Distributional and Efficiency Impacts of Higher EU Climate Targets*

Gustav Fredriksson[1], Florian Landis[1], Sebastian Rausch[1,2]

[1]Centre for Energy Policy and Economics (CEPE), ETH Zurich

[2]ZEW Leibniz Centre for European Economic Research, Mannheim & Heidelberg University

7 June 2021

IAEE Online Conference

*Disclaimers: The results in this presentation are preliminary and should not be cited. Our paper and presentation are based on data from Eurostat's 2010 Household Budget Survey (HBS) and Eurostat's 2010 European Union Statistics on Income and Living Conditions (EU-SILC). The responsibility for all conclusions drawn from the data lies entirely with the authors. The results and conclusions are solely those of the authors, and not those of Eurostat, the European Commission or any of the national statistical authorities whose data have been used.

Background

- In its 2030 Climate Target Plan, the EU proposed to increase its 2030 greenhouse gas emissions reduction target from 40% to at least 55% (relative to 1990)
- Carbon pricing is an important part of the new strategy

- A key question concerns how existing carbon pricing schemes should be amended to absorb the additional abatement
- In particular, there is a need to consider how the additional abatement should be spread:
  i. Across sectors (ETS vs. non-ETS)
  ii. Across member states (i.e., through the Effort Sharing Regulation targets)

- At the same time, the impact of greater carbon market integration should also be understood

Assessing the abatement allocation options

Two relevant criteria for assessing the options of where to assign the new abatement:

1. **Overall cost (efficiency)**

   → Depends on the extent to which marginal abatement costs (MACs) are equalized across polluting sectors and countries (Böhringer et al., 2009; Metcalf, 2009)

   - In segmented markets: Assign the additional abatement to where it is cheapest
   - Full MAC equalization through market integration (Ranson and Stavins, 2016)

2. **Distribution of cost across and within countries (equity)**

   - EU climate policy is intentionally designed to compensate lower-income member states (Landis and Heindl, 2019)
   - Any adverse distributional effects within countries should be addressed to ensure political feasibility

Research question

What are the efficiency & distributional (within and between EU countries) effects of different EU carbon pricing policy design options in the context of a 55% target?

Policy design entails:

1. Abatement split between ETS and non-ETS sectors
2. Non-ETS burden sharing rule across countries
3. Degree of carbon market integration

Contributions

1. One of the first analyses on the distributional implications of aligning European carbon pricing policies with a higher 2030 target
    - Shed new light on how different burden sharing rules across sectors and countries impact both household and country incidence

2. Contribute to the literature on integrated carbon markets, which has largely ignored household incidence
    - Previous studies typically focus on aggregate outcomes, such as efficiency (e.g., Böhringer et al., 2005; Böhringer, Dijkstra and Rosendahl, 2014)

Model (1)

Static multi-sector, multi-region numerical general equilibrium model based on the GTAPinGAMS model type (see Lanz and Rutherford, 2016)

- 10 sectors, including four primary energy sectors (coal, gas, refined oil products, crude oil)
- 31 regions: all EU member states, UK, NOR, CHE, composite «Rest of World»
- CES production & demand functions
- Trade modelled using the Armington approach

Households have fixed endowments of production factors (labor, capital, natural resources)

- Perfectly mobile within regions; immobile between regions

Household income deciles for 21 regions

Model (2)

Revenue recycled:

- Within countries in proportion to benchmark expenditure shares
- Across countries according to Phase IV rules (for ETS revenue) & non-ETS allowance shares (for non-ETS revenue if non-ETS markets are integrated)

Model only takes into account the direct costs associated with decarbonization

- It does not capture the benefits from averted climate change harm or the co-benefits from fewer emissions

Data

Economy-wide macroeconomic & energy data from GTAP 9 (2011 reference year)

Household-level data for 21 European countries from two Eurostat surveys (2010 reference year):

- Consumption expenditure data from the Household Budget Survey (HBS)
- Income data from the European Union Statistics on Income and Living Conditions (EU-SILC)

Group households into income deciles → Within-country analysis possible for 21 countries

Baseline & scenarios

Baseline

40% overall target assuming:

- Current ETS/non-ETS abatement split;
- Current non-ETS targets (as stipulated by the ESR); and
- Segmented non-ETS market structure

Scenarios

55% overall target assuming different:

