

# CompNet

The Competitiveness Research Network

## EU firms in the Global Economy: a Competitiveness Assessment

Sara Azzarito (IWH/CompNet)  
Leonardo Indraccolo (IWH/CompNet)  
Neeharika Kakunuri (IWH/CompNet)  
Marco Matani (IWH/CompNet)  
Eva Pereira (GEE)

2<sup>nd</sup> TSI Workshop, Halle (Saale) 23 June 2023

23 June 2023



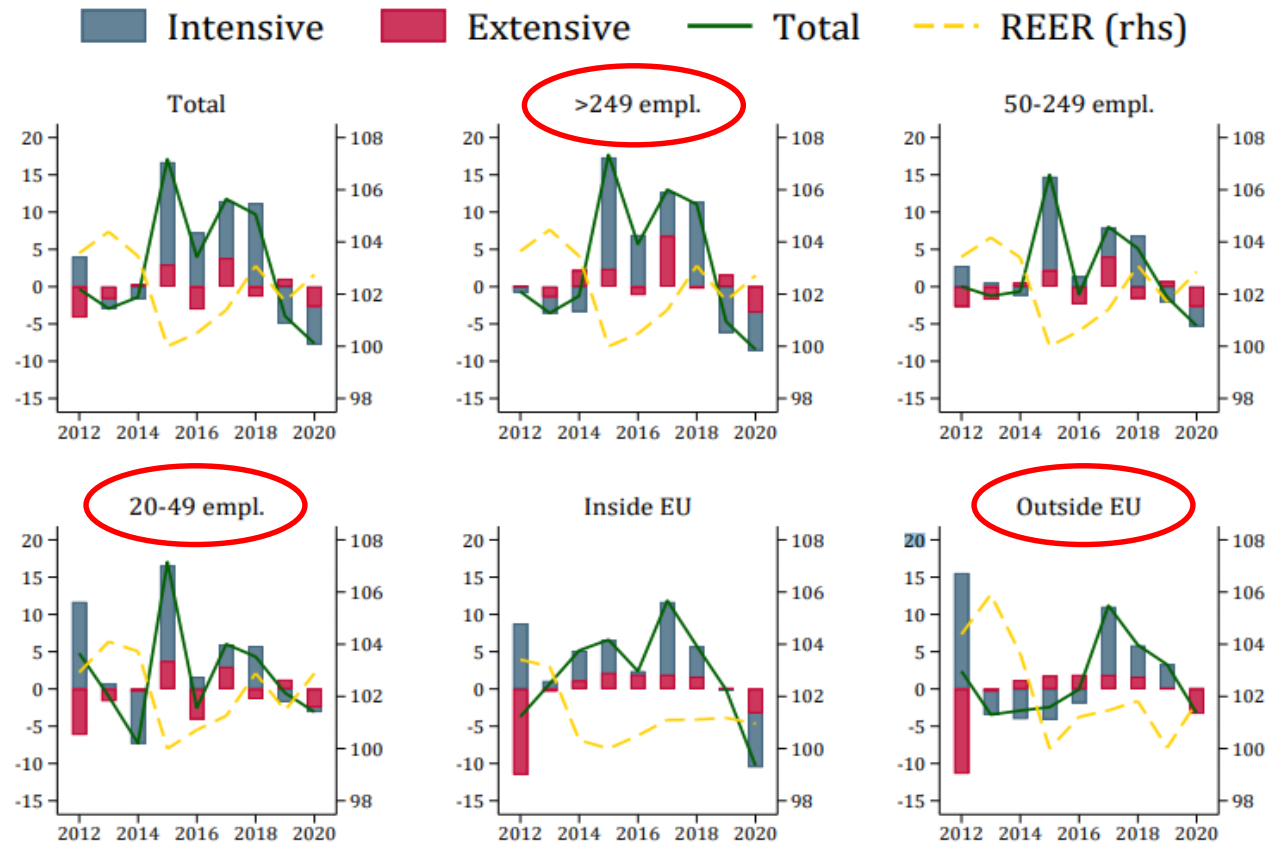
This project has received funding from the European Commission; Directorate-general for Structural Reform Support under grant agreement No 101101853.

## 4 Sections:

- 1) Trade and the COVID-19 shock
- 2) Productivity shocks transmission within GVCs
- 3) Unit Labor Cost as a Driver of Firm Competitiveness
- 4) Disentangling firm competitiveness: The results of an overall Indicator (ECI)

# 1) Trade and the COVID-19 shock

## Export developments by margin. European countries, 2012-2020, % changes



- Export changes: **intensive vs extensive**, by firm characteristics
- Drop in p.p. principally driven by large firms (> 249 empl.)
- Small exporters (20-49 empl.) and exporters mostly trading outside the EU: shock almost entirely at the extensive margins

Source: CompNet 9th Vintage, unconditional\_country\_20e\_unweighted.dta and Eurostat

