Deglobalization and the reorganization of supply chains

Effects on regional inequalities in the EU

Glenn Magerman
ECARES, ULB
CEPR and CESIfo

Alberto Palazzolo
ECARES, ULB
NBB

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Globalization is slowing down after 50+ years

Globalization has slowed down since 2008

- Natural supply chain disruptions
- Geopolitical tensions and armed conflicts.
- Revealing vulnerabilities from (in)direct exposure to the world.

Political blocks implemented measures to

- reduce dependence on third countries,
- incentivize domestic production.

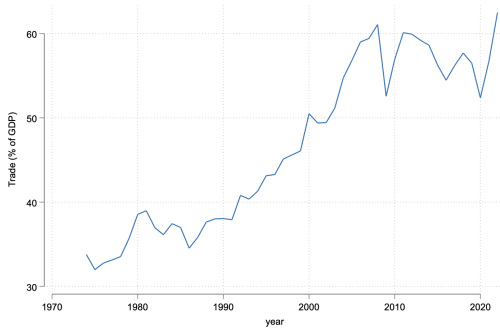


Figure: World trade-to-GDP (%), World Bank.

Protectionist measures have been rising since 2008

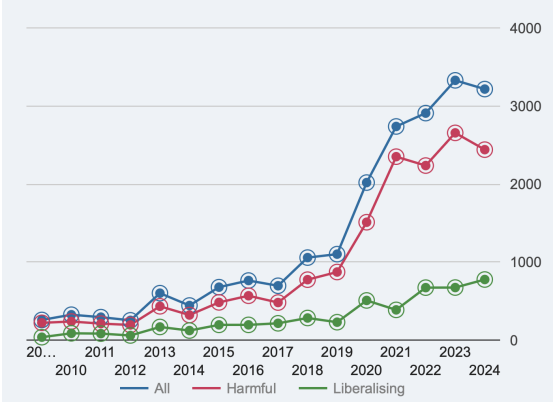


Figure: Yearly new interventions, Global Trade Alert.

USA: Investment and Jobs Act (2021), CHIPS and Science Act (2022), Defence Production Act (2022), Inflation Reduction Act (2022).

EU: Open Strategic Autonomy (2013-...), Recovery and Resilience Facility (2021), relaxation of EU state aid rules (2022), RePowerEU (2023), EU Chips Act (2023), Green Deal, Blue Deal.

Individual countries: Industrial Policy (France, Germany, ...), security (Art 346 TFEU).

Sub-national regions: European Semiconductor Regions Alliance (2023), 27 regions from 12 EU Member States.

What is the impact of protectionist measures on EU welfare?

Various policy instruments to incentivize domestic production

- Trade policy, industrial policy, public policy.

Each type of policy has direct and indirect effects on the EU and its regions

- Example: tariffs on steel from China on Bayern vs Andalucia.
- Direct exposure: import share of sector-regions using Chinese steel in production.
- Indirect exposure: spillovers to other EU sector-regions (supply chains).

Yet we don't know how EU regions are exposed, connected, or affected

- Regional information on production/consumption and IO linkages is scarce.
- Optimal policy depends on EU economic structure.
- Which policies to implement?

This paper

Evaluate a toolbox of protectionist policies

- Trade, industrial, and public policy.
- Different levels of decision making (supranational vs local).

Develop a quantitative GE framework to evaluate these policies

- Multi-sector, multi-region, with input-output linkages within/across regions.
- Monopolistic competition, industry-level economies of scale, and public goods.
- Local/EU governments choosing policies, raise taxes and provide subsidies to fund these.
- Nests Arkolakis Costinot Rodriguez-Clare (2012) and Lashkaripour Lugovskyy (2023).

Quantify their impact on EU welfare and that of its regions

- All EU NUTS2 regions (235) + ROW, 55 sectors and IO linkages within/across regions.

Preview of results

Aggregate (EU) welfare effects

- Trade policy: negative welfare effects.
- Industrial, public policy: positive effects.

Channels that affect welfare

- Classical gains from trade effects are small.
- Economies of scale boost welfare under each policy.
- Input-output linkages dominate under each policy.

Regional heterogeneity

- Small aggregate effects obfuscate massive variation across regions.
- Within countries, some regions are top winners and others top losers under same policy.
- A region can win under one policy and lose in another.

