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Pricing GHG emissions in agriculture: Accounting for trade and fairness for effective climate policy

Joint work with Mattia Ricci, Ignazio Perez Dominguez, Jordan Hristov (JRC) & Stijn Van Houtven (KU Leuven)

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Intro

- Good reasons for enhanced climate action in agriculture
  - Food system represent 1/3 of global GHG emissions (Crippa et al., 2021)
  - Gap in EU climate policy: AGR share in EU GHG rising from <10% to 16% 2010-2030 (EC, MIX-CP)
  - Dietary change good for climate, health, air pollution (Springmann et al., 2016, 2023, 2025, etc.)
- Some emerging ideas
  - True cost pricing
  - DNK meat & dairy (production) tax from 2030
  - ETS3
  - Mission Letter VDL: further green the VAT system
- But several sensitivities
  - Distributional impacts, social & political acceptability
  - Agricultural sector, competitiveness, trade

FINANCIAL TIMES

Tackling methane-belching cows is a taxing business

Loading taxes or other restrictions on farmers is politically difficult

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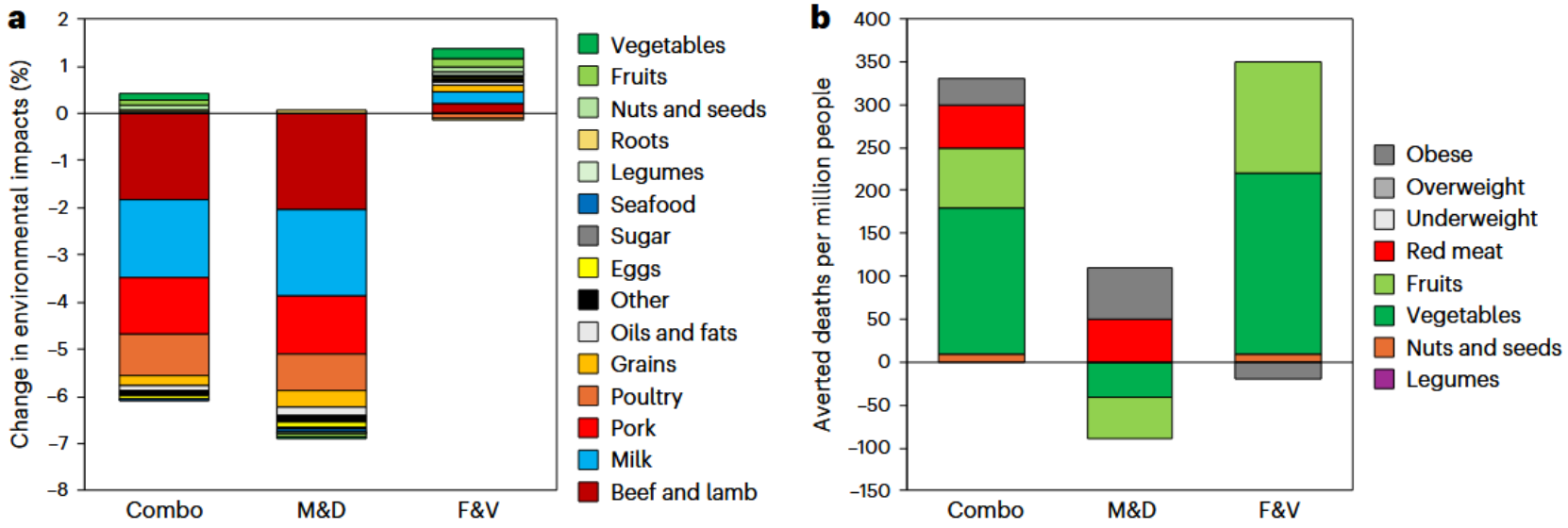
Scientific context

- Springmann, M., et al. (2025). A reform of value-added taxes on foods can have health, environmental and economic benefits in Europe. *Nature Food*, 1-9.



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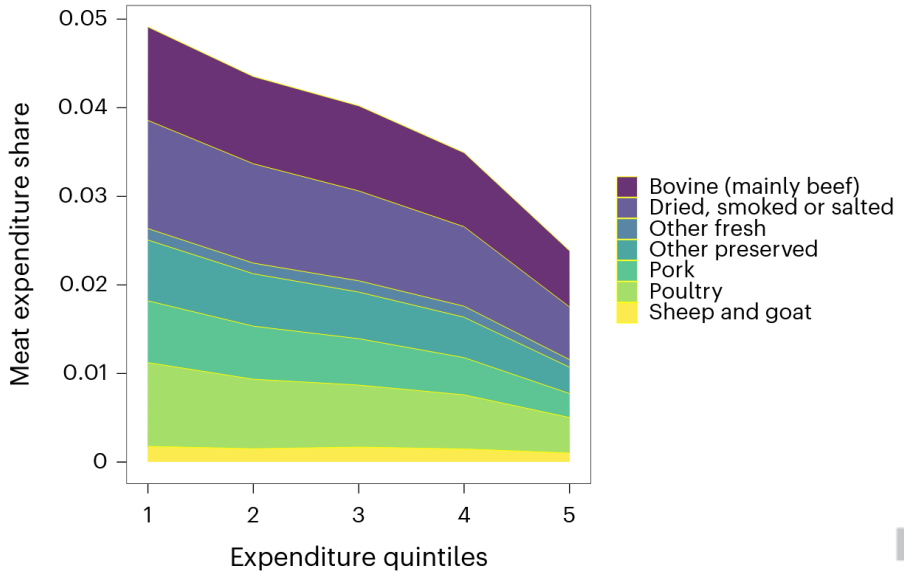