Note: Year-on-year growth rates. *Intensive* is the mean export value obtained as the ratio between total export amount and number of exporters, both pooled over countries. *Extensive* is the number of exporters pooled over countries. *Total* is total export amount pooled over countries. *REER* are real effective exchange rates, i.e., the nominal effective exchange rates (NEERs) deflated by consumer price indices (CPIs), and are computed for each panel like the average over countries weighted by the respective export share..The *REER* for *Inside EU* covers 27 trading partners in the European Union from 2020, while for all other panels the *REER* covers 15 additional trading partners: AU, CA, US, JP, NO, NZ, MX, CH, UK, TR, RU, CN, BR, KR and HK. Figures are for CZ, DK, FI, FR, HR, HU, LT, MT, PL, PT, RO, SK, SI, and SE. For size classes, figures are for NACE Rev.2 section C - Manufacturing in CZ, DK, FI, FR, HR, HU, LT, MT, PL, PT, RO, SK, SI, and SE. For destinations, figures are for CZ, FI, LT, MT, PT, SK, SI, and SE. Balanced sample over years.

## 2) Productivity shocks transmission within GVCs

- Two-stage diffusion process of technology across countries (Bartelsman et al., 2008 and 2013)
- Building on the work of 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).

### 1<sup>st</sup> Stage: From GVC to National Frontier Firms

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

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

### 2<sup>nd</sup> Stage: From National Frontier to National Mid-Productive and Laggard Firms

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

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

# 2) Productivity shocks transmission within GVCs

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

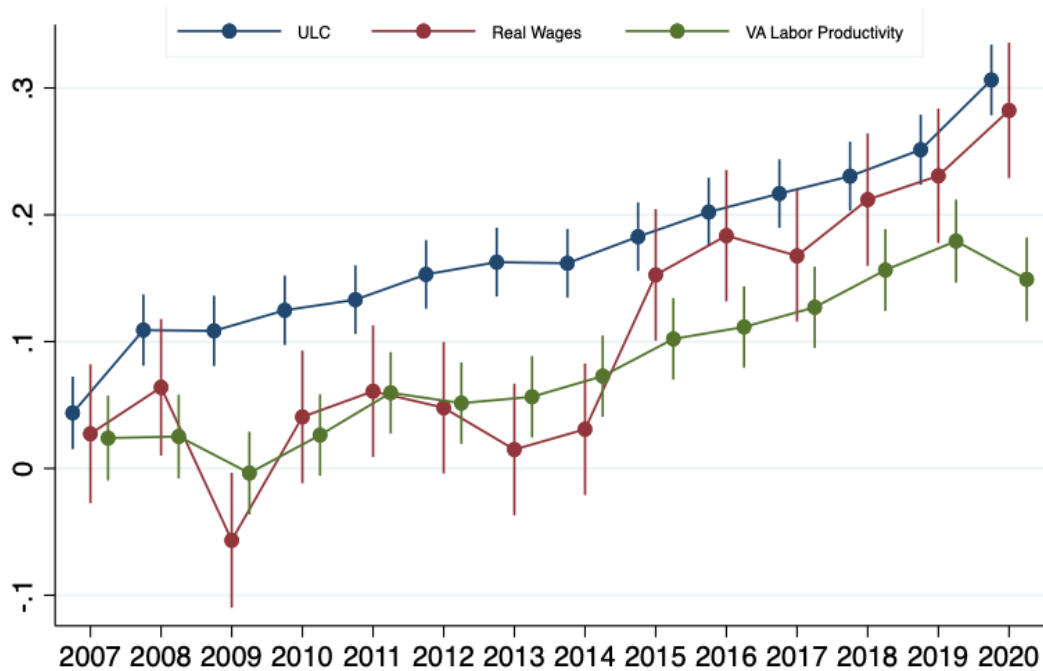
	(1) Frontier	(3) Middle	(5) Laggards
TFP growth GVC (import) frontier	0.4636*** (0.1352)	0.2243** (0.0905)	0.2342 (0.1466)
TFP growth GVC (import) frontier × 2008-2010 dummy	0.1790 (0.2684)	0.1652 (0.1614)	0.7637** (0.3617)
TFP growth GVC (import) frontier × 2020 dummy	1.5797** (0.7425)	0.1781 (0.7159)	0.9058 (1.2805)
Lagged labor productivity gap with GVC (import)	0.1138*** (0.0191)	0.0345* (0.0207)	0.0575** (0.0260)
GVC (import) participation growth	-1.5198 (1.6663)	0.3132 (1.4075)	0.7987 (2.0903)
TFP growth national frontier		0.5267*** (0.0457)	0.5121*** (0.0682)
TFP growth national frontier × 2008-2010 dummy		0.5842*** (0.1285)	0.8458*** (0.1966)
TFP growth national frontier × 2020 dummy		0.5762*** (0.1311)	0.8796*** (0.2848)
Lagged labor productivity gap with national frontier		0.0277 (0.0227)	-0.0227 (0.0390)
2008-2010 dummy	-0.5013** (0.2156)	-0.3058* (0.1681)	-0.6612*** (0.2421)
2020 dummy	-0.3018 (0.3260)	-0.6983*** (0.2302)	-2.1518*** (0.4884)
Constant	1.0791*** (0.2399)	-1.2086** (0.5449)	-1.9191** (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* are firms that belong to the last two deciles of the TFP distribution of each country and macro-sector. In column 2, *Middle* are mid-productive firms whose TFP is 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* are 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. Country-sector fixed effects are included. Results for the GVC frontier computed on exports are 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
- Overall, the COVID-19 shock hit the hardest mid-productive and laggard firms
- Transmission was stronger during COVID-19 → Higher exposure to GVC disruption
  - Direct for national frontier firms
  - Indirect for national mid-productive and laggard firms (through national frontier firms)