Today

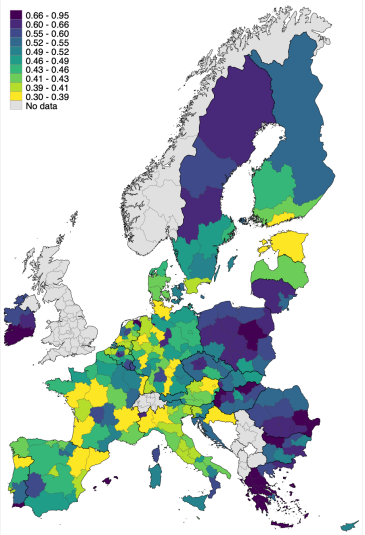
Regional heterogeneity and EU budget

Quantitative framework

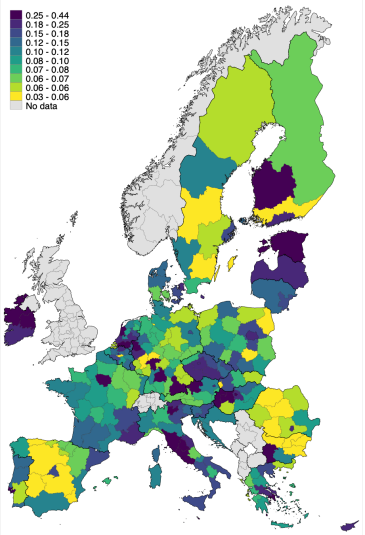
Welfare channels

Welfare effects of policies

Production and trade patterns are highly dispersed across EU regions



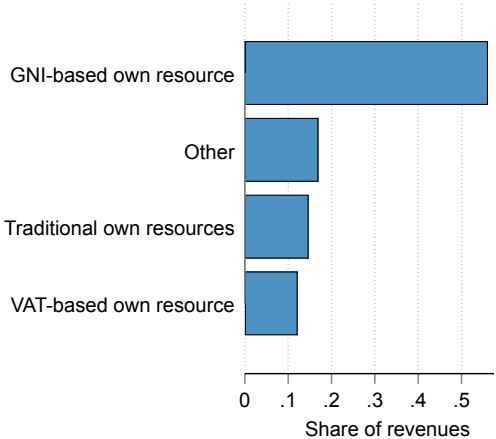
Krugman Specialization Index (value added).

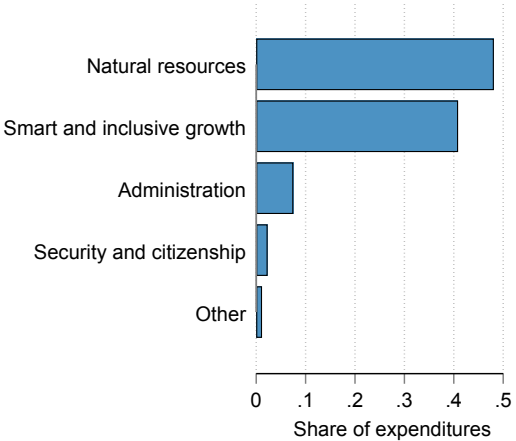


Import penetration ratio (manufacturing).

EU budget: sources of revenues and areas of expenditures

Long-term: Multi-annual Financial Framework (MFF) (e.g. 2014-2020, 1.08 trillion euro).
Yearly: 139 billion euro, must be balanced (Art 310 TFEU).





Quantitative framework

Households

Preferences: Households in region j maximize

$$U_j(C_j, G_j) = C_j^{\eta_j} G_j^{1-\eta_j}$$

with $C_j = \prod_{s=1}^{S} \left(Q_j^s\right)^{\alpha_j^s}$ and $\prod_{s=1}^{S} \left(G_j^s\right)^{\delta_j^s}$

$$\underbrace{Q_j^s = \left(\sum_{i=1}^{N} (Q_{ij}^s)^{\frac{\sigma^s - 1}{\sigma^s}} \right)^{\frac{\sigma^s}{\sigma^s - 1}}}_{\text{across regions}} \qquad \underbrace{Q_{ij}^s = \left[\int_{\omega} q_{ij}^s(\omega)^{\frac{\theta^s - 1}{\theta^s}} d\omega \right]^{\frac{\theta^s}{\theta^s - 1}}}_{\text{across varieties}}$$

Demand for e.g. cars across countries (Fra/Ger) and brands (Peugeot/Renault/BMW/Audi).

