global frontier decreases with distance of the firm from the global frontier itself.

Two-stages technology diffusion from Western to Eastern EU countries through GVCs.
Import main channel of technology transmission.
The capacity of Eastern EU countries to absorb productivity spillovers declined after the global financial crisis (Chiacchio et al., 2018).

Within country productivity diffusion is always stronger than cross-country diffusion.
New Zealand is not benefiting from the diffusion of best technologies outside the nation (Zheng at al., 2021).

Higher trade openness allowed recent EU members to reap imported efficiency gains, experienced technological convergence before the global financial crisis (Martínez Turégano, 2021).

Previous Work

Period: February - October 2023

Data Source: CompNet 9th Vintage (22 European countries from 1999 to 2021)

Output:

- CompNet (2023), Firm Productivity Report, July
- Di Mauro, F. & Matani, M. (2023). Talking about competitiveness in Europe: Productivity not protection. VoxEU.org, 29 September

Previous Work

- Two-stage diffusion process of technology across countries (Bartelsman et al., 2008)
- Chiacchio et al. (2018): national firms are frontier (top 2 deciles of TFP), laggard (bottom 2 deciles of TFP), or mid-productive (other TFP deciles in between).

1st Stage: From GVC to National Frontier Firms

$$\Delta TFP_{c,s,t}^{nat\ front} = \alpha + \beta_1 \Delta TFP_{c,s,t}^{GVC\ front} + \beta_2 \ln\left(Prod_{c,s,t-1}^{GVC\ front} / Prod_{c,s,t-1}^{nat\ front}\right) + \beta_3\ \Delta GVC_{c,s,t} + \delta_{c,s} + \tau_t + \varepsilon_{c,s,t}$$

- $\beta_1 \rightarrow$ correlation between TFP changes of **national frontier firms** and changes in TFP at the **GVC frontier**
- $\beta_2 \rightarrow$ "catch-up" effect: lagged distance of **national frontier firms** from **the GVC frontier** in terms of labor productivity
- $\beta_3 \rightarrow$ changes in GVC participation: p.p. change in the **share of imports on turnover** at the macro-sector level
- τ_t are time dummies for 2020 and 2008-2010

2nd Stage: From National Frontier to National Mid-Productive and Laggard Firms

$$\Delta TFP_{c,s,t}^{nat\ other} = \alpha + \beta_1 \Delta TFP_{c,s,t}^{GVC\ front} + \beta_2 \ln\left(Prod_{c,s,t-1}^{GVC\ front} / Prod_{c,s,t-1}^{nat\ other}\right) + \beta_3\ \Delta GVC_{c,s,t} + \beta_4 \Delta TFP_{c,s,t}^{nat\ front}$$
$$+ \beta_5 \ln\left(Prod_{c,s,t-1}^{nat\ front} / Prod_{c,s,t-1}^{nat\ other}\right) + \delta_{c,s} + \tau_t + \varepsilon_{c,s,t}$$

- $\beta_4 \rightarrow$ correlation between TFP changes of **national middle- or low-productive firms** and changes in the TFP of **national frontier firms**
- $\beta_5 \rightarrow$ "catch-up" effect: lagged distance of **national middle- or low-productive firms** from **the national frontier** in terms of labor productivity

Previous Work

TFP growth transmission with time interactions. European countries and macro-sectors, 2005-2020

