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Effect of a uniform global carbon price on industry competitiveness

Hauke Ward, Jan C Steckel, Michael Jakob

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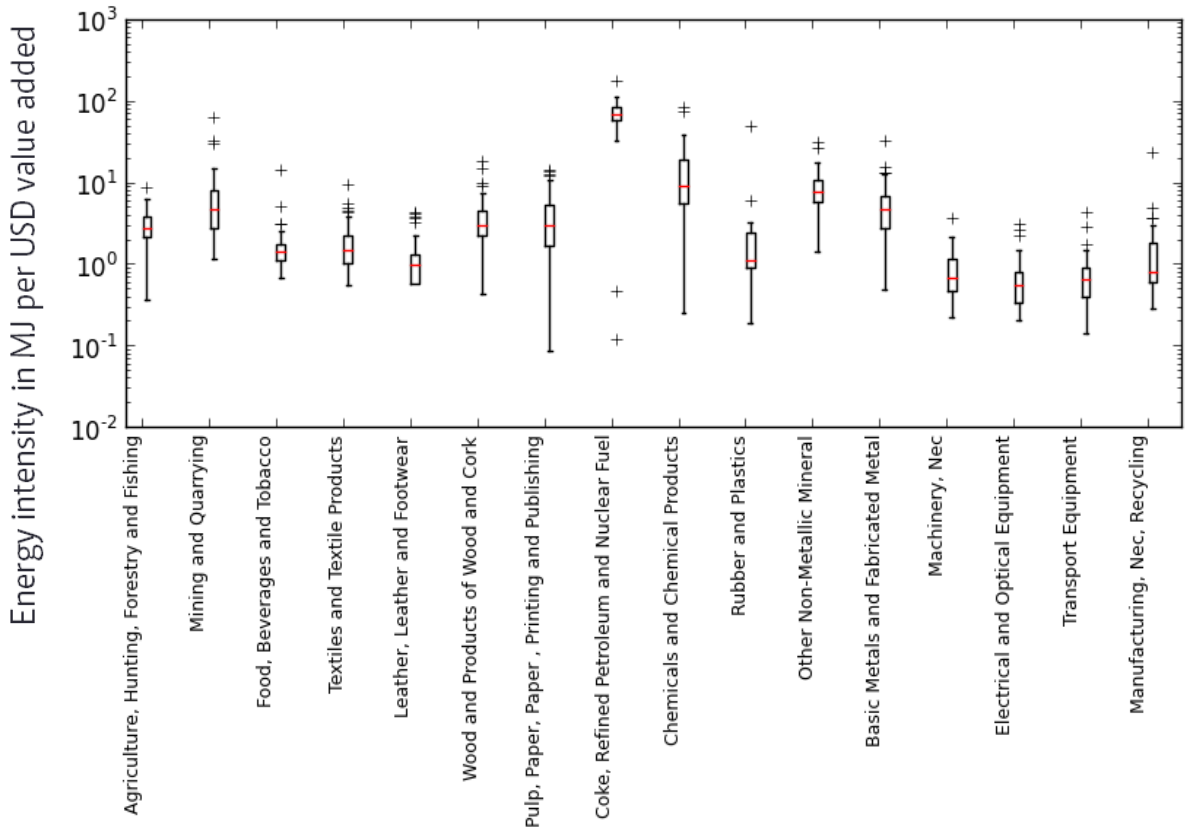
Energy and Environmental Policies

Unilateral climate policy bears risks

- Increasing relative production prices
- Strong impacts for energy intensive and trade exposed industries (EITE) (Alexeeva-Talebi et al., 2012)
- Competitiveness (and job) losses (Carbone and Rivers, 2017)
- Relocation to less regulated production places (Böhringer et al., 2012)
- Carbon leakage (Gerlagh and Kuik, 2014)
- First best solution in the literature: global carbon pricing (Cramton et al., 2017)
  - Prevents carbon leakage
  - Is cost effective

Motivation: Differences in technology



A global uniform carbon price will impact the competitiveness across countries

Research gap on global carbon pricing impacts

Visualization of sectoral energy intensity, World Input-Output Database (WIOD) 2009

Understanding the associated effects

Research questions

- Who will be impacted?
- How severe are those impacts?
- Who might benefit?