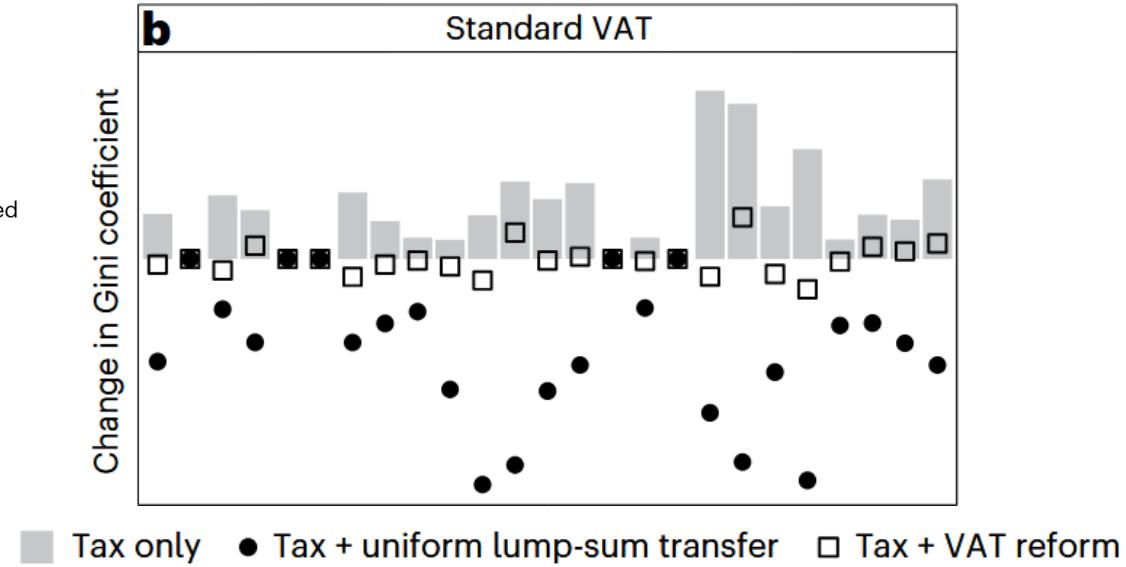

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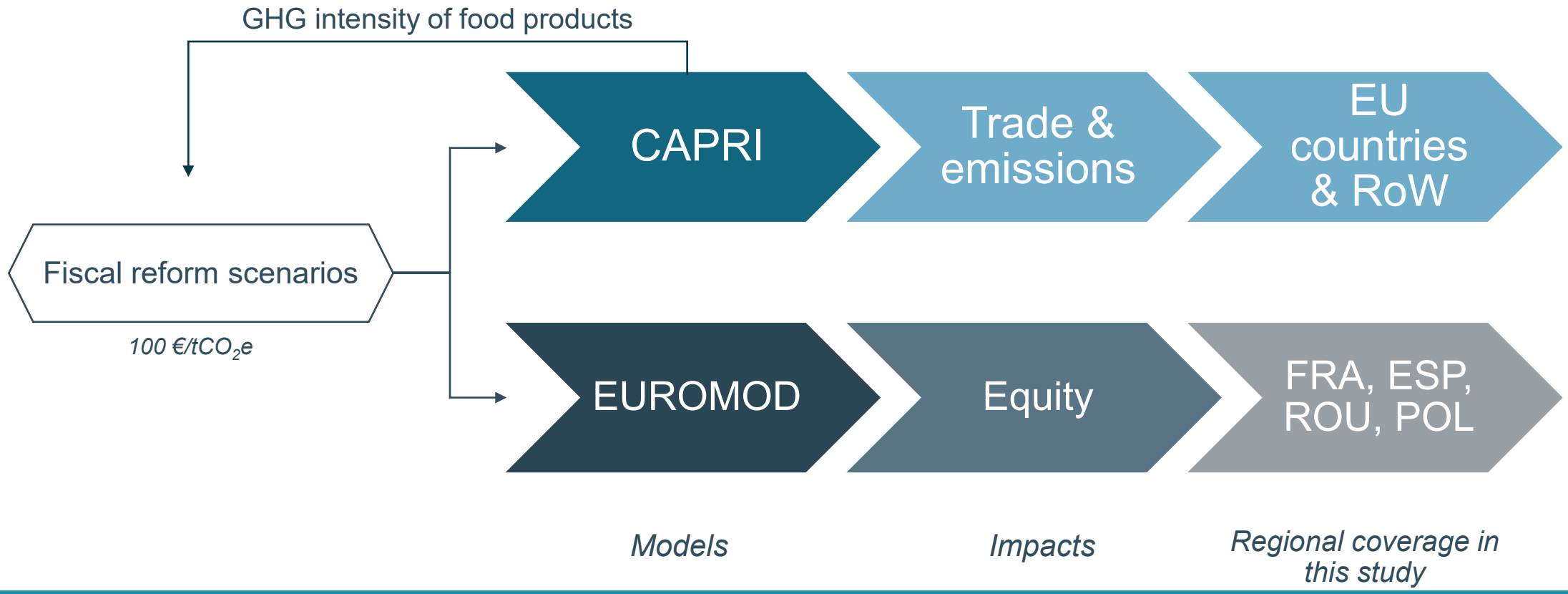
- This study: How to bring down agri-food emissions in an effective & fair way?
  - Effective: Environmental impacts considering international trade
  - Fair: Distributional impacts considering revenue recycling options