# 3) Unit Labor Cost as a Driver of Competitiveness

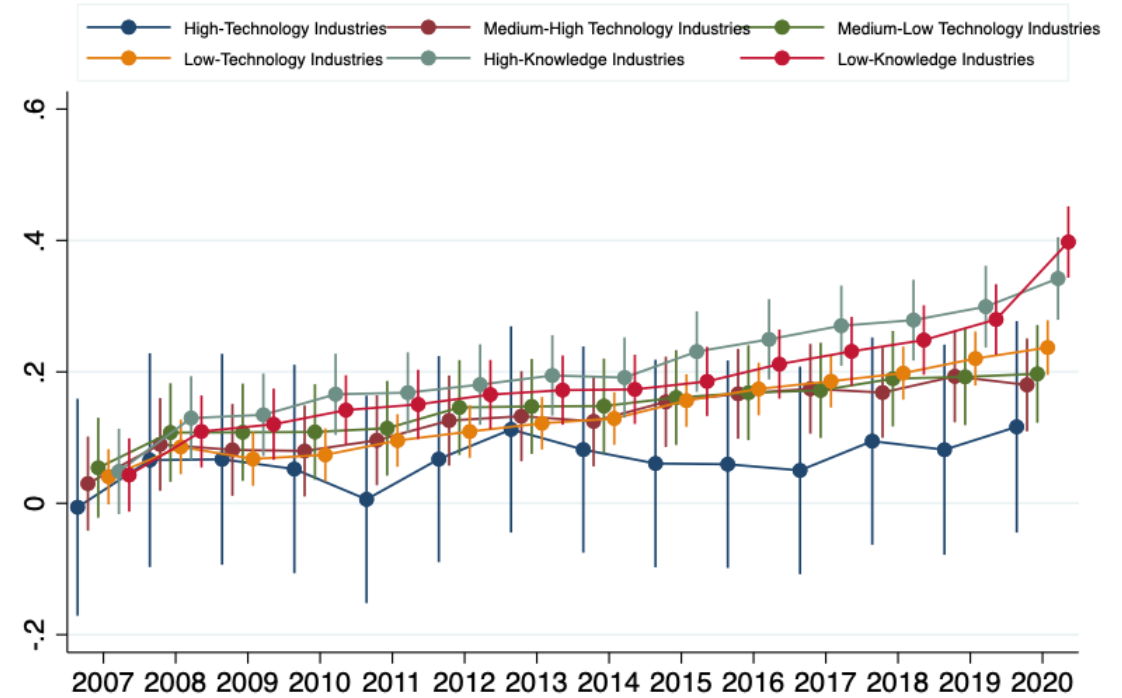
Growth in Value-Added Labor Productivity, Real Wages and ULC  
European Countries, 2007-2020



Source: CompNet 9th Vintage unconditional\_industry2d\_20e\_weighted.dta

Note: Predicted growth of medians at the industry level obtained by regressing on a full set of years, industry and country dummies. *ULC* is the ratio of nominal labor cost over real value added. *Labor Productivity VA* is value added per employee. Unbalanced panel of countries between 2006 and 2020.