Understanding the associated effects

Our approach to answer the RQs

- I) Investigate carbon content of industries‘ consumption goods across countries
- Modified Leontief analysis using IO data
- Consumption good perspective not consumers’ perspective
- Exemplarily carbon tax of **50 USD/ton of CO_2**
- II) Understand the importance of industries via a revealed comparative advantage (RCA) analysis
- III) Translate potential overall impacts to GDP level

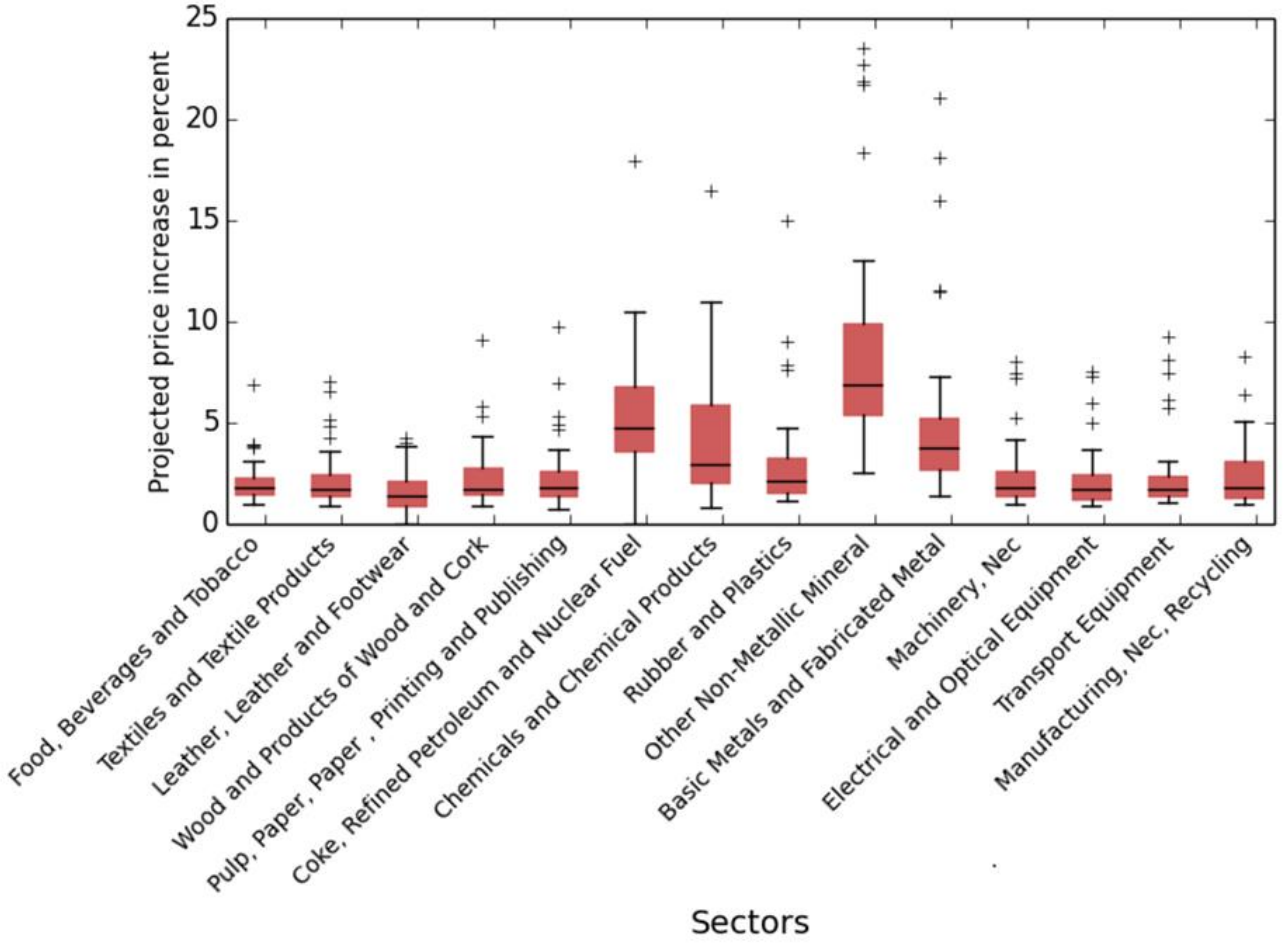
Data

- WIOD database for 2009 (Timmer et al. 2012)
- Data on sectoral energy usage and related emissions
- And on labor hours used with qualification
- Contains 41 regions (incl. one residual region)
- 35 sectors
- Focus on manufacturing sectors (core of EITE)

Methodological approach I)

