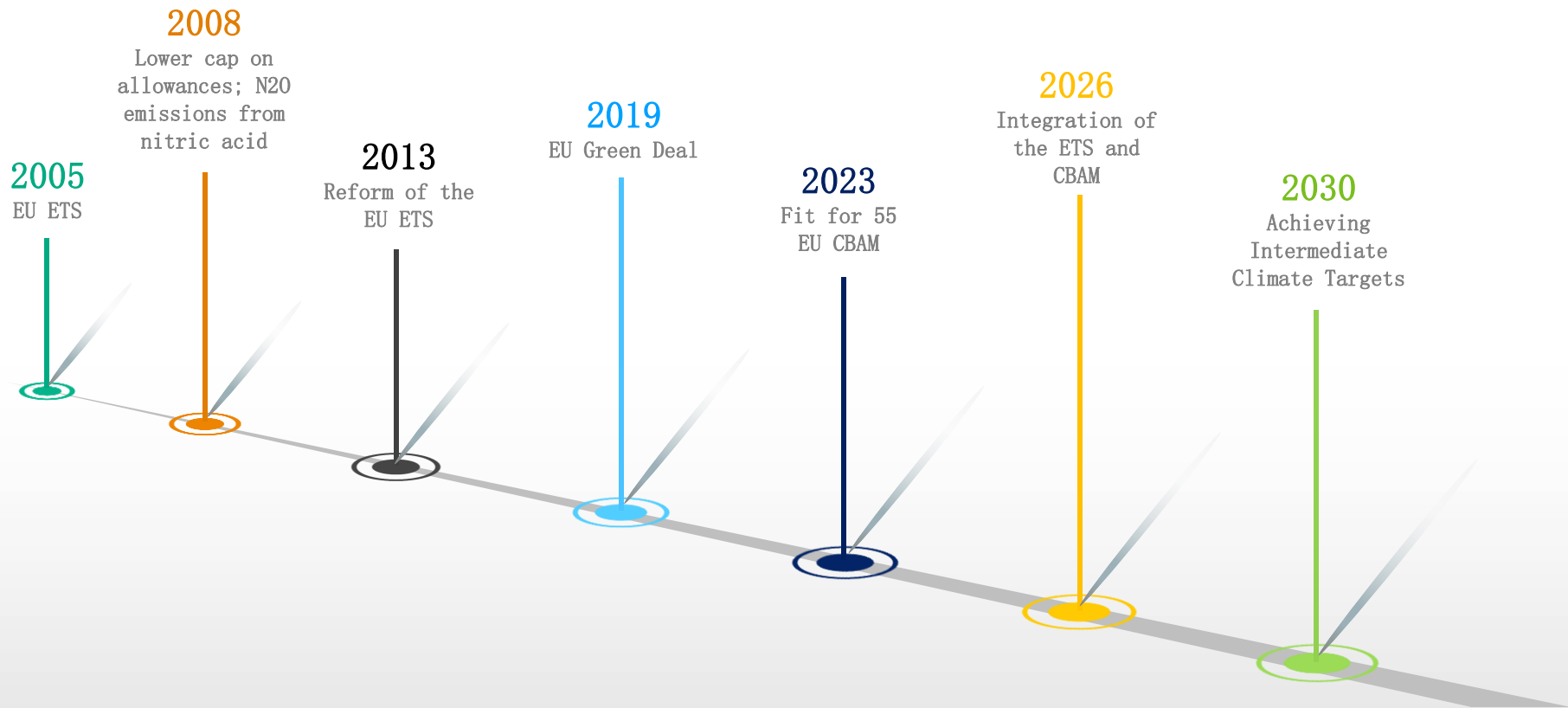


# Fertilizing Climate Policy: The Dual Impact of CBAM on EU Agricultural Emissions and Regional Disparities

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# Background

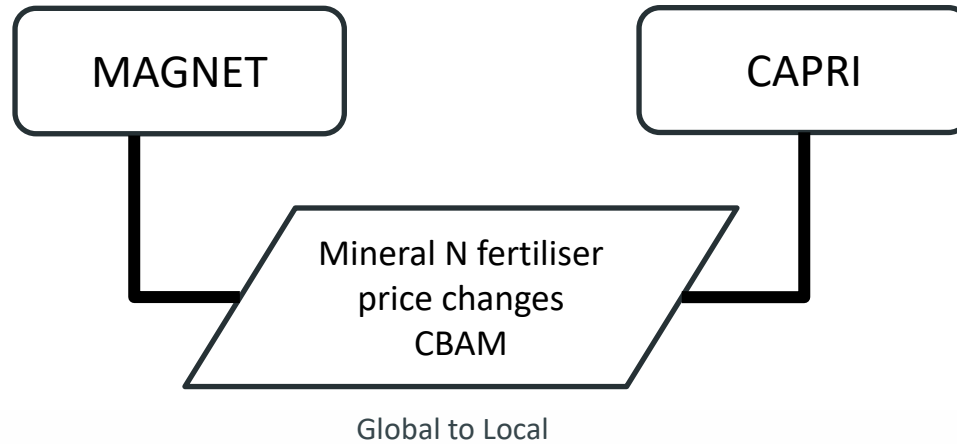


# Objective

Analyze the indirect impact of the EU CBAM on the agricultural sector by examining its effect on mineral nitrogen fertilizer markets.