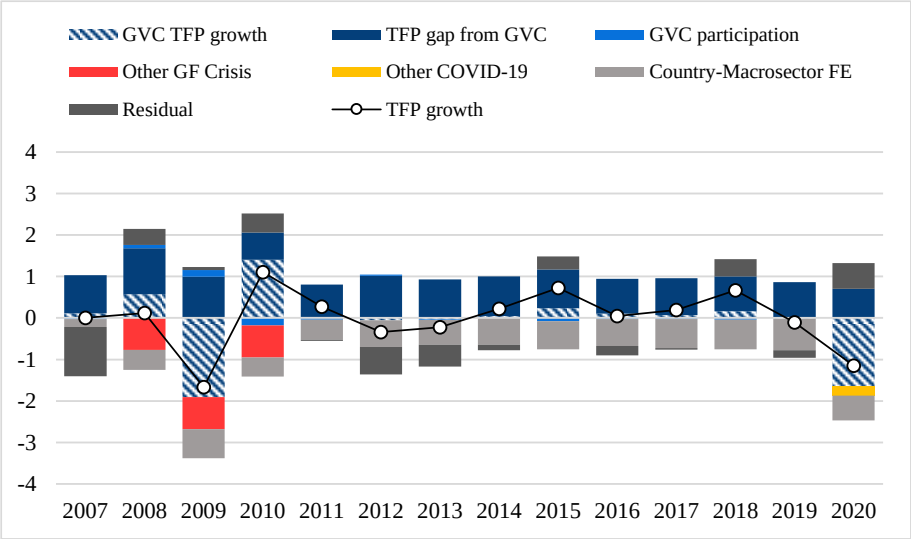
TFP growth	(1) Frontier	(3) Middle	(5) Laggards
TFP growth GVC (import) frontier	0.4636***	0.2243**	0.2342
	(0.1352)	(0.0905)	(0.1466)
TFP growth GVC (import) frontier × 2008-2010 dummy	0.1790	0.1652	0.7637**
	(0.2684)	(0.1614)	(0.3617)
TFP growth GVC (import) frontier × 2020 dummy	1.5797**	0.1781	0.9058
	(0.7425)	(0.7159)	(1.2805)
Lagged labor productivity gap with GVC (import)	0.1138***	0.0345*	0.0575**
	(0.0191)	(0.0207)	(0.0260)
GVC (import) participation growth	-1.5198	0.3132	0.7987
	(1.6663)	(1.4075)	(2.0903)
TFP growth national frontier		0.5267***	0.5121***
		(0.0457)	(0.0682)
TFP growth national frontier × 2008-2010 dummy		0.5842***	0.8458***
		(0.1285)	(0.1966)
TFP growth national frontier × 2020 dummy		0.5762***	0.8796***
		(0.1311)	(0.2848)
Lagged labor productivity gap with national frontier		0.0277	-0.0227
		(0.0227)	(0.0390)
2008-2010 dummy	-0.5013**	-0.3058*	-0.6612***
	(0.2156)	(0.1681)	(0.2421)
2020 dummy	-0.3018	-0.6983***	-2.1518***
	(0.3260)	(0.2302)	(0.4884)
Constant	1.0791***	-1.2086**	-1.9191**
	(0.2399)	(0.5449)	(0.9170)
Observations	1,872	1,867	1,835
Adjusted R-squared	0.0468	0.6793	0.4658

Source: CompNet 9th Vintage, jd_inp_prod_industry2d_20e_weighted.dta and OECD ICIO
Note: Robust standard errors in parentheses, clustered at the country-sector level. *** p<0.01, ** p<0.05, * p<0.1. In column 1, *Frontier* is the log TFP growth of firms that belong to the last two deciles of the TFP distribution of each country and macro-sector. In column 2, *Middle* is the log TFP growth of mid-productive firms with TFP computed like the average TFP of firms between the third and the eight deciles of the TFP distribution within each country and macro-sector, using employment like weight. In column 3, *Laggard* is the log TFP growth laggard firms that belong to the first two deciles of the TFP distribution for each country and macro-sector. Results for trade linkages between BE, CH, CZ, DE, DK, ES, FI, FR, HU, HR, IT, LV, LT, MT, NL, PL, PT, RO, SI, SK, and SE. Unbalanced sample over 2005-2020. The latest available year is 2018 for DE, and 2019 for LV and NL. Country-sector fixed effects are included. Log TFP growth rates for the GVC frontier are computed weighting by imports. Results weighting by exports are consistent but omitted for the sake of brevity and are available upon request to the authors.