- Inter-industry flow matrix $Z \in \mathbb{R}^{(m*n)\times(m*n)}$
- Final demand $Y \in \mathbb{R}^{(m*n)\times n}$
- Divide sectoral inflows by total sectoral output to get A
- $L = (I - A)^{-1}$ accounts for all flows that have been eventually used in production, single elements $L^{r,s}_{r^*,s^*}$
- Emissions vector $F \in \mathbb{R}^{m\times n}$, with entries F^s_r
- Divide F by O to get f
- Associated emissions: $\hat{f}^s_r = \sum_{r^*}\sum_{s^*} f^{s^*}_{r^*} L^{r,s}_{r^*,s^*}$
- Not considering Y (usually $f \cdot L \cdot Y$)

Price increases (50 USD CO_2 tax)



Methodological approach II)

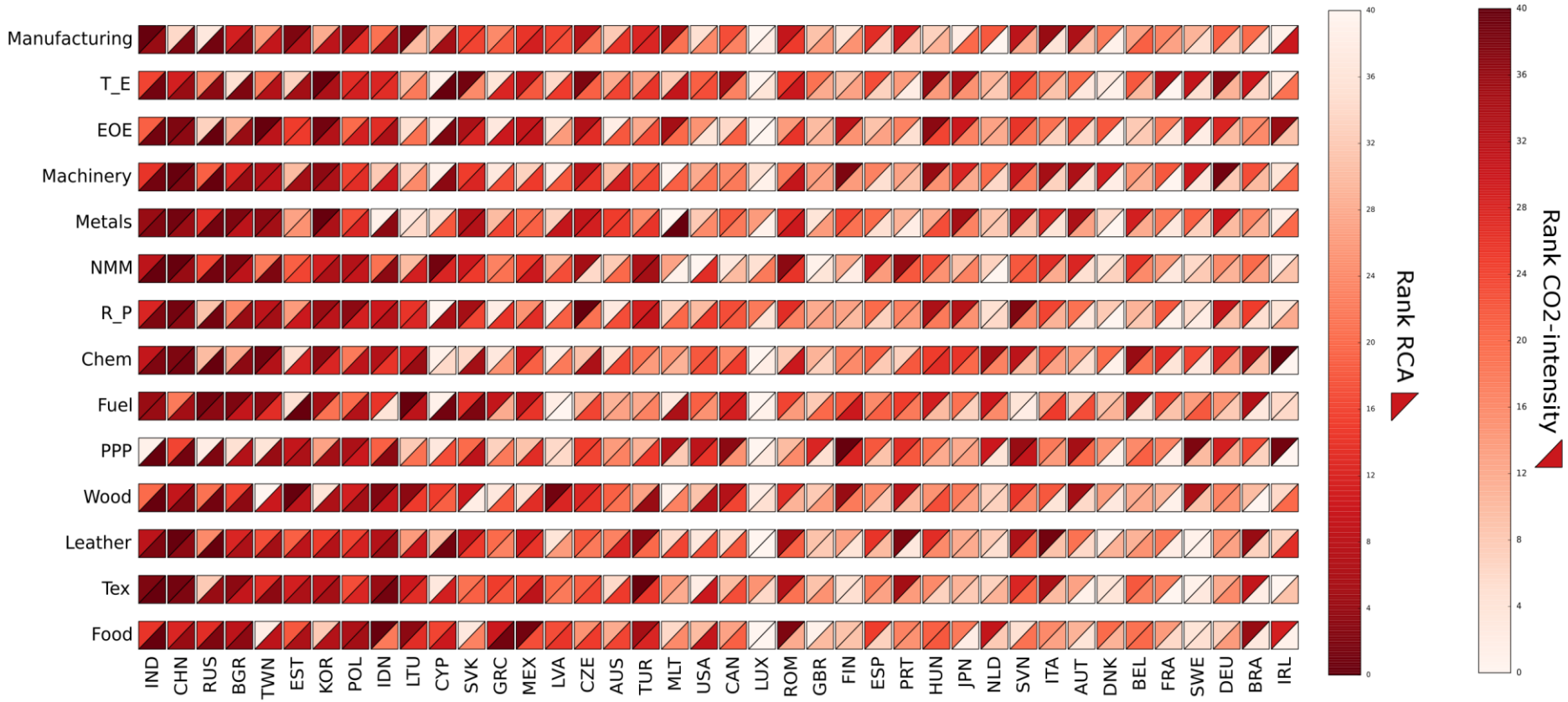
- Direct emissions alone <u>do not allow</u> to identify how severe impacts would be