# Methods

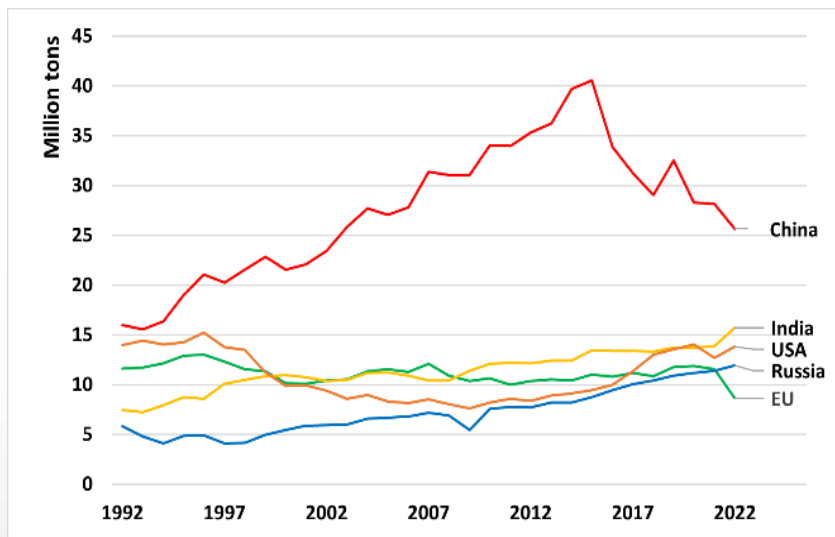


A modeling framework that:

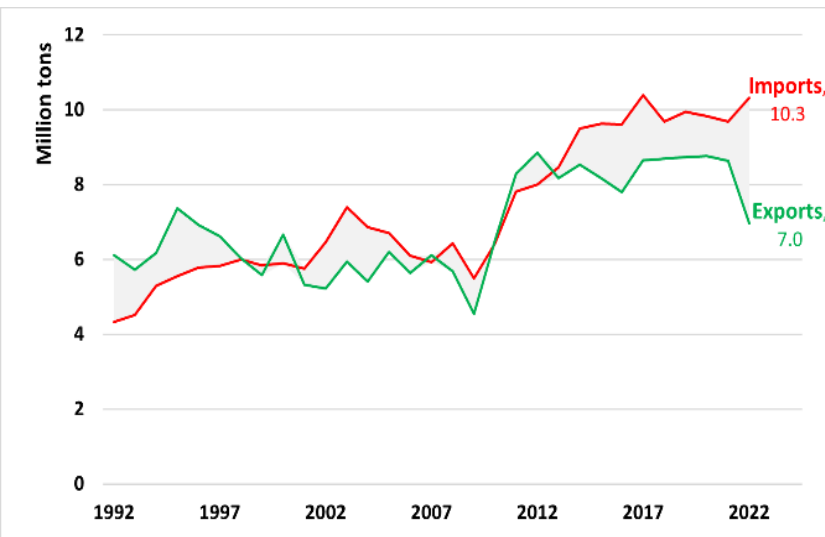
- a. Estimates the effects of the EU ETS and CBAM on mineral nitrogen fertilizer markets;
- b. Accounts for mineral nitrogen fertilizer use in agriculture, its substitutability with organic fertilizers, and their impact on overall agricultural production.