ULC by technology and knowledge categories  
European Countries, 2007-2020



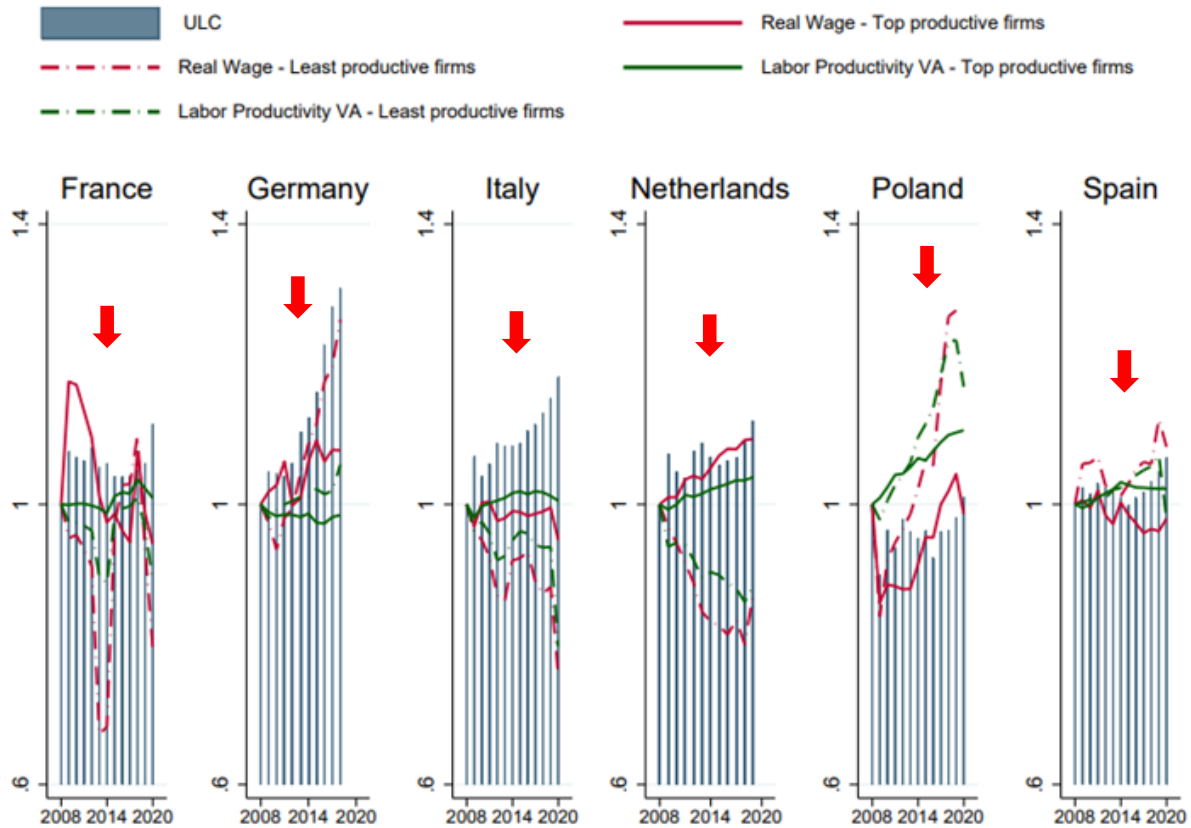
Source: CompNet 9th Vintage unconditional\_industry2d\_20e\_weighted.dta

Note: Predicted growth of medians at the industry level obtained by regressing on a full set of years, industry and country dummies. *ULC* is the ratio of nominal labor cost over real value added. *Labor Productivity VA* is value added per employee. Unbalanced panel of countries between 2006 and 2020.

- Constantly increasing ULC due to the continuous growth in real wages
- High-technology industries maintained their levels of competitiveness over time

# 3) Unit Labor Cost as a Driver of Competitiveness

ULC, Labour Productivity, and Real Wages by countries and productivity deciles  
Six Largest European Economies, 2008-2020, Index 2008=1



Source: CompNet 9<sup>th</sup> Vintage, unconditional\_country\_20e\_weighted.dta and jd\_inp\_prod\_country\_20e\_weighted.dta  
 Note: *Top* and *Least productive firms* are respectively firms in the 10<sup>th</sup> and 1<sup>st</sup> deciles of the distribution of value-added labor productivity. *ULC* computed at the country level as the ratio of nominal labor cost over real value added. *Labor Productivity VA* is value added per employee. *ULC*, *Real Wages*, and *Labor Productivity VA* are medians at the country level. Data for Germany and the Netherlands until 2018 and 2019, respectively.

- Increasing ULC across countries
- Heterogenous patterns
  - Surging real wages of the least productive firms (Germany and Spain)
  - Strong productivity growth counteracts wage increases and neutralizes ULC growth (Poland)
  - Stagnant productivity of the most productive firms, collapsing productivity for the least productive firms (Italy, France, Netherlands)

# 4) The Enterprise Competitiveness Indicator

The **Enterprise Competitiveness Indicator** (Lourenço et al., 2022) is a novel statistical indicator that aims to

- Systematize complex comparative microdata analysis
- Provide a comprehensive and accurate view of the international relative performance of firms/industries
- Provide analytical tools for competitiveness assessment for economic policy analysis
- Develop meaningful statistical indicators relevant for industrial policy analysis



# 4) The Enterprise Competitiveness Indicator

Development of a composite indicator measuring the relative performance of firms/industries to develop sustained competitive advantages to compete in the global market

Dimension	Competitiveness Determinant	Variables – CompNet Database
<b>1. Return</b>	Profit orientation	Return on assets (ROA); Estimated markup; Value added on Revenues; Operating profits on revenue
<b>2. Production Costs</b>	Cost Efficiency	Price cost margin; Revenue coverage of capital costs; Revenue coverage of labor costs; Revenue coverage of intermediate costs
<b>3. Productivity</b>	Efficiency of production factors	Labor productivity; Capital productivity; Capital Intensity
<b>4. Risk</b>	Financial risks	Collateral on total assets; Debt/Total assets; Cash flow/Total assets
<b>5. Quality Orientation</b>	Ability to develop future competitive advantages	Intangible fixed assets on Revenues; Wage premium; Estimated returns to scale