- Strong TFP transmission
  - From the GVC frontier to national frontier firms
  - From the national frontier firms to national mid-productive and laggard firms
- Transmission was stronger during COVID-19 → Higher exposure to GVC disruption
- More substantial transmission from the import than from the export side (omitted results)

Previous Work

Regression-based TFP Shock Decomposition
Average across European countries and macro-sectors, 2007-2020



Source: CompNet 9th Vintage (jd_inp_prod_industry2d_20e_weighted) and OECD ICIO.
Note: Figures are yearly averages across countries and macro-sectors weighted by real value added. Results for export linkages between BE, CH, CZ, DE, DK, ES, FI, FR, HR, HU, IT, LT, LV, MT, NL, PL, PT, RO, SI, SK, and SE. Unbalanced sample over 2005-2020. The latest available year is 2018 for DE, and 2019 for LV and NL.

- TFP growth of the EU GVC counterparts impacts the TFP of the overall economy
- Such impacts are significantly negative at the time of crisis (GFC in 2009 and COVID in 2020): are within-Europe GVCs robust / resilient ?

Application on MDI

Period: November 2023 - ongoing

Data Source: Micro-Data Infrastructure MDI (BR, SBS, ITGS) for Netherlands

NPB Contributions:

- Andreas Reinstaller and Zuzanna Molnárová (Oesterreichische Nationalbank)
- Urška Čede (Institute of Macroeconomic Analysis and Development)
- Tibor Lalinsky (National Bank of Slovakia)

Application on MDI

From the country-macrosector GVC frontier…

For each country c, macrosector s, and year t:

$$\Delta Prod_{c,s,t}^{GVC\_front\_f} = \sum_{c'} \sum_{s'} \left(\frac{x^{f}_{c,s,c',s',t}}{\sum_{c'} \sum_{s'} x^{f}_{c,s,c',s',t}} \Delta Prod^{nat\_front}_{c',s',t} \right)$$

$x^{f}_{c,s,c',s',t}$ -> amount of flow f (export or import) traded between macro-sector s in country c and macro-sector s' in country c' at time t;

$\Delta Prod^{nat\_front}_{c',s',t}$ -> year-on-year log productivity growth of national frontier firms (the top quintile of the productivity distribution) in partner country c' and macro-sector s' in year t.

…to the firm GVC frontier

For each firm i and year t:

$$\Delta Prod_{i,t}^{GVC\_front\_f} = \sum_{c'} \left(\frac{x^{f}_{i,c',t}}{\sum_{c'} x^{f}_{i,c',t}} \Delta Prod^{nat\_front}_{c',t} \right)$$

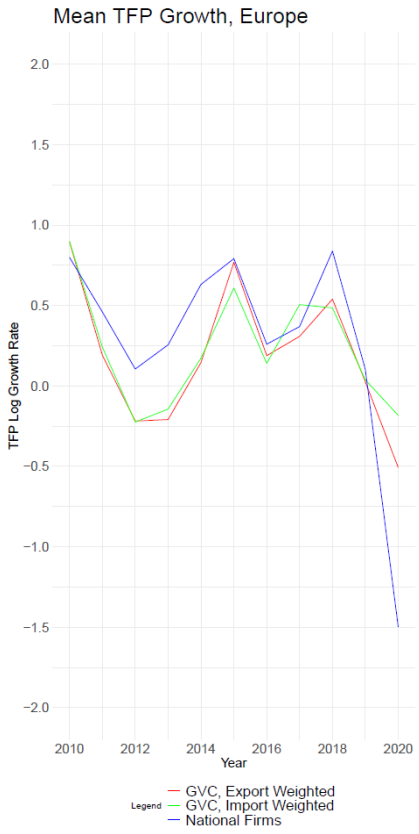
$x^{f}_{i,c',t}$ -> amount of flow f (export, import, or total trade) traded between firm i and country c' at time t;