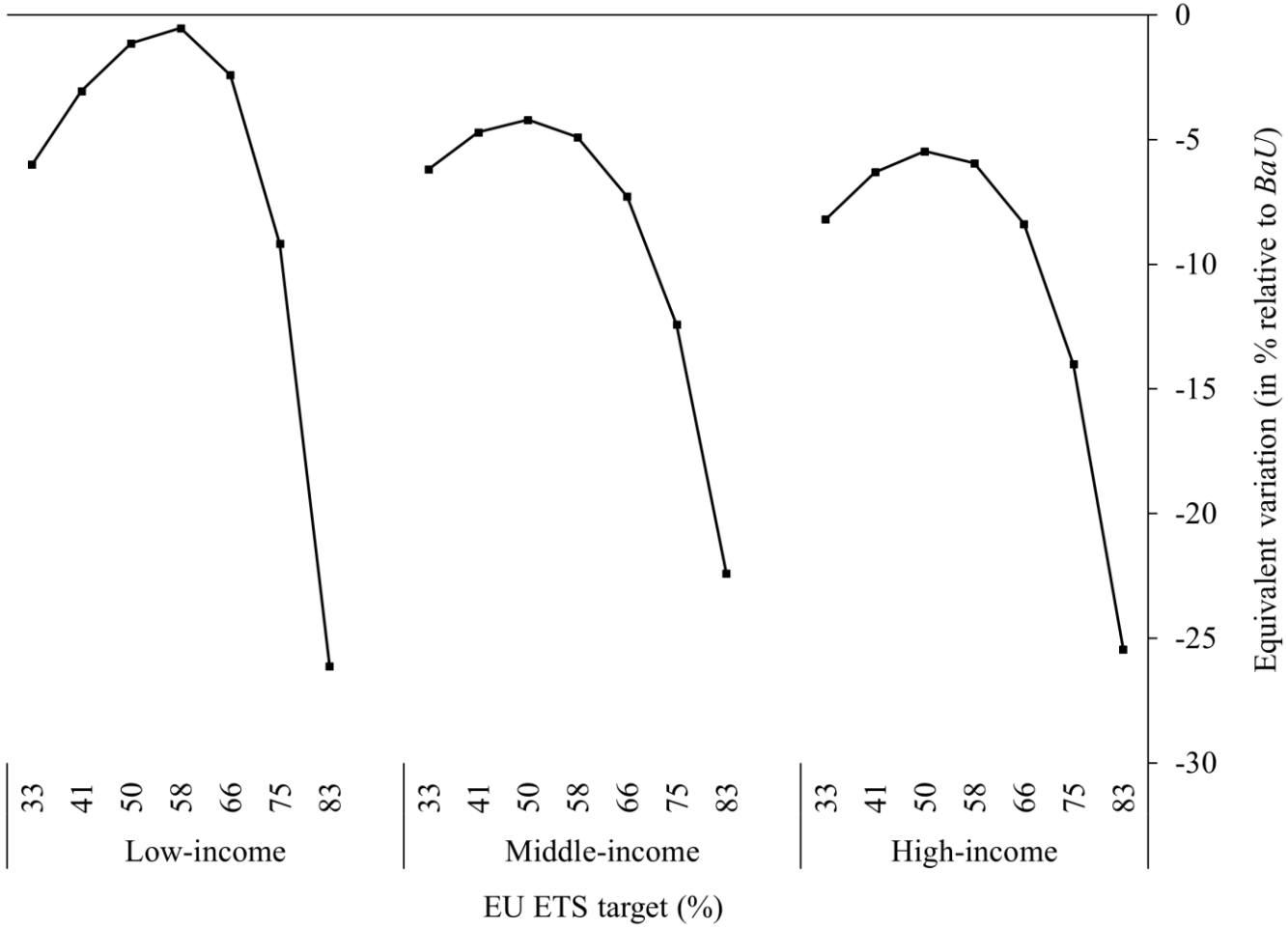
a) ETS targets (sectoral burden sharing)
b) Non-ETS targets (regional burden sharing)
c) Degrees of non-ETS market integration
    - *notrade* → Segmented non-ETS markets
    - *trade* → All countries integrate