Methodology: Modelling toolbox



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Scenarios

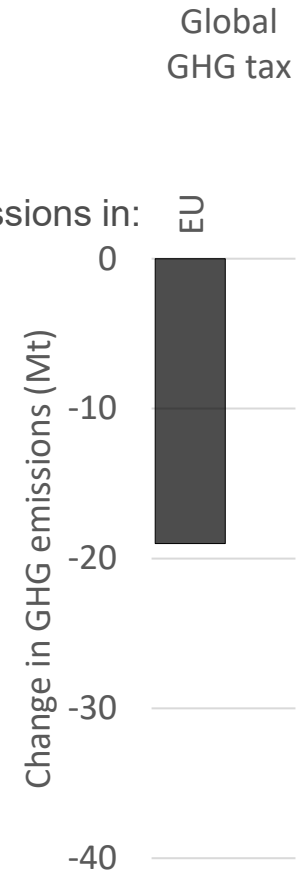
- Core scenarios in both CAPRI and EUROMOD:
  - **Consumption tax** based on GHG intensity of food products at 100 EUR/tCO2e
  - **VAT reform**: coarse consumption tax based on *existing* VAT categories & rates

- Additional scenarios in CAPRI to assess trade & environmental impacts:
  - **Global GHG tax**
  - **EU GHG tax**

- Additional scenarios in EUROMOD to assess distributional impacts:
  - **VAT reform + lump sum tax**
  - **Feebate**: VAT reform + lowered VAT on vegetables, fruit, bread, potatoes

Results: Emissions

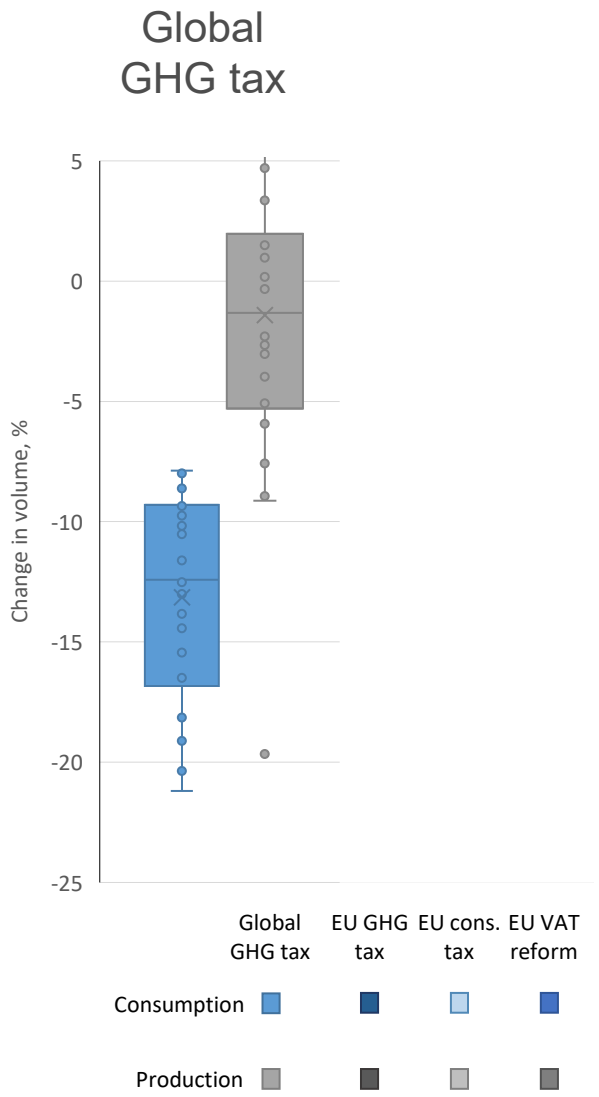
- First best: 100 €/tCO2$_e$ global GHG tax
- Unilateral EU GHG tax brings down emissions, but leakage
- ‘Reverse leakage’ under consumption tax, but limited domestic GHG reduction
- EU VAT reform resembles consumption tax, but rate setting restrictions limit effectiveness



Results: Trade

- Global GHG tax lowers EU consumption; production decline limited via exports ↑
- EU GHG tax lowers EU production; consumption decline limited via imports ↑
- Consumption decline with consumption tax similar to EU GHG tax, but exports ↑
- EU VAT reform resembles consumption tax, with more heterogeneity across MS