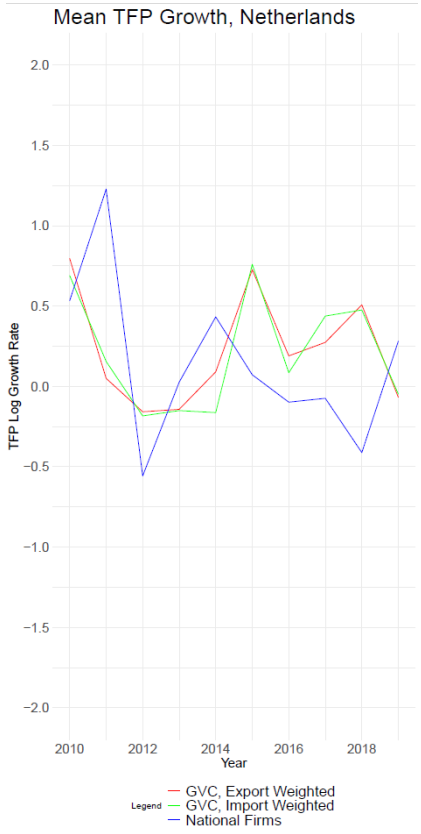
$\Delta Prod^{nat\_front}_{c',t}$ -> year-on-year log productivity growth of national frontier firms (the top quintile of the productivity distribution) in partner country c' in year t.

Gain: Firm-level analysis; **Loss**: No sectoral detail (no firm-level IO tables)