- $RCA_{r^*,s^*} = \frac{o_{r^*,s^*} / \sum_s o_{r^*,s}}{\sum_r o_{r,s^*} / \sum_r \sum_s o_{r,s}}$ (Balassa 1965)

- Measures how competitive a sector is

- Identify the importance within an economy

Vulnerable industries



Translating price increases into GDP shocks

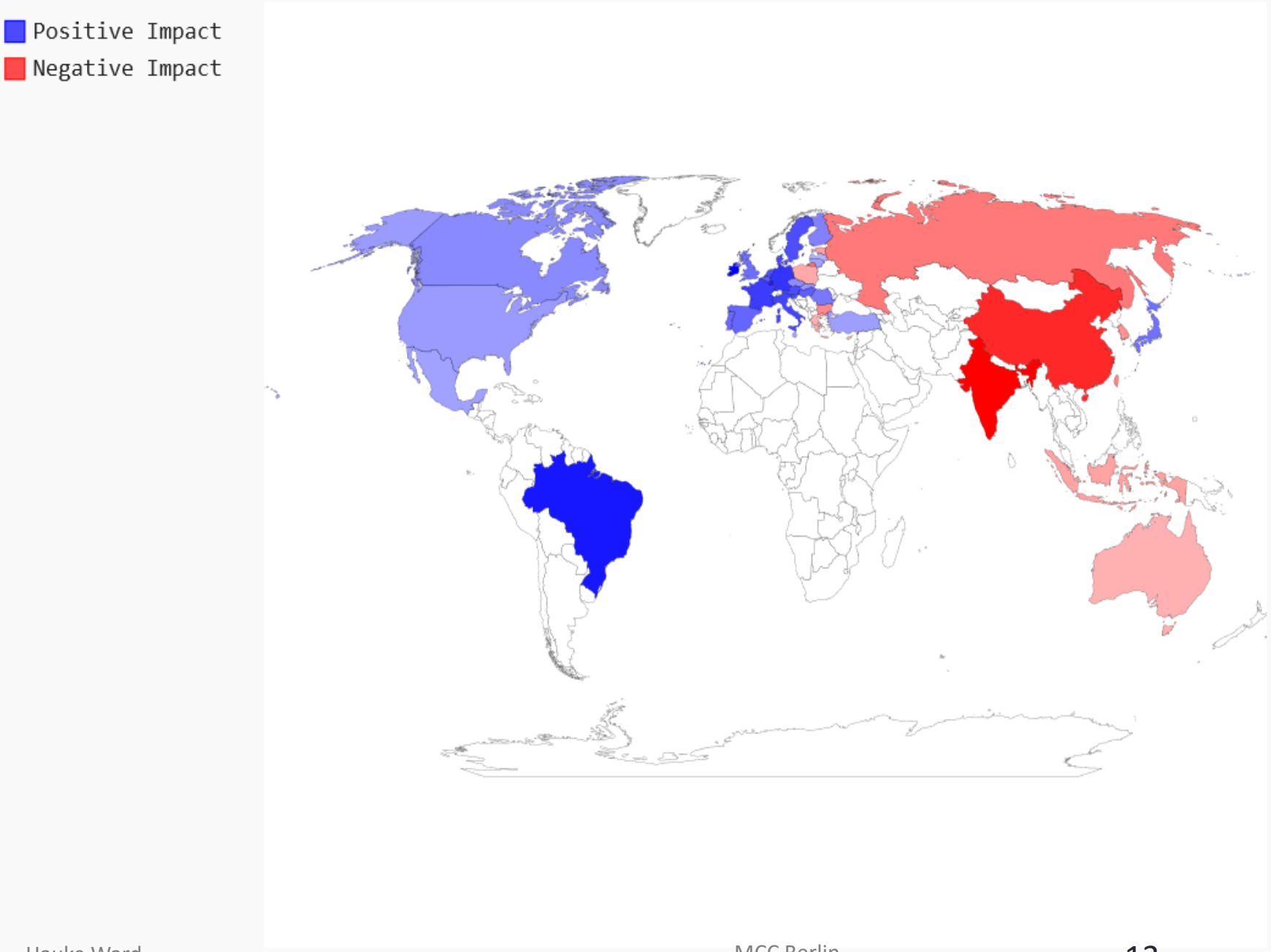
Assumptions for the analysis:

- One global market
- Initial shocks will occur in relation to the global average shocks
- Price increases are passed through to the consumer
- Price increases behave like an export tariff
- Shocks are assumed to occur for final demand goods only
- Direct and indirect effects