# Trends in Mineral N Fertilizer Markets

## Production

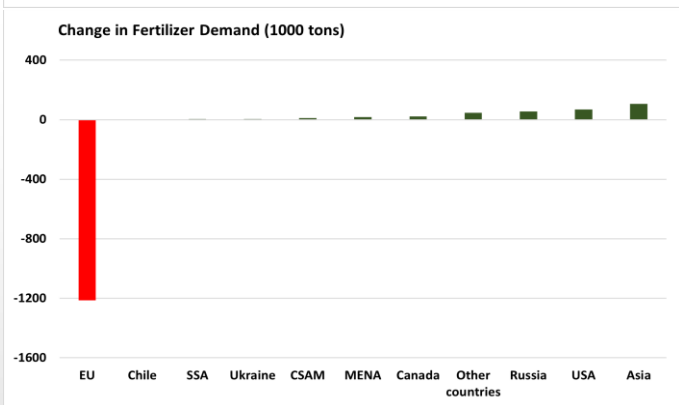
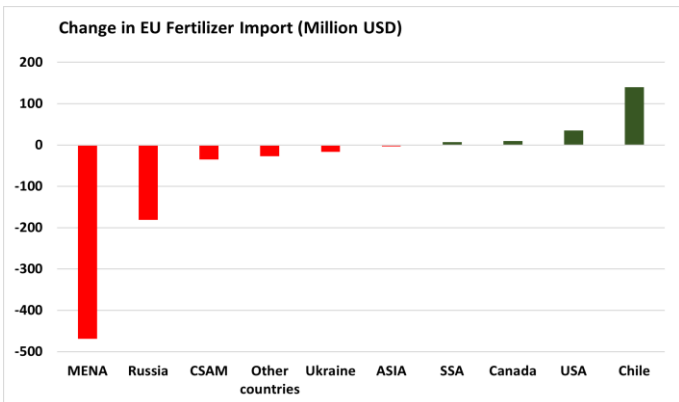


## EU Trade



Source: FAOSTAT (2024)

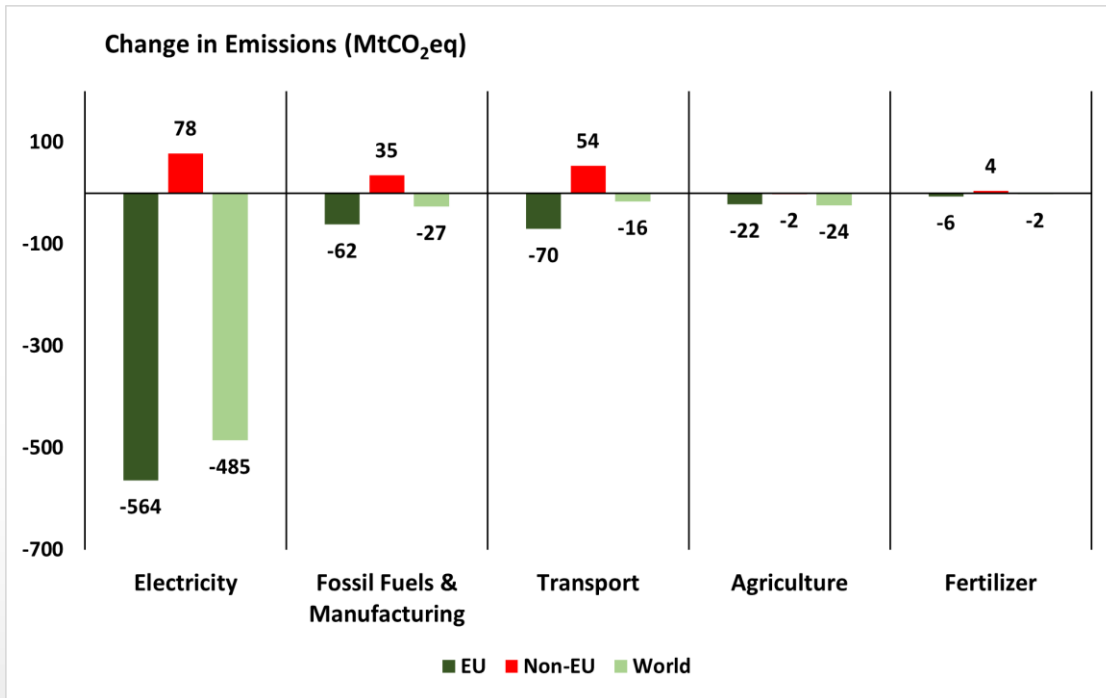
# Net change in EU fertilizer imports and global demand in 2030 vs. Reference Scenario