Gross National Income of region j

$$I_j = \underbrace{w_j L_j + r_j K_j}_{\text{domestic value added}} + \underbrace{\chi_j \sum_{i=1}^{N} r_i K_i - r_j K_j}_{\text{net foreign income}} - \underbrace{T_j^{LOC} - \phi_j T^{EU}}_{\text{taxes}}$$

Production

Technology: Sector s in region i produces a continuum of varieties ω with CRS technology

$$q_i^s(\omega) = Z_i^s \left[L_i^s(\omega)^{\gamma_i} K_i^s(\omega)^{1-\gamma_i} \right]^{1-\beta_i^s} \prod_{r=1}^{S} \left[\left(Q_i^r \right)^{\rho_i^{rs}} \right]^{\beta_i^s}$$

Prices for sector s goods from i to j

$$P_{ij}^s = \frac{\theta^s}{\theta^s - 1} \frac{c_i^s \tau_i^s \kappa_{ij}^s}{Z_i^s} M_i^{s \, -\frac{1}{\theta^s - 1}}$$

where M_i^s is the (endogenous) mass of firms.

External economies of scale:

$$-\frac{\partial \ln P_{ij}^s}{\partial \ln M_i^s} = \frac{1}{\theta^s - 1} = \mu^s$$

Local governments in each region i

Raise ad valorem taxes T_i^s and provide subsidies S_i^s on production of sector s goods.
Total net tax revenues are

$$\bar{T}_i = \sum_{s=1}^{S} (T_i^s - S_i^s) = \sum_{s=1}^{S} Y_i^s c_i^s \tilde{\tau}_i^s$$

Provide public goods
Total public goods consumption by the government is $\bar{G}_i = \sum_s P_i^s G_i^s$.

Can run unbalanced budgets
Budget constraint is given by $\bar{G}_i - T_i^{LOC} - \bar{T}_i = B_i$ where $B_i \gtrless 0$ is the local budget imbalance.

The supranational government

Collects taxes from regions as share of GNI: $T^{EU} = \sum_{i \in EU} \phi_i T^{EU}$.

Sets trade policy t_{ij}^s **and collects tariff revenues** $R_i = \sum_{j \in N} \sum_{s \in S} t_{ij}^s X_j^s$.

Redistributes money to local governments running imbalances B_i.

Runs a balanced budget

$$\sum_{i \in EU} \phi_i T^{EU} + \sum_{i \in EU} R_i - \sum_{i \in EU} B_i = 0$$

A region can be **net recipient or net contributor** of supranational funds:

$$\phi_i T^{EU} - B_i \gtrless 0$$

Welfare channels

Decomposing the welfare effects of policies

Change in welfare for region j is given by:

$$\hat{W}_j = \left(\frac{\hat{I}_j}{\hat{P}_j}\right)^{\eta_j} \left(\hat{G}_j\right)^{1-\eta_j}$$

$$d\log W_j = \underbrace{\eta_j \left[\left(\frac{w_j L_j}{I_j} - 1\right) d\log w_j + \chi_j \sum_{i=1}^{N} \frac{r_i K_i}{I_j} d\log w_i - \phi_j \frac{\mathrm{d}T^{EU}}{I_j}\right.}_{\text{Income}}$$

$$\underbrace{\left. - \sum_{s=1}^{S}\sum_{r=1}^{s} \alpha_j^s \tilde{\psi}_j^{rs} \frac{d\log \lambda_{jj}^r}{\sigma^r - 1} - \sum_{s=1}^{S}\sum_{r=1}^{S} \alpha_j^s \tilde{\psi}_j^{rs} d\log\left(\frac{\tau_j^r}{Z_j^r}\right) + \sum_{s=1}^{S}\sum_{r=1}^{S} \alpha_j^s \mu^r \tilde{\psi}_j^{rs} \left(d\log Y_j^r - d\log \bar{Y}_j\right)\right]}_{\text{Price index}}$$

$$\underbrace{+ (1-\eta_j)\left[\sum_{s=1}^{S} \delta_j^s d\log G_j^s\right]}_{\text{Public goods}}$$

Welfare effects: Where do policies enter the model?