Table A.1. Classification of low-, middle-, and high-income countries

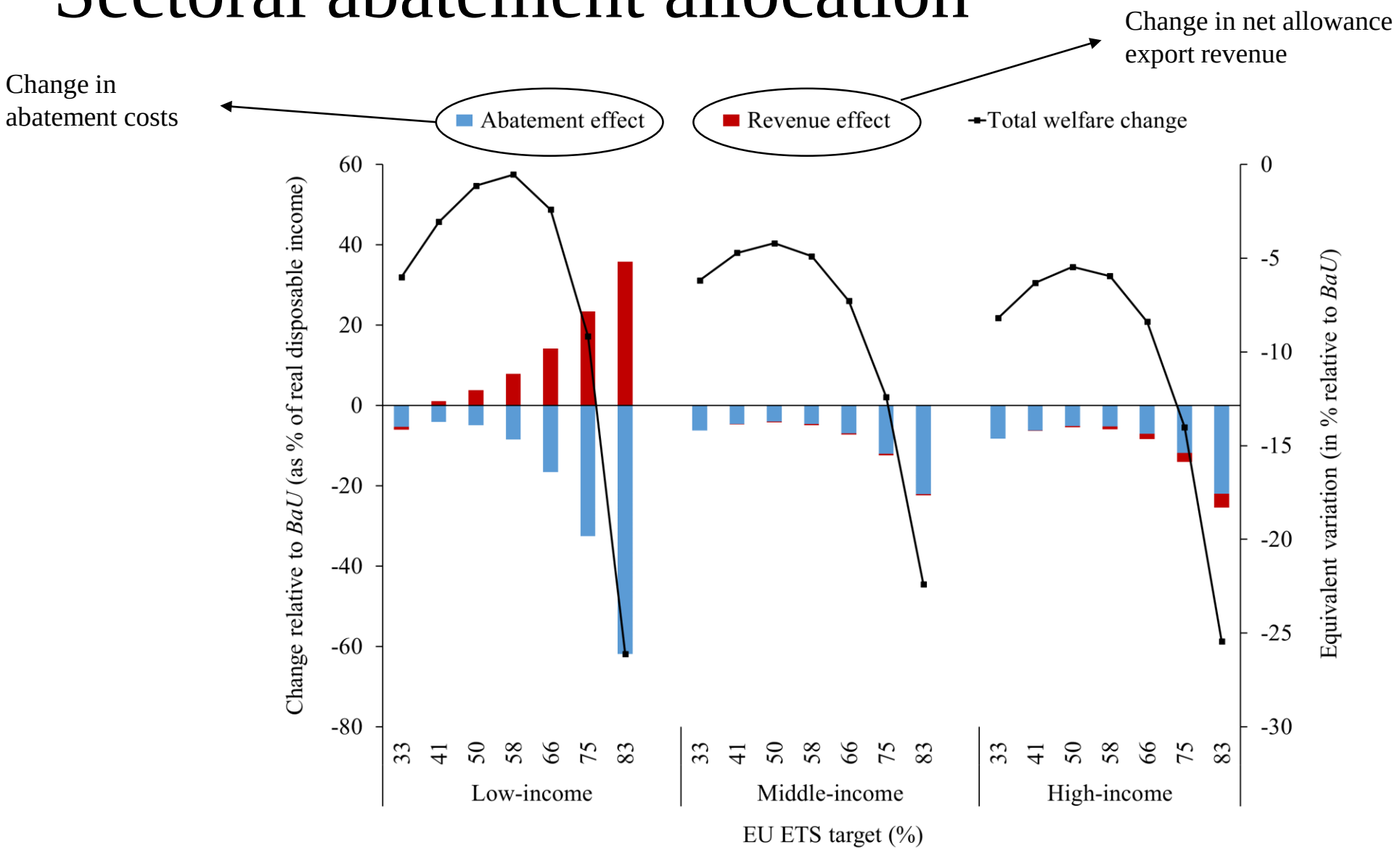
Low-income	Middle-income	High-income
Romania (ROU)	Slovenia (SVN)	Sweden (SWE)
Bulgaria (BGR)	Portugal (PRT)	Finland (FIN)
Estonia (EST)	Malta (MLT)	Cyprus (CYP)
Croatia (HRV)	Spain (ESP)	France (FRA)
Latvia (LVA)	Ireland (IRL)	Belgium (BEL)
Hungary (HUN)	Greece (GRC)	United Kingdom (GBR)
Czech Republic (CZE)	Denmark (DNK)	Germany (DEU)
Lithuania (LTU)	Netherlands (NLD)	Austria (AUT)
Poland (POL)	Italy (ITA)	Luxembourg (LUX)
Slovakia (SVK)		