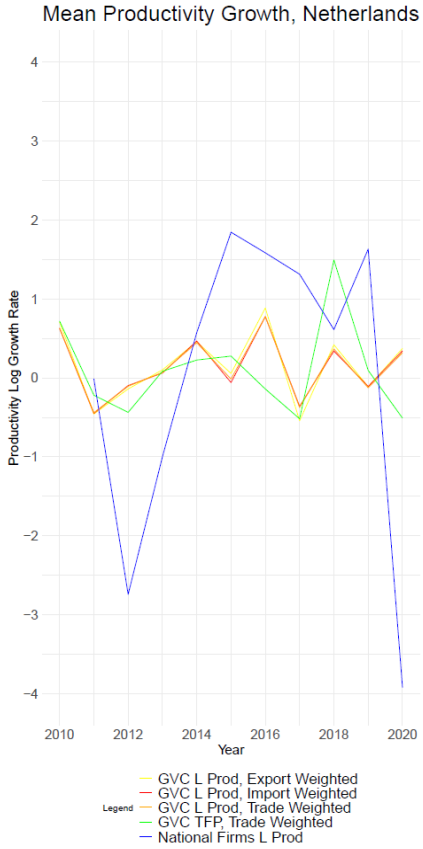
Application on MDI

CompNet



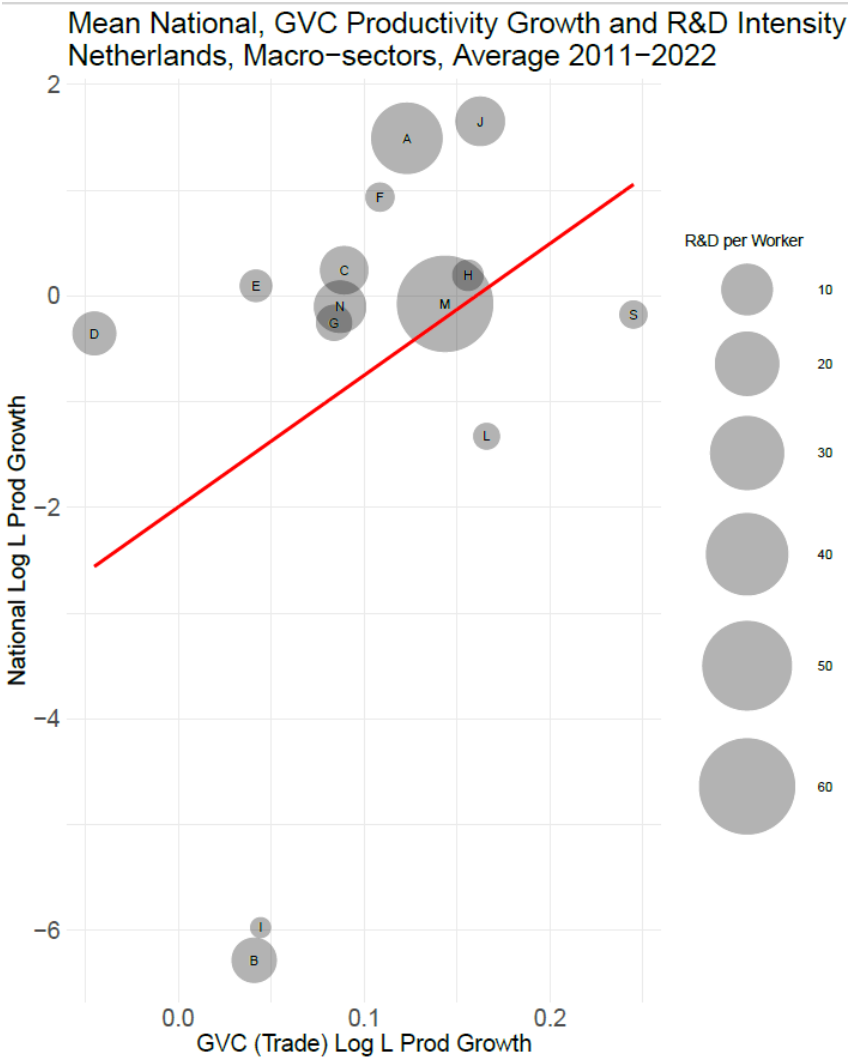


MDI



- Dutch firms' productivity growth more disconnected from GVC developments than the rest of EU
- GVC productivity growth leading indicator for Dutch firms' productivity growth