Policies Trade policy: t_{ij}^s (inside λ_{ij}^r). Industrial policy: τ_j^r. Public policy: G_j^r (inside Y_j^r).

$$
\begin{aligned}
d\log W_j = \quad & \eta_j \left[\left(\frac{w_j L_j}{I_j} - 1 \right) d\log w_j + \chi_j \sum_{i=1}^{N} \frac{r_i K_i}{I_j} d\log w_i - \phi_j \frac{\mathrm{d}\, T^{EU}}{I_j} - \right. \\
& - \sum_{s=1}^{S} \sum_{r=1}^{s} \alpha_j^s \tilde{\psi}_j^{rs} \frac{d\log \lambda_{jj}^r}{\sigma^r - 1} - \sum_{s=1}^{S} \sum_{r=1}^{S} \alpha_j^s \tilde{\psi}_j^{rs} d\log \left(\frac{\tau_j^r}{Z_j^r} \right) + \sum_{s=1}^{S} \sum_{r=1}^{S} \alpha_j^s \mu^r \tilde{\psi}_j^{rs} \left(d\log Y_j^r - d\log \bar{Y}_j \right) \Bigg] \\
& + (1 - \eta_j) \left[\sum_{s=1}^{S} \delta_j^s d\log G_j^s \right]
\end{aligned}
$$

Welfare effects: model channels

$$
\begin{aligned}
d\log W_j = \quad & \eta_j \left[\left(\frac{w_j L_j}{I_j} - 1 \right) d\log w_j + \chi_j \sum_{i=1}^{N} \frac{r_i K_i}{I_j} d\log w_i - \phi_j \frac{\mathrm{d}T^{EU}}{I_j} \right. \\
& \underbrace{- \sum_{s=1}^{S} \sum_{r=1}^{s} \alpha_j^s \tilde{\psi}_j^{rs} \frac{d\log \lambda_{jj}^r}{\sigma^r - 1}}_{\text{Gains from trade}} \underbrace{- \sum_{s=1}^{S} \sum_{r=1}^{S} \alpha_j^s \tilde{\psi}_j^{rs} d\log \left(\frac{\tau_j^r}{Z_j^r} \right)}_{\text{Productivity}} + \underbrace{\sum_{s=1}^{S} \sum_{r=1}^{S} \alpha_j^s \mu^r \tilde{\psi}_j^{rs} \left(d\log Y_j^r - d\log \bar{Y}_j \right)}_{\text{External economies of scale}} \\
& \left. + (1 - \eta_j) \left[\sum_{s=1}^{S} \delta_j^s d\log G_j^s \right] \right]
\end{aligned}
$$

Economies of scale

- If $\mu^s = 0$, there are no EES. All effects are on the firm intensive margin.
- If $\mu^s > 0$, increase in demand triggers firm entry, lowering prices.

Welfare effects: input-output linkages

$$
\begin{aligned}
d\log W_j = \quad & \eta_j \left[\left(\frac{w_j L_j}{I_j} - 1 \right) d\log w_j + \chi_j \sum_{i=1}^{N} \frac{r_i K_i}{I_j} d\log w_i - \phi_j \frac{\mathrm{d}\, T^{EU}}{I_j} \right. \\
& \underbrace{- \sum_{s=1}^{S} \sum_{r=1}^{s} \alpha_j^s \tilde{\psi}_j^{rs} \frac{d\log \lambda_{jj}^r}{\sigma^r - 1}}_{\text{Gains from trade}} \underbrace{- \sum_{s=1}^{S} \sum_{r=1}^{S} \alpha_j^s \tilde{\psi}_j^{rs} d\log \left(\frac{\tau_j^r}{Z_j^r} \right)}_{\text{Productivity}} \\
& \underbrace{+ \sum_{r=1}^{S} \mu^r \tilde{\psi}_j^{rs} \left(\sum_{i=1}^{N} \sum_{k=1}^{S} \psi_{ji}^{rk} d\log F_i^k - \sum_{r=1}^{S} \frac{L_j^r}{L_j} \sum_{i=1}^{N} \sum_{k=1}^{S} \psi_{ji}^{rk} d\log F_i^k \right)}_{\text{External economies of scale}} \\
& \left. + d\log w_j + (1 - \eta_j) \left[\sum_{s=1}^{S} \delta_j^s d\log G_j^s \right] \right]
\end{aligned}
$$