Results – Between countries

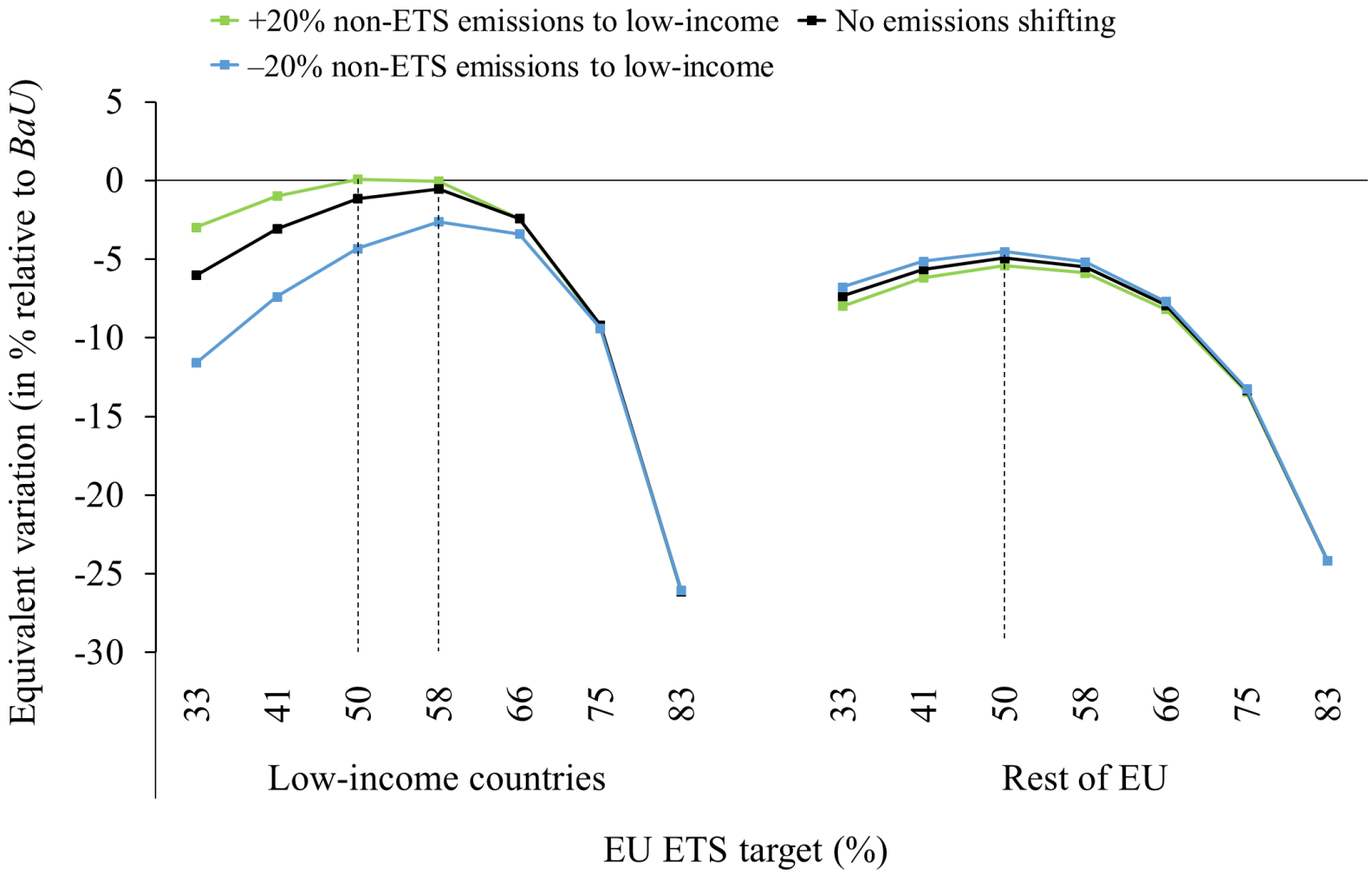
Sectoral abatement allocation



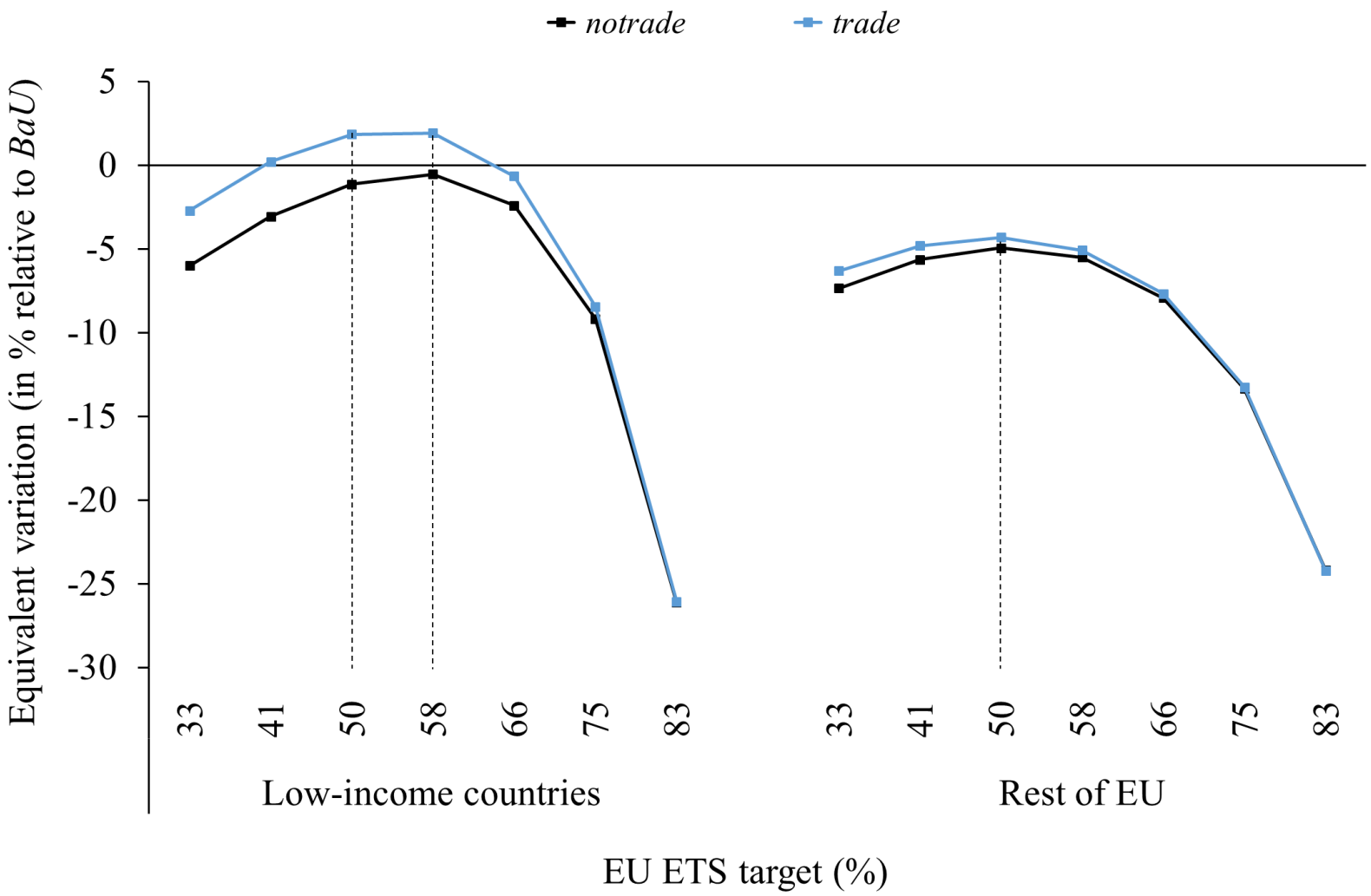
Sectoral abatement allocation



More similar sectoral preferences if low-income countries' non-ETS burden is reduced