Beef, volumes



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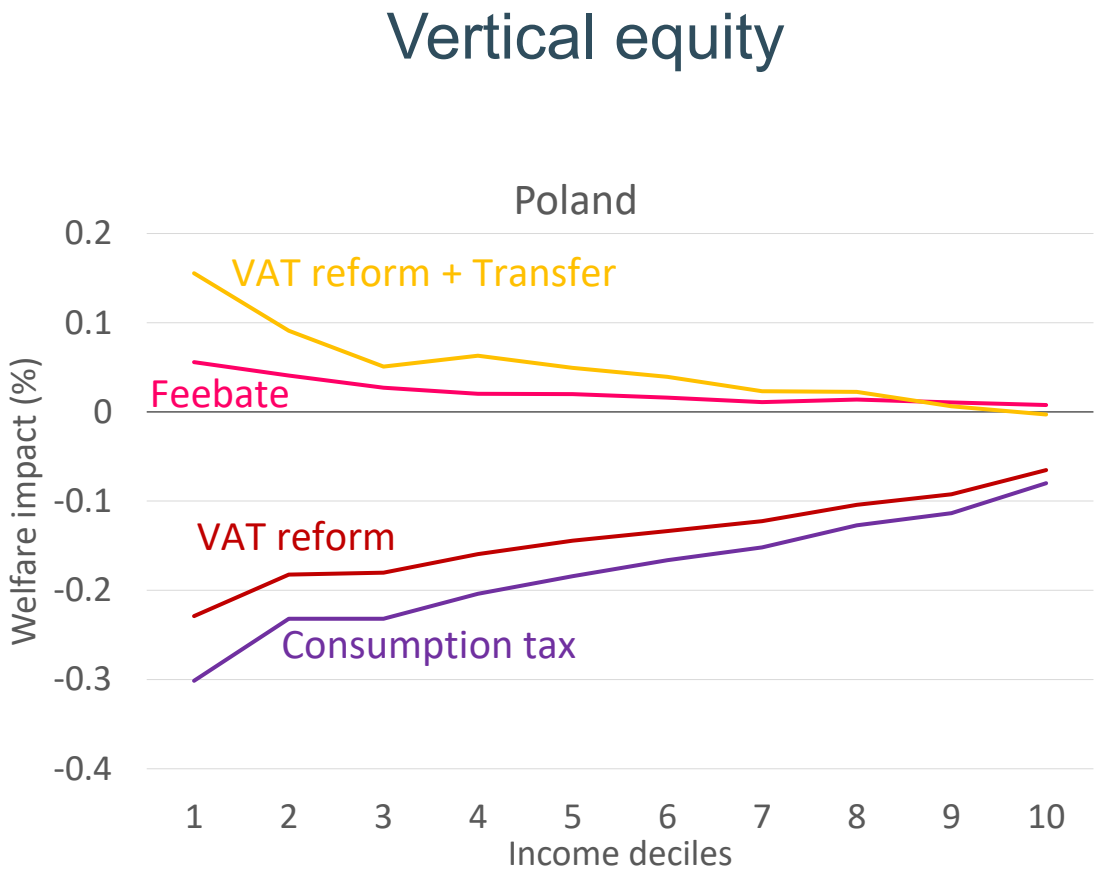
Distributional impacts

- Without revenue recycling, price-based measures to tackle food-related emissions are regressive.
- Revenue recycling (tax *shift* or lump sump transfers) offsets regressivity.



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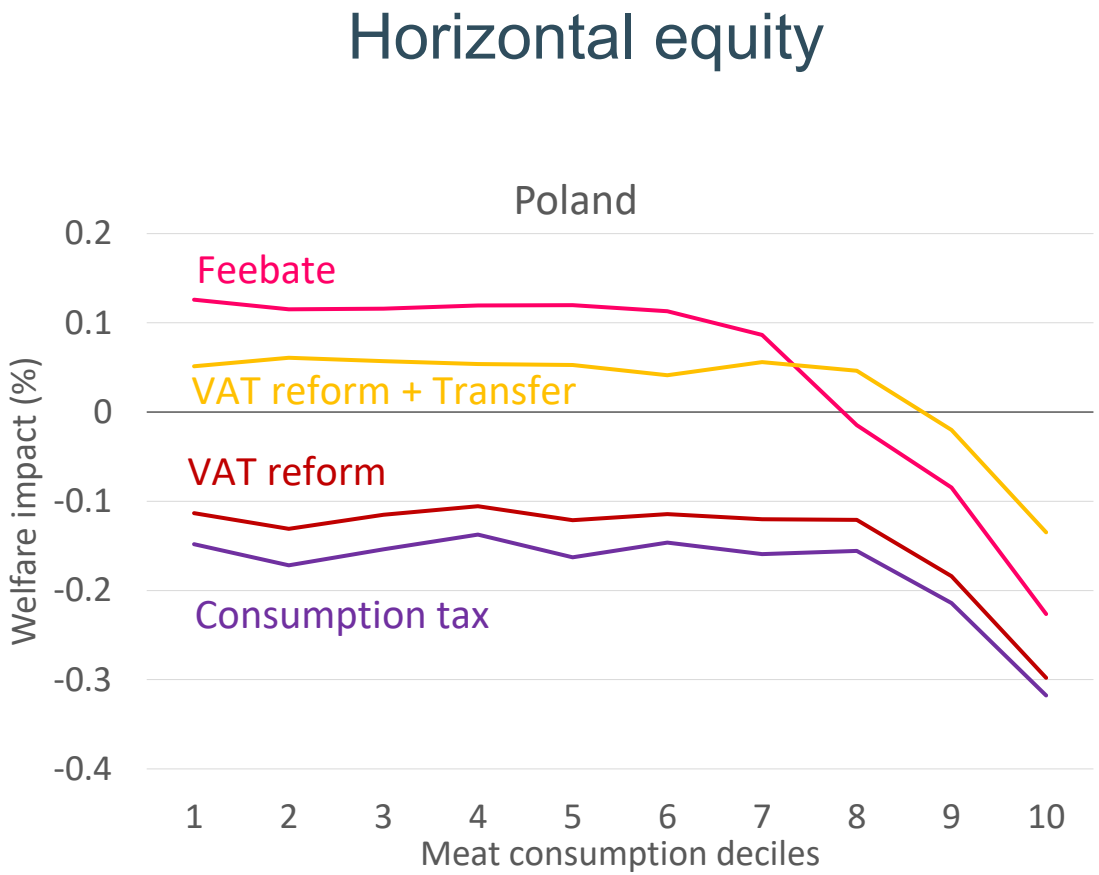
Distributional impacts

- Without revenue recycling, price-based measures to tackle food-related emissions are regressive.
- Revenue recycling (tax shift or lump sump transfers) offsets regressivity.
- Concerns about horizontal equity not fully addressed, with welfare losses for top 2-3 meat consumption deciles.
- Political economy implications



Conclusion

- Price-based measures can help align agriculture with climate goals.
- Trade and distributional aspects should be reflected in policy design to ensure an effective and equitable transition.
- Future work could consider
  - ETS3 + CBAM
  - Consumption tax + export levy
  - Income-side effects of tax reforms

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Thank you!
Questions?