Input-output multipliers: Prices of sector s in j

- High $\tilde{\psi}_j^{rs}$: r is an important supplier to $s \rightarrow \Delta$VA contributes more to price change in s.
- High ψ_{ji}^{rk}: k is an important customer of $r \rightarrow \Delta$FD triggers firm entry and lowers prices.

Welfare effects of policies

Data sources

Regional production, value added, consumption, value chains, net taxes

- MRIO data for RHOMOLO model (JRC at the European Commission).
- 235 EU regions, 19 extra-EU, 1 RoW aggregate.
- 55 sectors in each region, with their IO linkages within and across regions/countries.

EU transfers to NUTS2 regions

- Regional Cohesion data (Open Data Platform, European Commission).
- Used to calculate initial values for B_i.

Policy exercises

Exercise 1 – Trade policy

- 10% increase in trade costs for all manufacturing imports κ_{ij}^{s}.
- Raised by the supra-national government.

Exercise 2 – Industrial policy

- 10% increase to production subsidies in all manufacturing sectors τ_{i}^{s}.
- Provided by each local government to its own sectors.

Exercise 3 – Public policy

- 10% increase in final demand for manufacturing sectors G_{i}^{s}.
- Provided by each local government to its own sectors.

Aggregate welfare effects

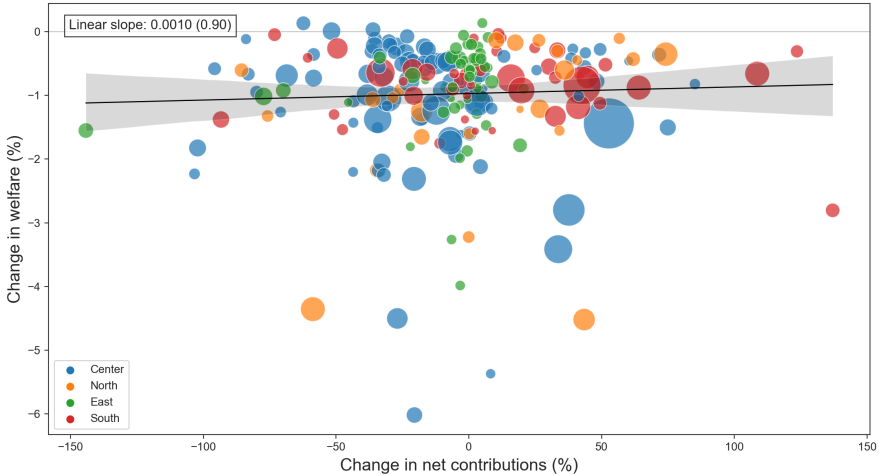
EU $\hat{W}$(%)	ACR	ACR + EES	Full	Stdev(Full)
Trade policy	-0.16	-0.11	-0.27	0.49
Industrial policy	0.00	0.01	0.03	0.15
Public policy	-0.03	-0.03	0.01	0.08

Notes: EU aggregate welfare effects is GNI weighted sum of regional outcomes: $\hat{W} = \sum_j \phi_j \hat{W}_j$. Stdev is the standard deviation across regional outcomes.

Trade policy

Intuition: Imports drop. Reallocation to intra-EU suppliers, but at higher prices.