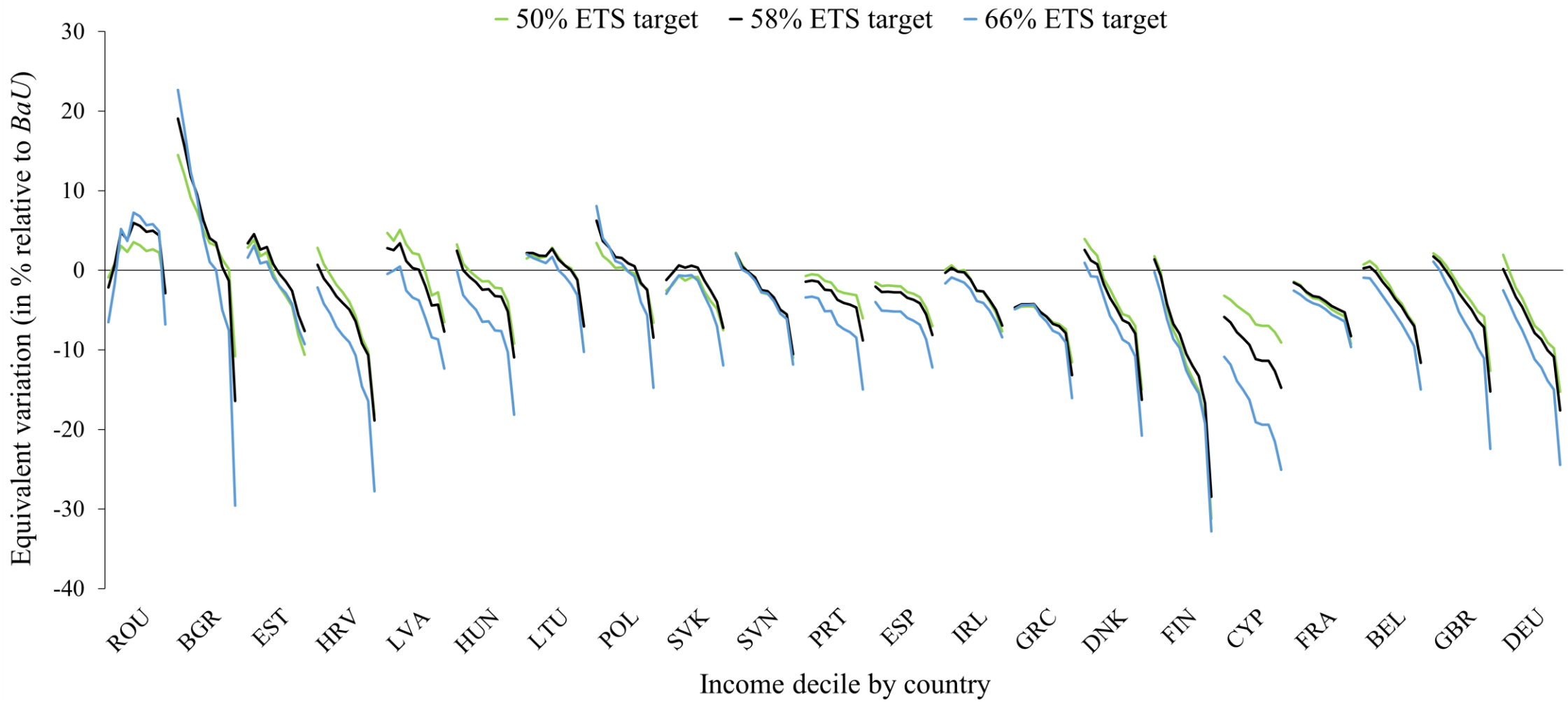


Increased market integration

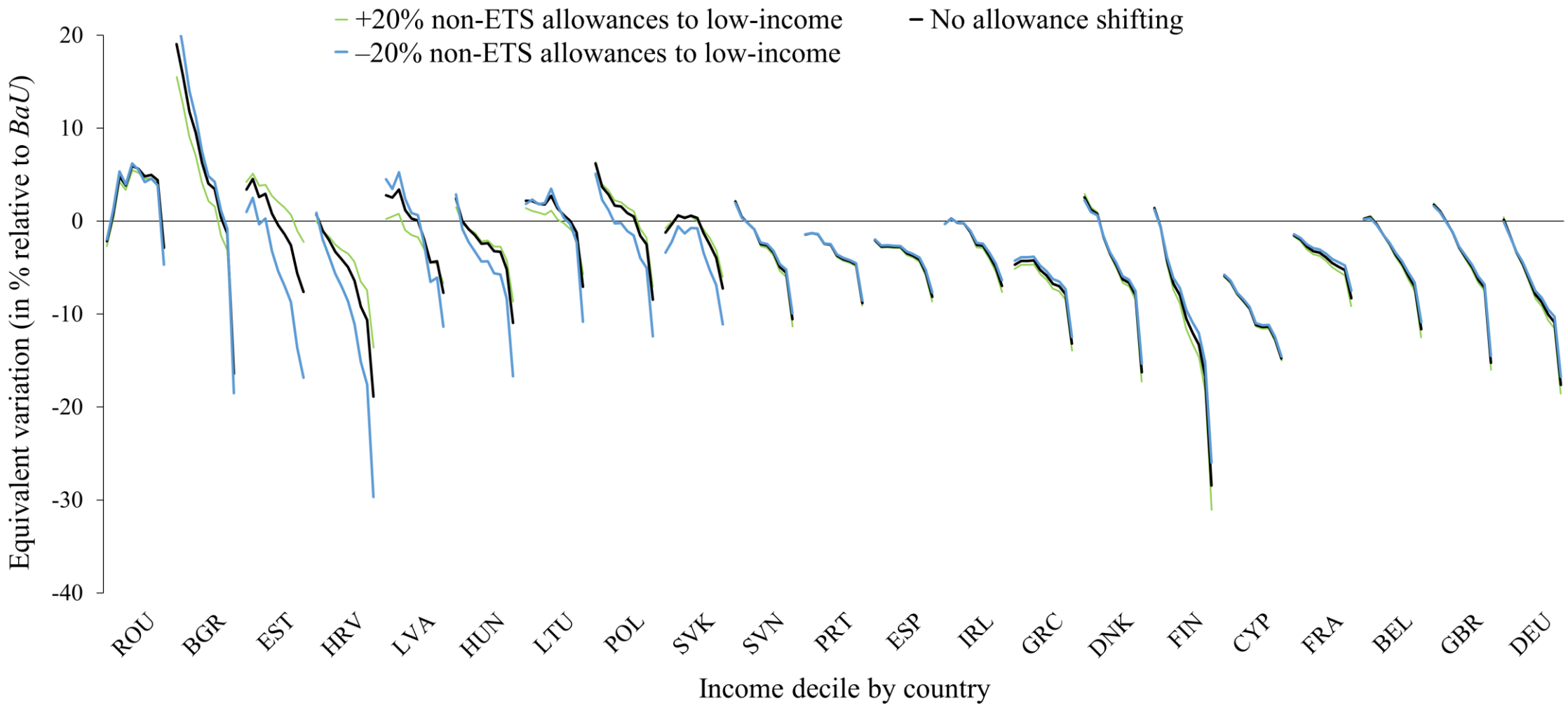