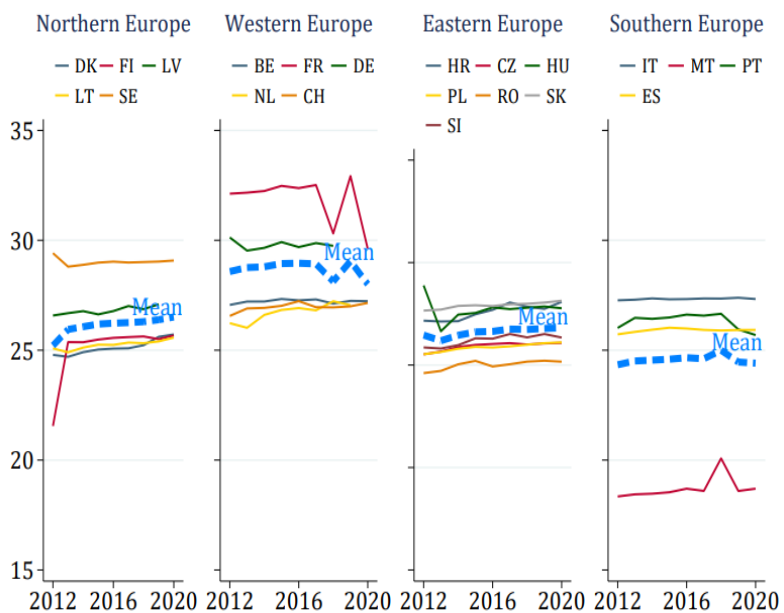
# 4) The Enterprise Competitiveness Indicator

- We rank countries according to firm competitiveness as measured by a micro-aggregated **Enterprise Competitiveness Indicator (ECI)** (Amador et al., 2022; Lourenço et al., 2022)
- Composed of 5 **dimensions** equally weighted
- Each dimension is composed of 3 or 4 **variables** equally weighted within the dimension
- All variables are standardized by the **min-max procedure** (Nardo et al., 2008)

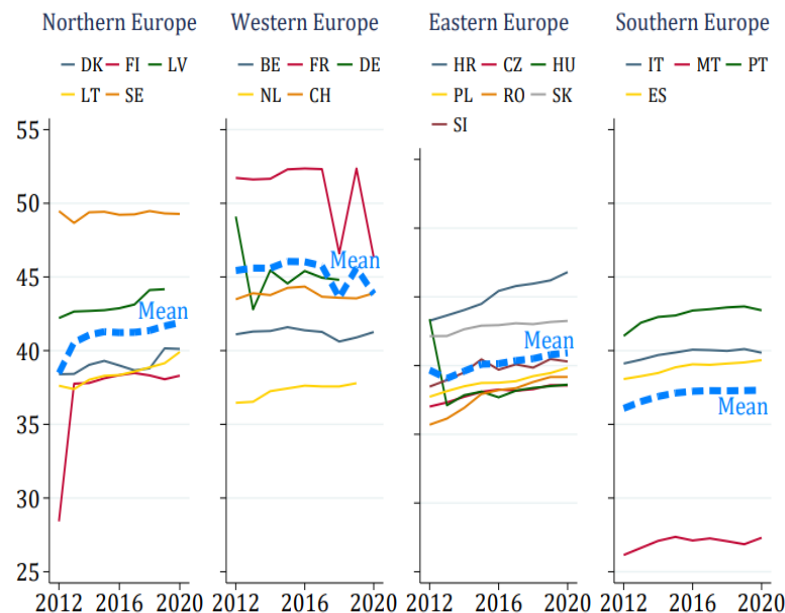
Dimension $D^n$	Firm characteristics	Variables $X^{v,n}$
1. Return	Profit orientation	Return on assets (ROA); Estimated markup; Value added on Revenues; Operating profits on revenue
2. Production Costs	Coverage of production costs	Price cost margin; Revenue coverage of capital costs; Revenue coverage of labor costs; Revenue coverage of intermediate costs
3. Productivity	Efficiency of production factors	Labor productivity; Capital productivity; Capital Intensity
4. Risk	Financial risks	Collateral on total assets; Debt/Total assets; Cash flow/Total assets
5. Quality Orientation	Ability to develop future competitive advantages	Intangible fixed assets on Revenues; Wage premium; Estimated returns to scale

# 4) The Enterprise Competitiveness Indicator

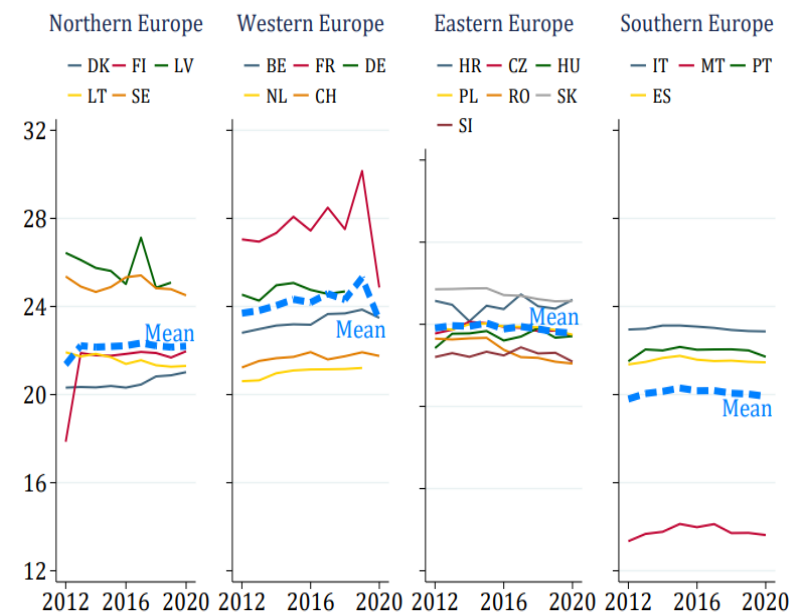
## Overall (%)