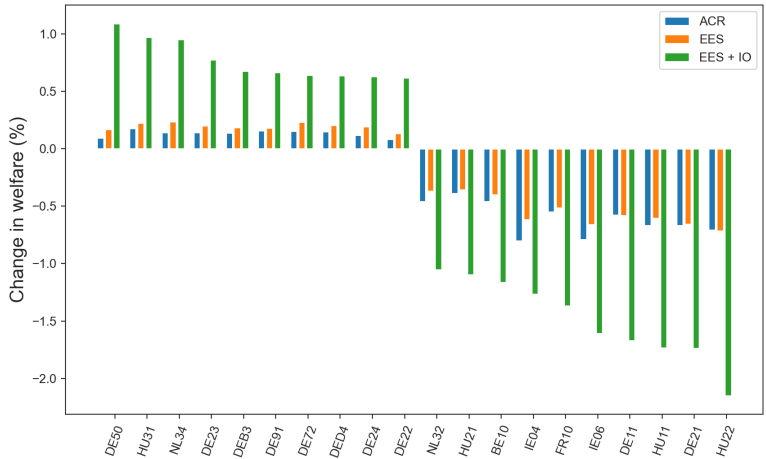
Welfare: Almost every region loses. Large variation in Center, less for South.



Trade policy

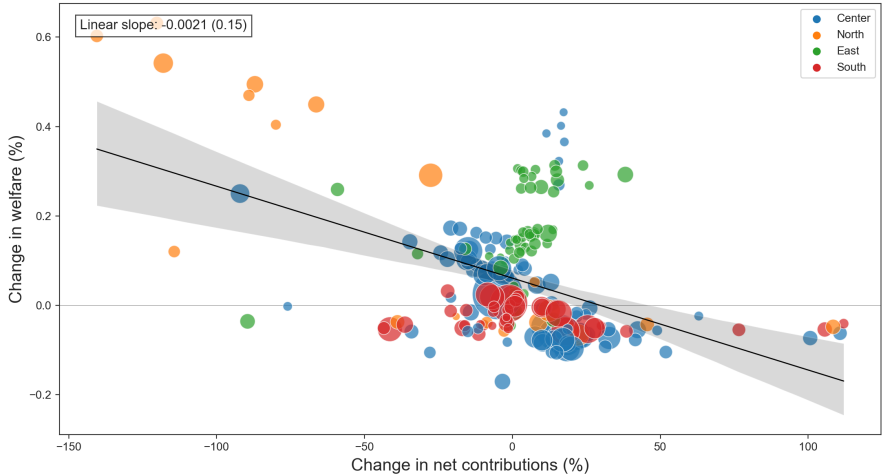
Massive heterogeneity in outcomes across regions

- Input-output linkages contribute most to welfare changes.
- Even within countries (e.g. DE, NL, HU) some regions are top winners, others top losers.



Industrial policy

Intuition: Lower costs. Reallocation to intra-EU suppliers, at lower prices. No tariff revenues.
Welfare: Winners and losers, largest gains for North East.



Industrial policy

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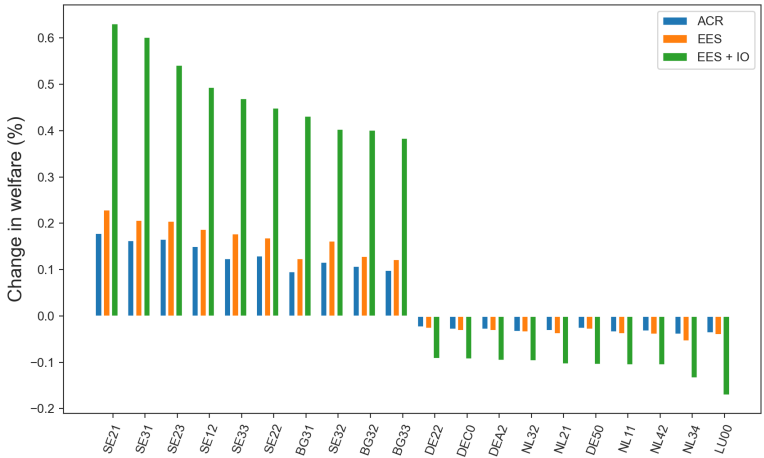
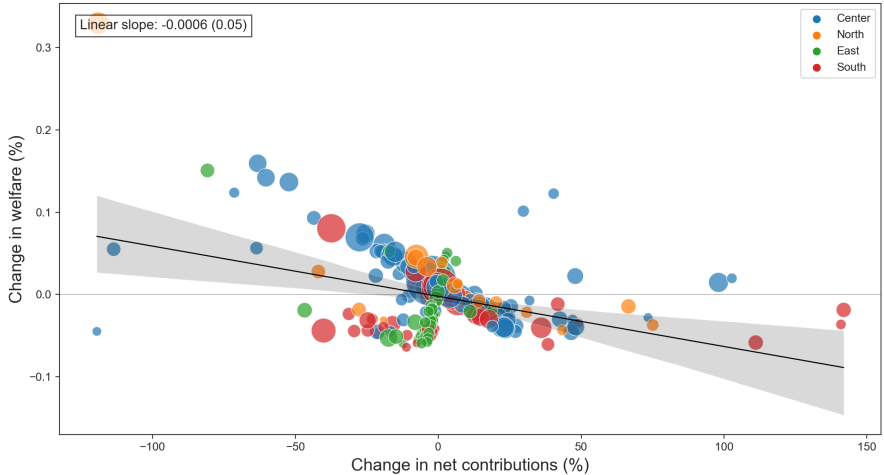