Results – Within countries

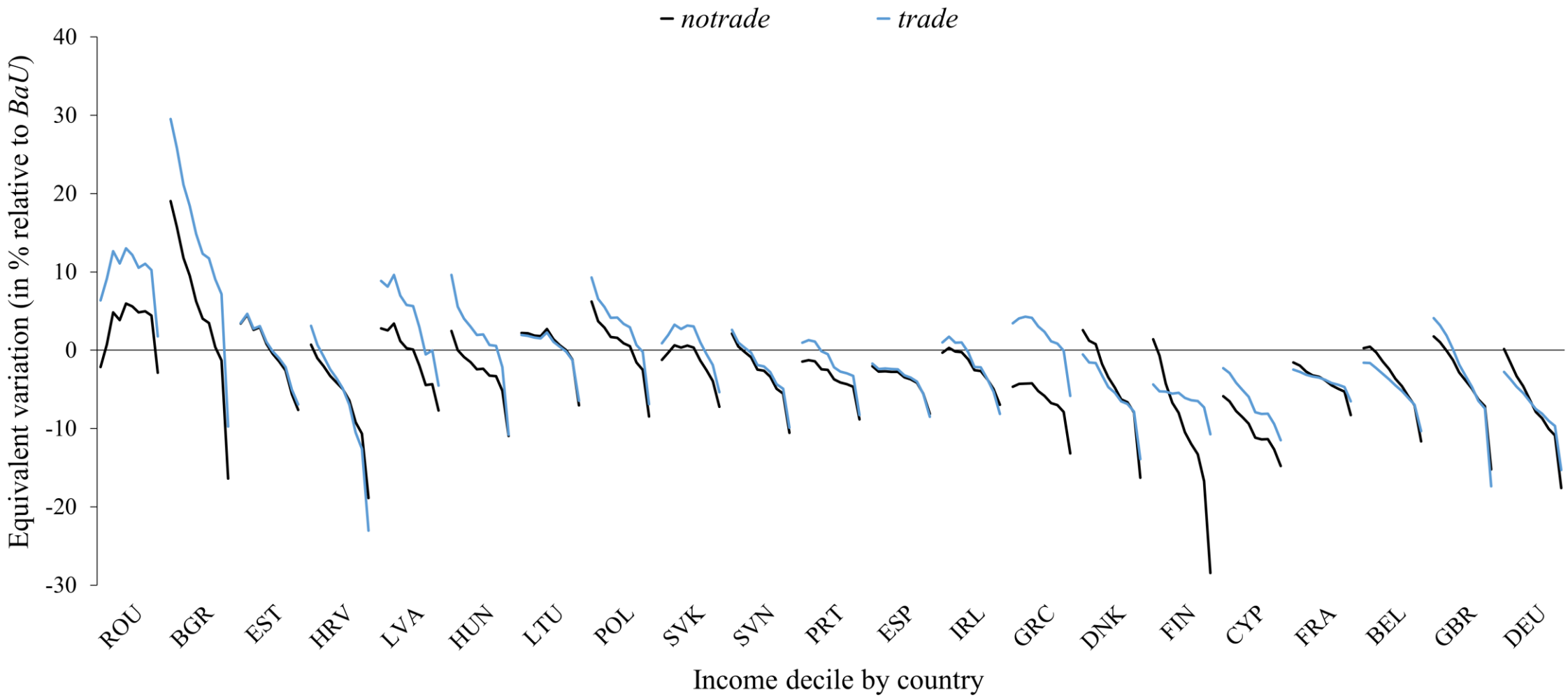
Progressive incidence (independent of sectoral split)