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Pricing GHG emissions in agriculture: Accounting for trade and fairness for effective climate policy

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ABSTRACT

Although agriculture is a significant source of greenhouse gas emissions, the sector remains outside the scope of greenhouse gas (GHG) pricing policies in the EU. To align the future food system with the transition to net-zero emissions, two key questions arise: To what extent can tax policies help achieve this transition in a fair and effective way? And, would it be preferable to levy a GHG tax on the production or the consumption side? We employ an EU agro-economic model to compare supply and demand-side GHG taxes, quantifying their environmental impact as well as their effects on the EU competitiveness. We find that supply-side pricing in agriculture exhibits leakage rates of over 40 % and leaves EU producers at a competitive disadvantage; on the other hand, demand-side measures level the playing field in the Single Market and generate positive leakage as they boost the exports of (greener) EU producers. However, increased exports from the EU imply that emission reduction is rather limited domestically. Focussing on four countries – Spain, France, Romania, and Poland – we explore the distributional impacts of demand-side pricing measures using household-level microsimulation. We show that, when demand is kept constant, these reforms are regressive without complementary measures. Designing a VAT reform as a Feebate and equal-per-capita revenue recycling address vertical equity concerns and produce welfare gains for the majority of the population, while the top 20–30 % of meat consumers experience welfare losses. Overall, findings suggest that price-based measures can help align agriculture with climate goals, while trade and distributional aspects should be reflected in policy design to ensure an effective and equitable transition.

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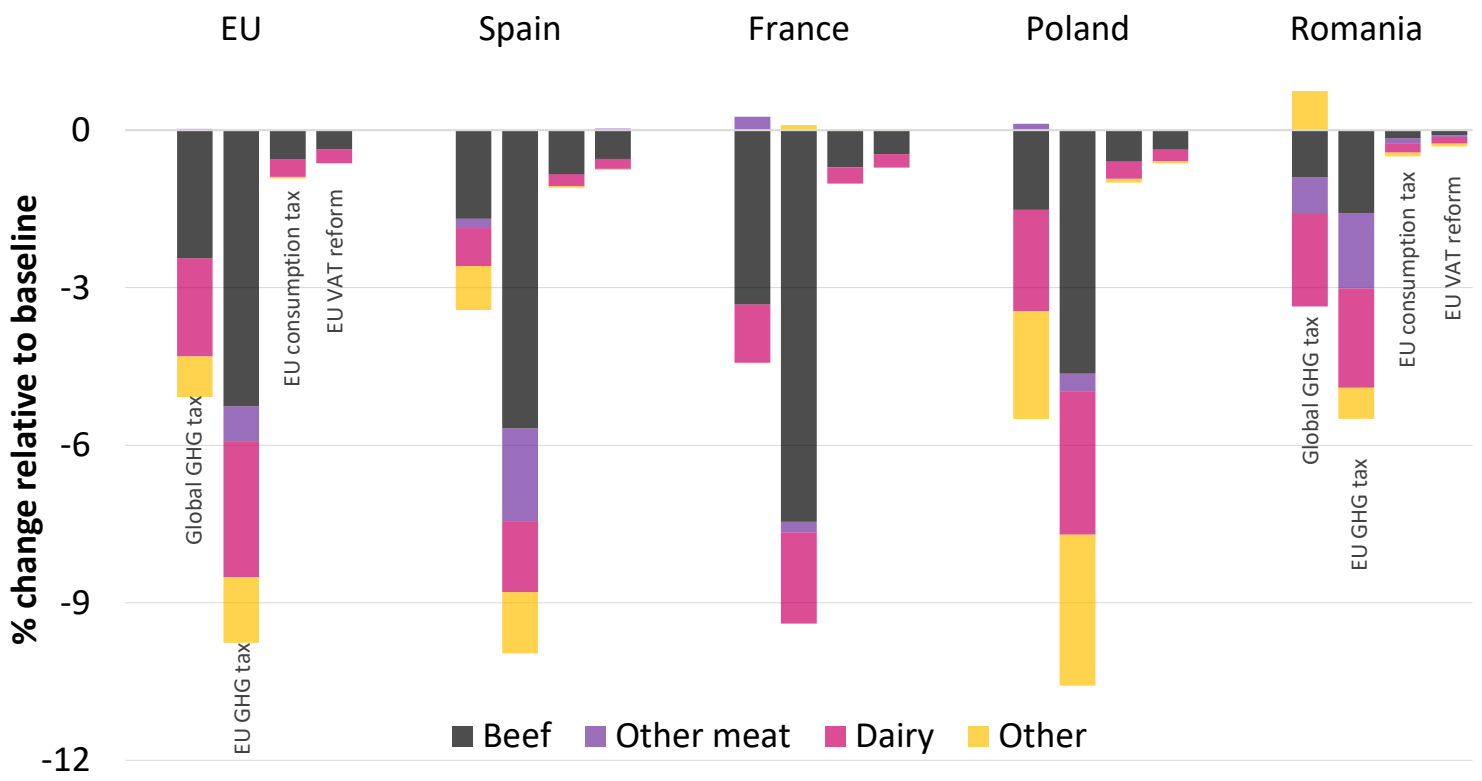
Extra material