Public policy

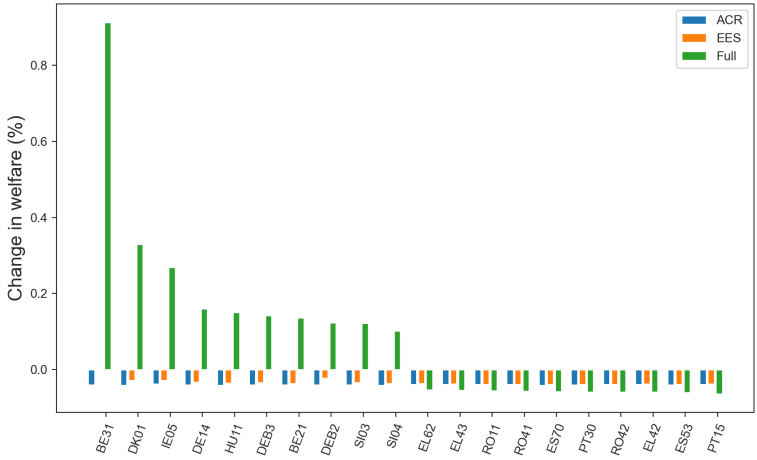
Intuition: Govt spending increases demand at a cost of higher taxes.
Welfare: winners and losers. Largest variance for Center.



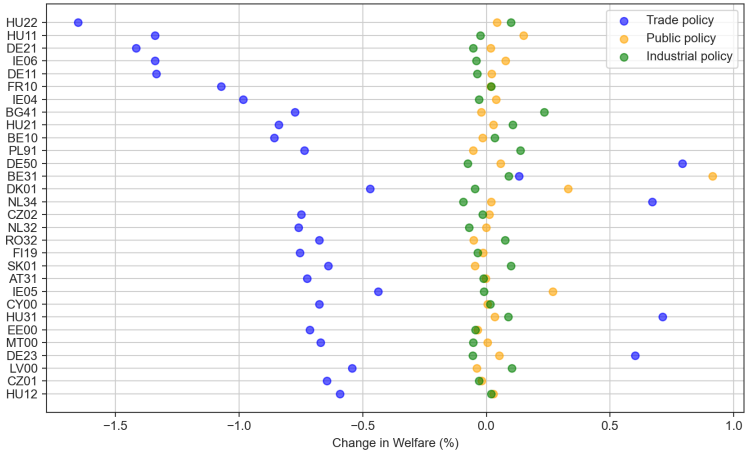
Public policy

Massive heterogeneity in outcomes across regions

- Input-output linkages contribute most to welfare changes (some with opposite effects).
- Losses are smaller and less dispersed.



Regions can win under one policy and lose in another



Top 30 gaps in welfare outcomes across policies.

Conclusion

What is the impact of a toolbox of protectionist policies on EU outcomes?

- Different policies to reduce dependence generate very different aggregate welfare effects.
- With massive variation across regions.
- Top winners and losers can occur within same country under same policy.
- Regions can win under one policy but lose under another.

Next steps: What is optimal policy?

- Subsidiarity and proportionality principles vs. externalities (e.g. subsidy shopping).
- Role for the EU government to coordinate scale economies?
- Need for EU-level industrial policy?

Thank you!

Glenn Magerman: glenn.magerman@ulb.be.

Alberto Palazzolo: alberto.palazzolo@ulb.be.