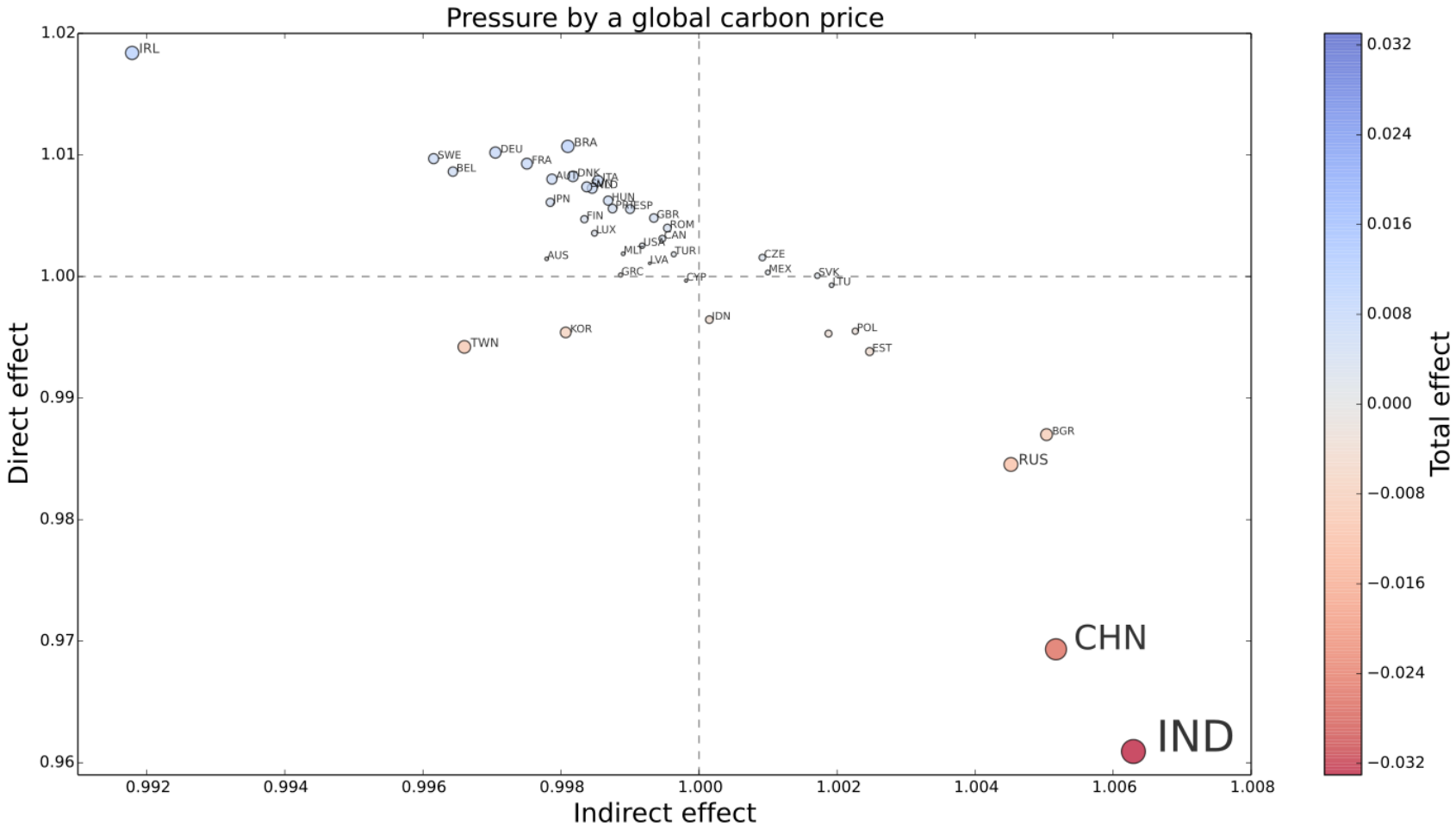
Methodological approach III)

- Solleder (2013): a 1% increase in export taxes is associate to a 2.8% reductions in export values
- Impacts on demand for consumption goods:
- $y_s^{*r} = y_s^r \cdot (0.972)^{**}((\Delta p_s^r - [\![\Delta \bar{p}^s]\!])\cdot 100)$
- $O^* = LY^*$ and $O = LY$
- Multiplying these by sectoral value added per good-> impacts on GDP
- Multiplying these by sectoral labor intensities ->labor market impacts