Detailed info on scenarios: Tax rates

	Spain				France				Poland				Romania			
	Current VAT rate	Cons. tax	VAT reform	Feebate	Current VAT rate	Cons. tax	VAT reform	Feebate	Current VAT rate	Cons. tax	VAT reform	Feebate	Current VAT rate	Cons. tax	VAT reform	Feebate
Sheep/goat meat	10	**29**	**21**	**21**	6	**24**	**20**	**20**	5	**23**	**23**	**23**	9	**23**	**19**	**19**
Beef	10	**27**	**21**	**21**	6	**22**	**20**	**20**	5	**21**	**23**	**23**	9	**26**	**19**	**19**
Pork meat	10	**13**	10	10	6	**8.2**	**10**	**10**	5	**7.7**	**8**	8	9	**12**	9	9
Poultry meat	10	**11**	10	10	6	**6.8**	6	6	5	**6.3**	5	5	9	**10**	9	9
Rice	4	**6.6**	4	4	6	**8.2**	**10**	**10**	5	**7.7**	**8**	**8**	9	**12**	9	9
Eggs	10	**11**	10	10	6	**6.3**	6	6	5	**5.8**	5	5	9	**9.8**	9	9
Milk & cheese	10	**13**	10	10	6	**8.1**	**10**	**10**	5	**7.6**	**8**	**8**	9	**12**	9	9
Fish & seafood	10	10	10	10	6	5.5	6	6	5	5	5	5	9	9	9	9
Vegetables	4	**4.2**	4	**3**	6	**5.7**	6	**0**	5	**5.2**	5	**3**	9	**9.2**	9	**8**
Bread & cereals	4	**4.5**	4	**3**	6	**6**	6	**0**	5	**5.5**	5	**3**	9	**9.5**	9	**8**
Fruit	4	**4.1**	4	**3**	6	**5.6**	6	**0**	5	**5.1**	5	**3**	9	**9.1**	9	**8**
Potatoes	4	**4.3**	4	**3**	6	**5.8**	6	**0**	5	**5.3**	5	**3**	9	**9.3**	9	**8**
Oils & fat	10	**11**	10	10	6	**6.1**	6	6	23	**24**	23	23	9	**9.6**	9	9
Sugar	10	**10**	10	10	6	**5.6**	6	6	8	**8.1**	8	8	9	**9.1**	9	9

Detailed results: Emissions



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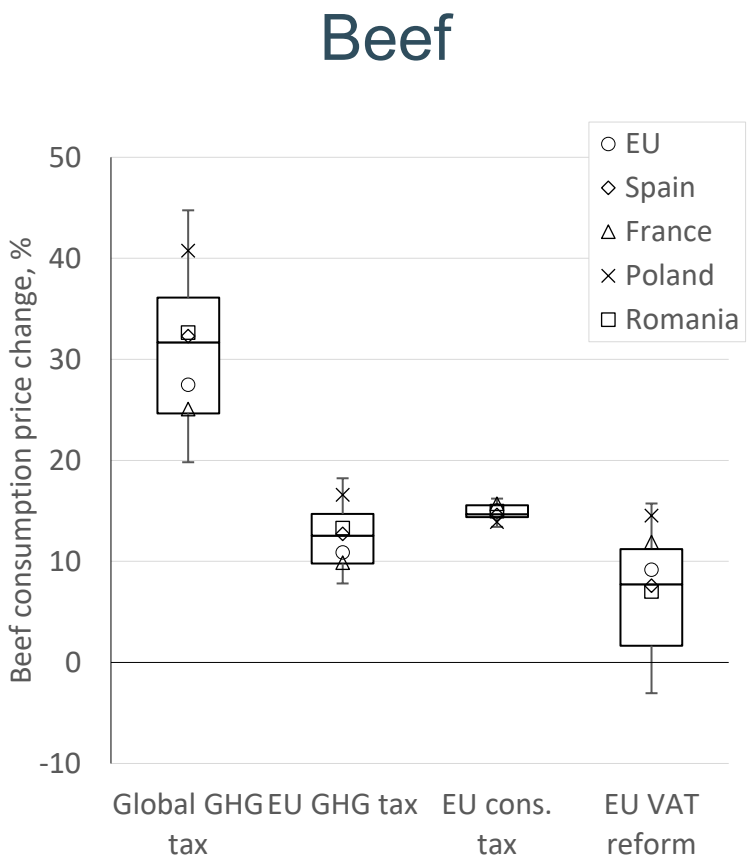
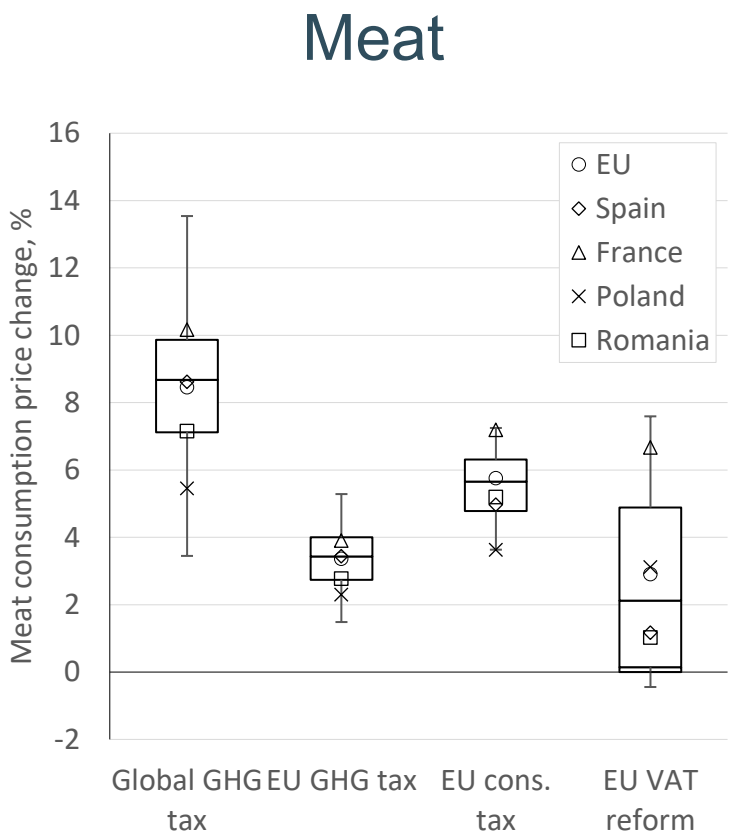
Detailed results: Consumption prices