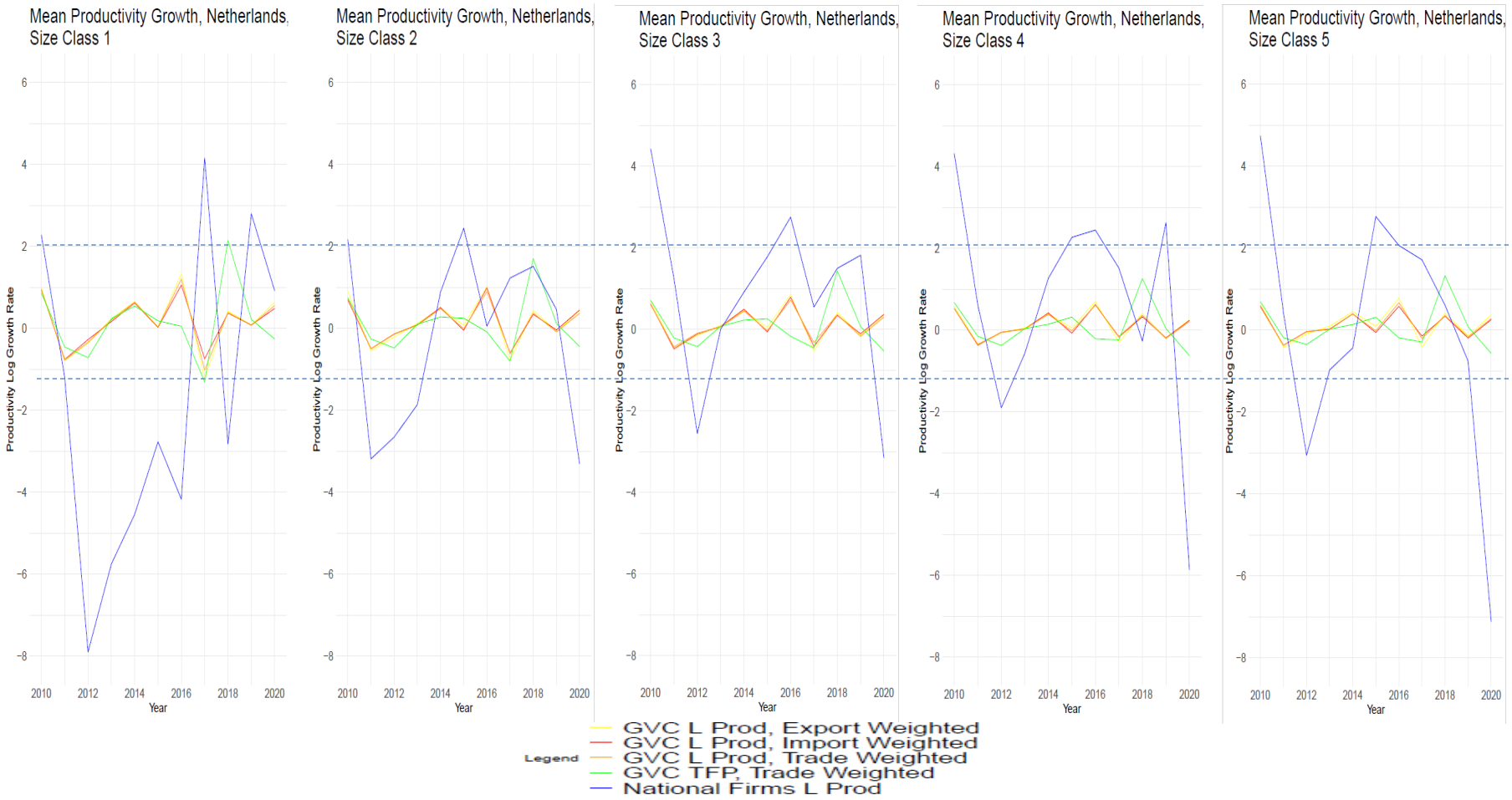
Application on MDI



A ~ Agriculture, forestry and fishing
B ~ Mining and quarrying
C ~ Manufacturing
D ~ Electricity, gas, steam and air conditioning supply
E ~ Water supply; sewerage, waste management and remediation activities
F ~ Construction
G ~ Wholesale and retail trade; repair of motor vehicles and motorcycles
H ~ Transportation and storage
I ~ Accommodation and food activities
J ~ Information and communication
L ~ Real estate activities
M ~ Professional, scientific and technical activities
N ~ Administrative and support service activities
S ~ Other services activities

All the most R&D intensive macro-sectors overperform the prediction from the respective GVC productivity growth rate

Application on MDI



- Both national and GVC productivity growth become less volatile for higher size classes
- **But** the two highest size classes tumbled the most in 2020: because of stronger GVC involvement?

Application on MDI

Baseline specification

$$\Delta Prod_{i,t} = \beta_1 \Delta Prod_{i,t}^{GVC\_front} + \beta_2 \ln\left(Prod_{i,t-1}^{GVC\_front} / Prod_{i,t-1}\right) + \delta_i + \tau_t + \varepsilon_{i,t}$$

- $\Delta Prod_{i,t} = \ln\left(Prod_{i,t} / Prod_{i,t-1}\right)$: Year-on-year log change in labor productivity of firm *i*
- $\Delta Prod_{i,t}^{GVC\_front}$: Year-on-year log change in labor productivity of the GVC frontier of firm *i*
- $\ln\left(Prod_{i,t-1}^{GVC\_front} / Prod_{i,t-1}\right)$: Lagged gap in labor productivity between firm *i* and its GVC frontier, measures the Catch up Effect
- δ_i is firm FE
- τ_t is year FE
- Productivity measures for 21 European partner countries are sourced from CompNet
- Robustness checks with alternative productivity measures (TFP, Solow residuals)