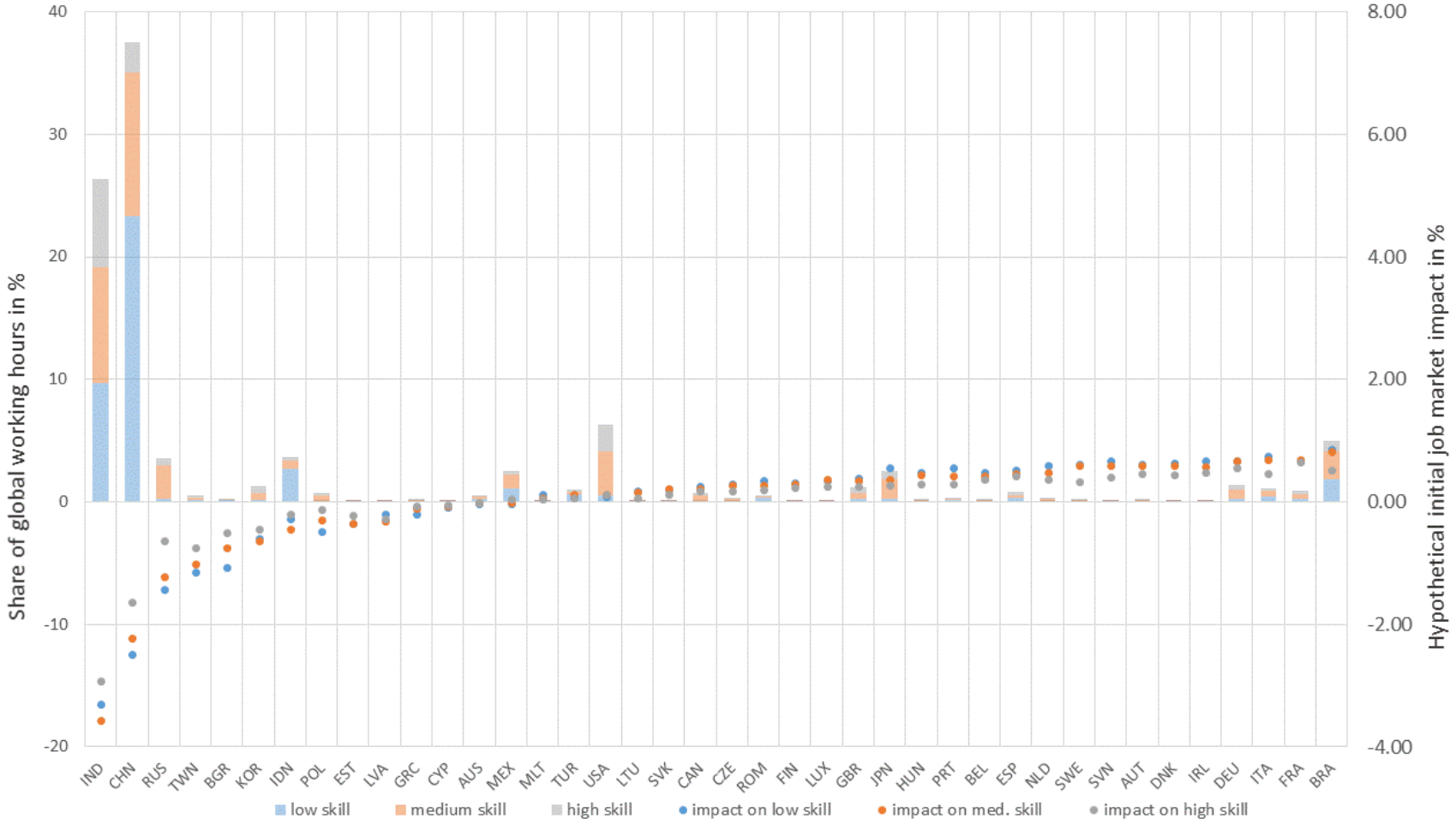
Potential Changes in GDP per capita



Direct and indirect impacts



Impacts at the labor market



Discussion and conclusion

- East European and Asian Economies would negatively be impacted
- Positive effects for Western economies and Brazil
- Highest volatility for low-qualified labor
- Negative impacts need to be considered in climate negotiation
- The US could benefit from climate policy!

Negative impacts could be weakened by:

De-carbonization of energy systems

Access to more efficient technologies

Rewiring of and substitution within supply chains

Shealah Craighead - White House, official press photo

Thank you!

- Contact: ward@mcc-berlin.net

Literature

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