Progressive incidence (independent of regional split)



Poorer HHs in lower-income countries especially benefit from integration



Conclusion

- In segmented markets, lower-income countries prefer a higher ETS target compared to richer countries
- More similar ETS target preferences across countries if:
  i. Lower-income countries' non-ETS burden is reduced; or
  ii. Non-ETS carbon markets are integrated
- Lower-income countries benefit the most from non-ETS market integration
  - No observed efficiency-equity trade-off

- Within countries, typically progressive outcomes (in spite of non-progressive recycling)
- Incidence in lower-income countries further improves if non-ETS markets are linked

Thank you for your attention!

Mail: gfredriksson@ethz.ch

References

- Böhringer, Christoph, Andreas Löschel, Ulf Moslener, and Thomas F. Rutherford. 2009. “EU climate policy up to 2020: An economic impact assessment.” *Energy Economics*, 31: S295–S305. International, U.S. and E.U. Climate Change Control Scenarios: Results from EMF 22. https://doi.org/10.1016/j.eneco.2009.09.009.
- Böhringer, Christoph, Bouwe Dijkstra, and Knut Einar Rosendahl. 2014. “Sectoral and regional expansion of emissions trading.” *Resource and Energy Economics*, 37: 201–225. https://doi.org/10.1016/j.reseneeco.2013.12.003.
- Böhringer, Christoph, Tim Hoffmann, Andreas Lange, Andreas Löschel, and Ulf Moslener. 2005. “Assessing Emission Regulation in Europe: An Interactive Simulation Approach.” *The Energy Journal*, 26: 1–21. http://www.jstor.org/stable/41323070.
- Landis, Florian, and Peter Heindl. 2019. “Renewable Energy Targets in the Context of the EU ETS: Whom do They Benefit Exactly?” *The Energy Journal*, 40. https://ideas.repec.org/a/aen/journl/ej40-6-landis.html.
- Lanz, Bruno, and Thomas F. Rutherford. 2016. “GTAPinGAMS: Multiregional and Small Open Economy Models.” *Journal of Global Economic Analysis*, 1, 1–77. http://dx.doi.org/10.21642/JGEA.010201AF.
- Metcalf, Gilbert E. 2009. “Market-based policy options to control U.S. Greenhouse gas emissions.” *Journal of Economic Perspectives*, 23: 5–27. https://doi.org/10.1257/jep.23.2.5.
- Ranson, Matthew, and Robert N. Stavins. 2016. “Linkage of greenhouse gas emissions trading systems: learning from experience.” *Climate Policy*, 16: 284–300. https://doi.org/10.1080/14693062.2014.997658.