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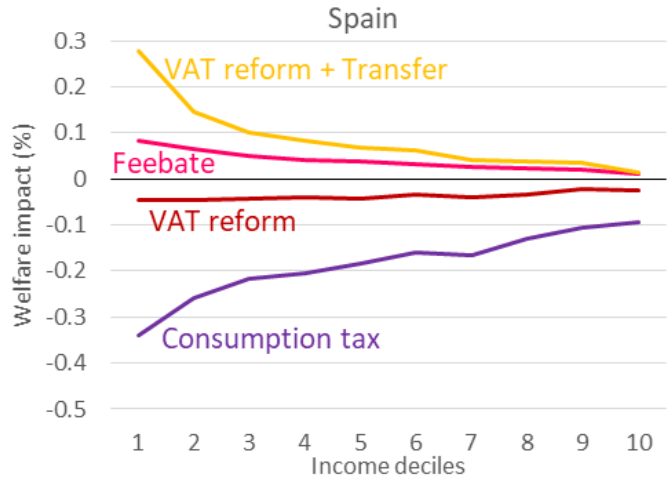
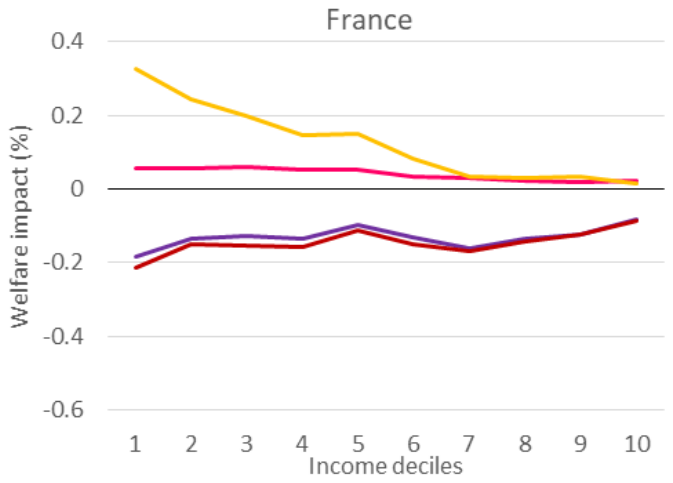
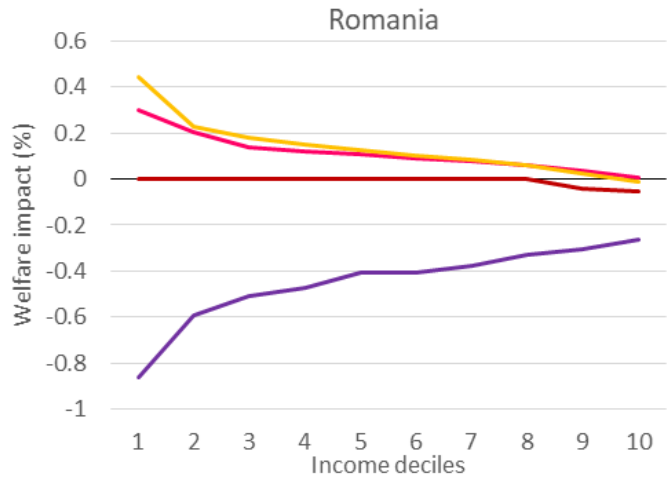
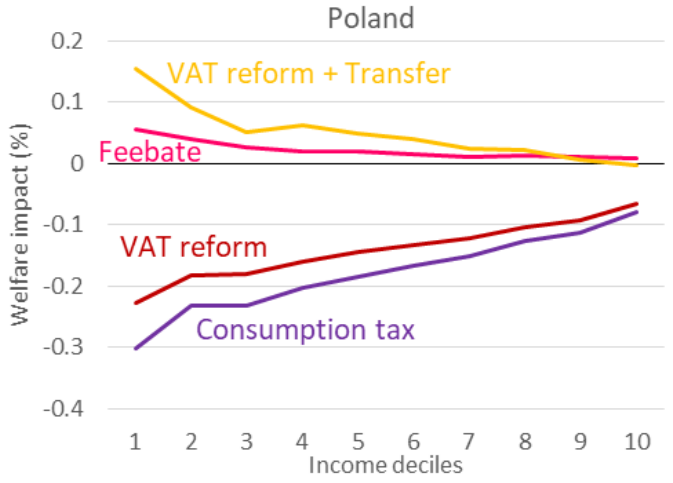
Additional results: Vertical equity