Application on MDI

LogΔ LabProd	(1) Import	(2) Export	(3) Trade	(4) Import	(5) Export	(6) Trade
	All LabProd					
GVC LogΔ LabProd	0.1516 (0.18906)	0.7168*** (0.22168)	0.6627*** (0.19166)	-0.1309 (0.40972)	-0.1305 (0.45841)	0.0640 (0.41978)
Gap from GVC LabProd	0.7299*** (0.00417)	0.7321*** (0.00443)	0.7418*** (0.00376)	0.7612*** (0.00906)	0.8078*** (0.00954)	0.7755*** (0.00861)
R&D Intensity				-0.0385 (0.02438)	0.1193*** (0.03156)	-0.0224 (0.02434)
Observations	70,005	62,438	87,349	15,154	13,168	17,063
Adj. R-squared	0.45898	0.47123	0.46292	0.24673	0.28226	0.25182
Firm FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
	Top 50% LabProd					
GVC LogΔ LabProd	0.3629** (0.16957)	0.5613*** (0.20084)	0.5252*** (0.17782)	0.0224 (0.37937)	-0.1277 (0.42364)	0.1100 (0.39075)
Gap from GVC LabProd	0.7838*** (0.00381)	0.7887*** (0.00404)	0.7952*** (0.00347)	0.8006*** (0.00854)	0.8114*** (0.00908)	0.7951*** (0.00811)
R&D Intensity				0.0994* (0.02536)	0.1047* (0.02673)	0.1066** (0.02485)
Observations	49,107	43,531	59,165	11,268	9,951	12,482
Adj. R-squared	0.35304	0.38672	0.36028	0.011239	0.094554	0.02878
Firm FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
	Top 80% LabProd					
GVC LogΔ LabProd	0.1487 (0.28195)	1.0033*** (0.33967)	0.4848 (0.30916)	0.3578 (0.64351)	0.2692 (0.70097)	0.3407 (0.67999)
Gap from GVC LabProd	0.8137*** (0.00530)	0.8206*** (0.00572)	0.8233*** (0.00494)	0.8246*** (0.01173)	0.8280*** (0.01262)	0.8007*** (0.01139)
R&D Intensity				0.0870*** (0.03125)	0.0883*** (0.03219)	0.0924*** (0.03134)
Observations	23,241	20,563	27,391	5,652	4,978	6,147
Adj. R-squared	0.18091	0.22139	0.1919	-0.81516	-0.61293	-0.79313
Firm FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES

- GVC productivity transmission happens almost entirely on the export side
- Transmission is stronger for the most productive (presumably most internationalized) firms
- R&D Intensity drains significance away from GVC productivity growth
- But the gap with GVC productivity remains significant: regardless the R&D efforts, there may be benefits from engaging with frontier GVC counterparts

Application on MDI

LogΔ LabProd	(1) Import	(2) Export	(3) Trade
GVC LogΔ LabProd	0.1123	0.6602***	0.6380***
	(0.20025)	(0.23587)	(0.20344)
Gap from GVC LabProd	0.7318***	0.7314***	0.7431***
	(0.00424)	(0.00452)	(0.00382)
GVC LogΔ LabProd × Covid Dummy	0.4263	0.4058	0.2966
	(0.57904)	(0.66062)	(0.57538)
Gap from GVC LabProd × Covid Dummy	-0.0188**	0.0064	-0.0124*
	(0.00739)	(0.00815)	(0.00684)
Covid Dummy	-1.8135	4.9669**	-0.4067
	(2.23735)	(2.46282)	(2.04867)
Observations	70,005	62,438	87,349
Adj. R-squared	0.45932	0.47154	0.46332
Firm FE	YES	YES	YES
Time FE	YES	YES	YES

- No evidence of heightened sensitivity to GVC productivity transmission during Covid (no increased exposure to GVC disruptions)
- No significant slow down in the catching up process with the most productive GVC partners
- From the CompNet analysis, both increased exposure and seriously impaired catching up were the case in Europe during Covid
- Dutch firms relatively more robust to GVC disruptions

Conclusions

Netherlands appears broadly in line with the rest of Europe in terms of how Dutch firms engage in GVC productivity transmission.

Still, we found some country-specific characteristics that might contribute to partially shield Dutch firms from the productivity shocks stemming from GVCs, ensuring higher robustness overall:

- Muted productivity transmission from the import side;
- Stronger role of R&D than GVC productivity
- No rising exposure to GVC disruptions during crises
- Scarce slow down of catching up with frontier GVC partners during crises

Future Work

Include more countries in the analysis

Onboard NPBs' suggestions about focusing on multinational firms and refining the GVC computations adding sectoral details

Investigate GVC productivity transmission developments during crises separately for differently productive firms

Thanks for your attention

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