## Return (%)



## Production Cost (%)



Source: CompNet 9<sup>th</sup> Vintage, unconditional\_mac\_sector\_20e\_weighted

Note: The ECI variables are standardized like in equation (1) using the minima and maxima taken over the entire time span. Mean is the unweighted average for countries with complete time series in each group. Data for Finland does not include "Information and communication" and "Professional, scientific and technical activities". Data for Germany does not include "Construction" and "Wholesale and retail trade; repair of motor vehicles and motorcycles". Data for Malta are only representative of "Wholesale and retail trade; repair of motor vehicles and motorcycles". Data for Slovenia does not include "Information and communication". Data for the Latvia and the Netherlands until 2019. Data for Germany until 2018.

- Stagnant overall competitiveness

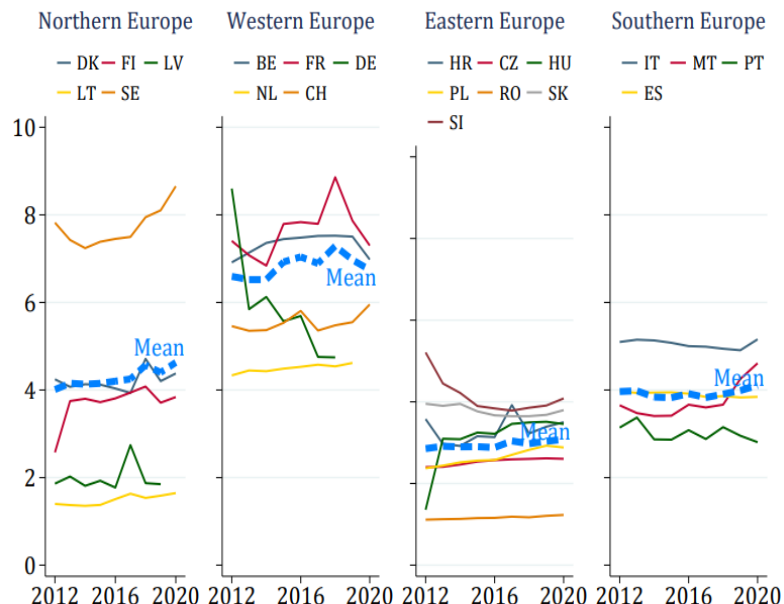
- Northern Europe: +5.16%
- Western Europe: -2.03%
- Eastern Europe: +1.33%
- Southern Europe: +0.30%

- Return on the rise...

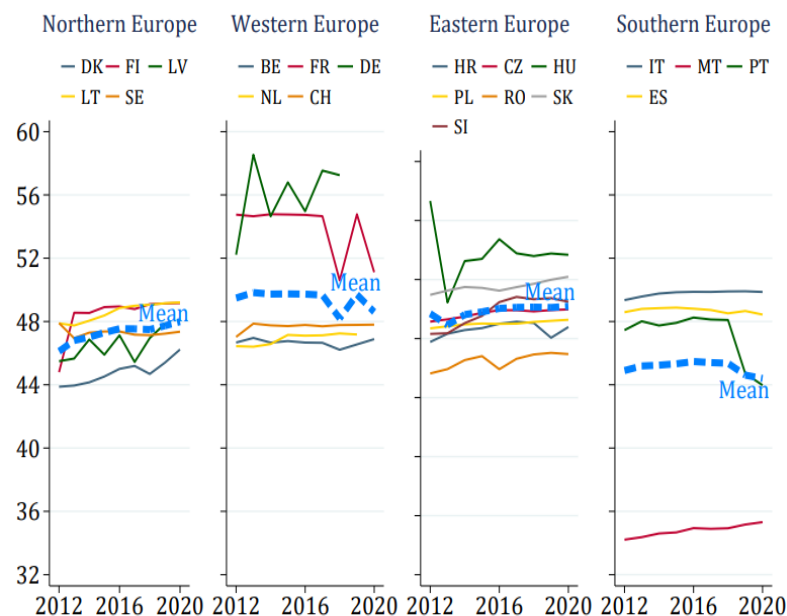
- Northern Europe: +8.90%
- Western Europe: -3.53%
- Eastern Europe: +3.18%
- Southern Europe: +3.42%