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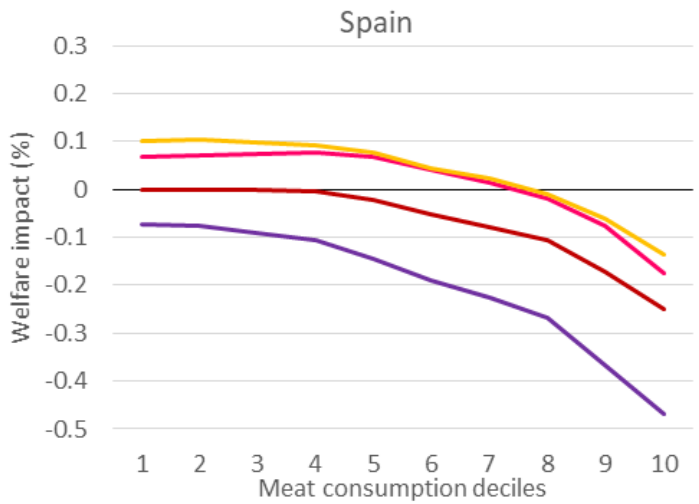
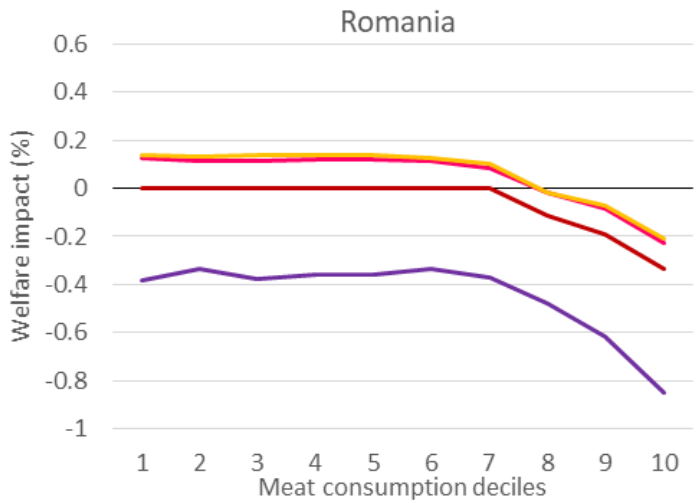
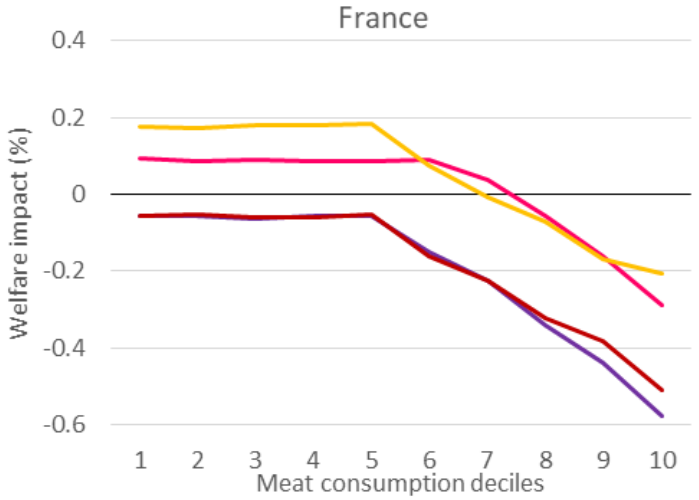
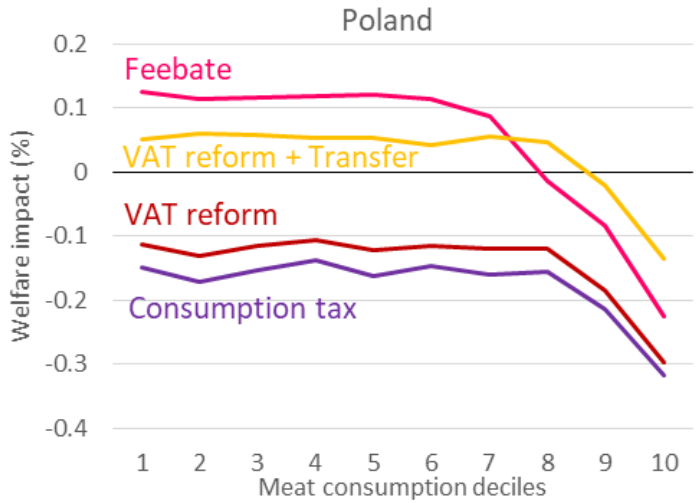
Additional results: Horizontal equity









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Demand elasticities

Own-price elasticities	Beef meat	Pork meat	Sheep/goat meat	Poultry meat	Cheese
Spain	-0.58	-0.47	-0.62	-0.61	-0.35
France	-0.67	-0.64	-0.50	-0.83	-0.34
Poland	-0.63	-0.50	-0.64	-0.60	-0.39
Romania	-0.29	-0.34	-0.62	-0.55	-0.29