# 4) The Enterprise Competitiveness Indicator

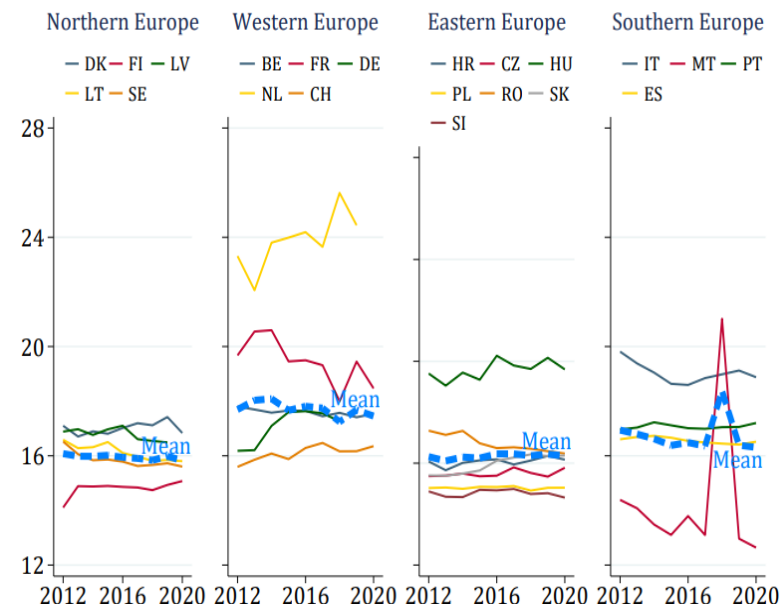
## Productivity (%)



## Risk (%)



## Quality Orientation (%)



Source: CompNet 9<sup>th</sup> Vintage, unconditional\_mac\_sector\_20e\_weighted

Note: The ECI variables are standardized like in equation (1) using the minima and maxima taken over the entire time span. Mean is the unweighted average for countries with complete time series in each group. Data for Finland does not include "Information and communication" and "Professional, scientific and technical activities". Data for Germany does not include "Construction" and "Wholesale and retail trade; repair of motor vehicles and motorcycles". Data for Malta are only representative of "Wholesale and retail trade; repair of motor vehicles and motorcycles". Data for Slovenia does not include "Information and communication". Data for the Latvia and the Netherlands until 2019. Data for Germany until 2018.

- ...but also Productivity grew

- Northern Europe: +15.44%
- Western Europe: +2.29%
- Eastern Europe: +7.87%
- Southern Europe: +3.53%

- The Netherlands stand out in terms of Quality Orientation

# 4) The Enterprise Competitiveness Indicator

ECI, REER and Market Shares

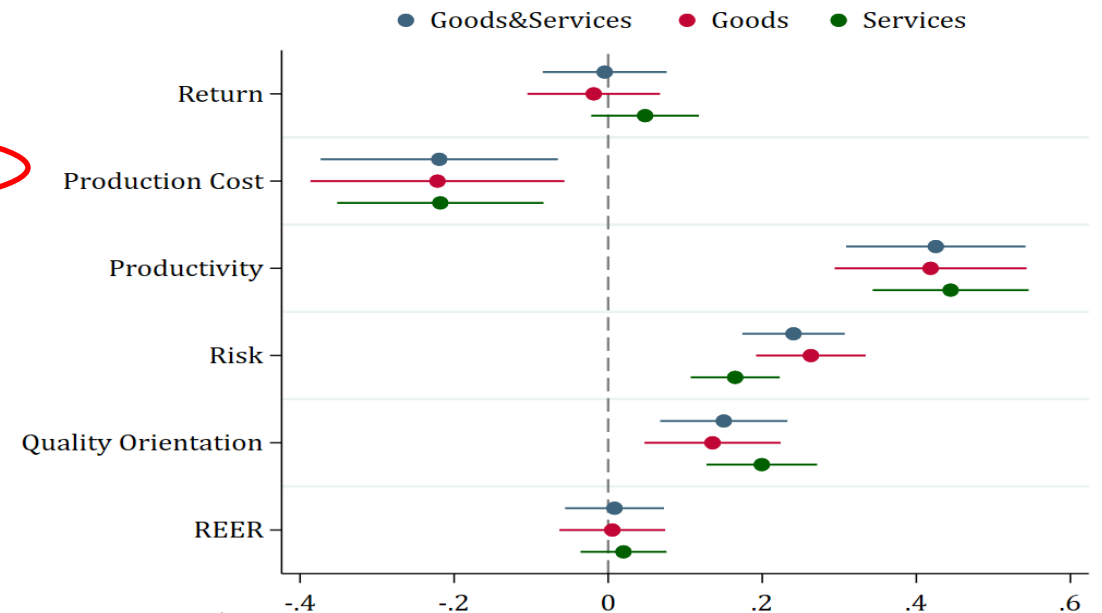
	(1) Goods & Services	(2) Goods	(3) Services
ECI	0.3263*** (0.0428)	0.3216*** (0.0448)	0.3429*** (0.0400)
REER	0.0699* (0.0397)	0.0686 (0.0416)	0.0761** (0.0371)
Constant	-14.5172*** (4.1744)	-14.2904*** (4.3745)	-15.4898*** (3.8990)
Observations	176	176	176
Adjusted R-squared	0.2355	0.2107	0.2874

Source: CompNet 9<sup>th</sup> Vintage, unconditional\_mac\_sector\_20e\_weighted and Eurostat

Note: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Year fixed effects are included. The real effective exchange rates (REERs) aim to assess a country's price or cost competitiveness relative to its principal competitors in international markets. REERs are the nominal effective exchange rates (NEERs) for 42 trading partners deflated by consumer price indices (CPIs).

- Our micro-aggregated ECI explains a significant part of export market shares (better than REER)

ECI by dimension, REER, and Market Shares



Source: CompNet 9<sup>th</sup> Vintage, unconditional\_mac\_sector\_20e\_weighted and Eurostat

Note: The ECI is computed like in Appendix C. Coefficients from regressing market share on all pooled ECI dimensions and REER with year fixed effects. The real effective exchange rates (REERs) aim to assess a country's price or cost competitiveness relative to its principal competitors in international markets. REERs are the nominal effective exchange rates (NEERs) for 42 trading partners deflated by consumer price indices (CPIs).

- Productivity, Risk, and Quality Orientation are the most significant dimensions

# Conclusions

- Small firms with less than 50 employees mostly reacted to COVID-19 by ceasing serving international markets
- The pandemic heightened productivity transmission, increasing exposure to GVC disruption
- ULC has been deteriorating in Europe with heterogeneous patterns across countries
- The micro-aggregated ECI documents stagnant European competitiveness over the last decade and explains well countries' export market shares
- Future steps for the Enterprise Competitiveness Indicator:
  - Develop alternative methodologies – Distance to Frontier (What Frontier?)
  - Robustness Evaluation: alternative variables and standardization procedures

# CompNet

The Competitiveness Research Network

THANK YOU FOR YOUR  
ATTENTION

Q & A

# References

Amador, J., Fernandes, A. and Nogueira, G. (2022) “The competitiveness of the Portuguese economy: A view from a composite indicator”, Banco de Portugal Economic Studies, Vol. VIII, pp.29-54

Bartelsman, Eric J. and Haskel, Jonathan and Martin, Ralf (2008) Distance to Which Frontier? Evidence on Productivity Convergence from International Firm-Level Data. CEPR Discussion Paper No. DP7032, Available at SSRN: <https://ssrn.com/abstract=1311156>

Bartelsman, E. J., J. Haltiwanger and S. Scarpetta (2013): “Cross-Country Differences in Productivity: The Role of Allocation and Selection”, The American Economic Review, Vol. 103 (1), 305-334

Chiacchio, F., K. Gradeva and P. Lopez-Garcia (2018) “The post-crisis TFP growth slowdown in CEE countries: exploring the role of Global Value Chains”, ECB Working Paper, No. 2143, European Central Bank (ECB), Frankfurt a. M.

Lourenço, M., C. Magalhães, A. Martins, F. Martins, E. Pereira, M. Pereira, R. Ponte and H. Reis (2022) “Um Indicador Compósito De Competitividade Das Empresas”, Banco de Portugal Occasional Papers



## ***The GVC frontier***

The GVC frontier is specific to each country  $c$ , macro-sector  $s$ , and year  $t$ . The TFP growth of the GVC frontier is the weighted average of the year-on-year TFP growth of national frontier firms in each partner country  $c'$  and macro-sector  $s'$ :

$$\Delta TFP_{c,s,t}^{GVC\_front\_f} = \sum_{c'} \sum_{s'} \frac{x_{c,s,c',s',t}^f}{\sum_{c'} \sum_{s'} x_{c,s,c',s',t}^f} \Delta TFP_{c',s',t}^{nat\_front} \quad (1)$$

where  $x_{c,s,c',s',t}^f$  is the amount of flow  $f$  (export or import) traded between macro-sector  $s$  in country  $c$  and macro-sector  $s'$  in country  $c'$  at time  $t$ .  $\Delta TFP_{c',s',t}^{nat\_front}$  is the year-on-year logarithmic TFP growth of national frontier firms in partner country  $c'$  and macro-sector  $s'$  in year  $t$ , that is, of firms in the top two deciles of the TFP distribution for  $c'$  and  $s'$  at time  $t$ .

[Back](#)

# Appendix

Supposing we were handling firm-level information, similarly to Lourenço et al. (2022) our ECI would be computed for the firm  $i$  like the average of five dimensions  $\{D_i^n\}_{n=1,\dots,5}$  with each dimension being weighted the same. In turn, each dimension would be computed as the average of a number  $NV^n$  of variables  $X_i^{n,v}$ . As a preliminary stage, each variable  $X_i^{n,v}$  is standardized into a 0-1 scale using the cross-country minimum and maximum over the sector  $s$  to which firm  $i$  belongs:

$$SX_i^{n,v} = \frac{X_i^{n,v} - \min_s(X^{n,v})}{\max_s(X^{n,v}) - \min_s(X^{n,v})} \quad (1)$$

Hence, the ECI for firm  $i$ ,  $ECI_i$ , would be calculated as follows:

$$ECI_i = \frac{1}{5} \sum_{n=1}^5 D_i^n = \frac{1}{5} \sum_{n=1}^5 \frac{1}{NV^n} \sum_{v=1}^{NV^n} SX_i^{n,v} \quad (2)$$

Appendix C proves that CompNet allows to compute the simple average of the firm-level ECI  $ECI_i$  like in equation 2,  $E^{c,s}[ECI_i]$ , for all macro-sectors  $s = 1, \dots, S$  of country  $c$  starting from the micro-aggregated averages of the variables at the macro-sectoral level. The simple average firm-level ECI at the country level  $E^c[ECI_i]$  is obtained by averaging macro-sectors using population weights.

[Back](#)