- Mineral N fertilizer prices  $\uparrow$  99%
- EU mineral N fertilizer production  $\downarrow$  21.4 %.
- EU Imports  $\downarrow$  37 %.
- Reduced EU imports don't lead to significant increase of mineral N fertilizer demand in RoW.

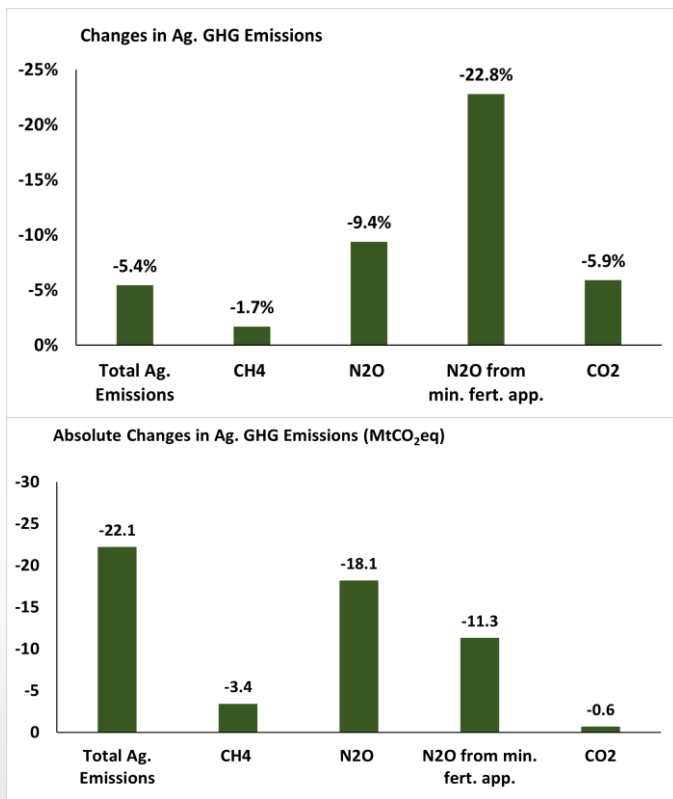
Notes: **MENA:** Middle East and North Africa; **CSAM:** Central and South America; **SSA:** Sub-Saharan Africa; **Other countries:** an aggregate group of regions other than the ones represented.

# Sectoral Absolute Emissions Change in 2030 vs. Reference Scenario



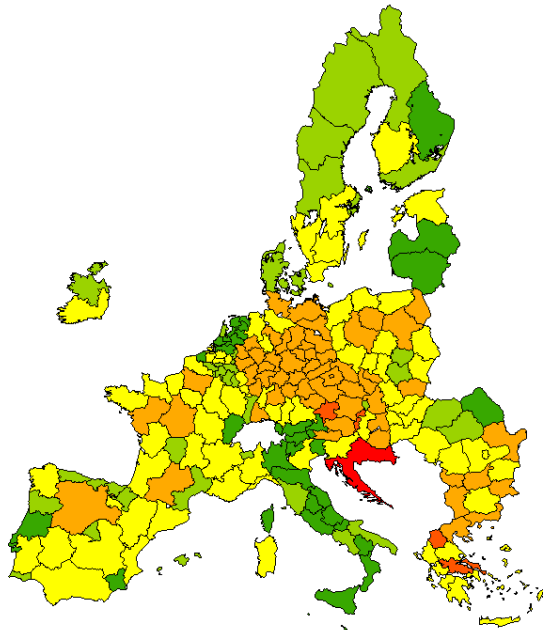
- EU electricity sector sees largest cut: 564 MtCO<sub>2</sub>eq.
- Non-EU electricity emissions rise slightly; global net cut: 485 MtCO<sub>2</sub>eq.
- Transport, fossil fuel, and manufacturing follow.
- Fertilizer production emissions drop 6 MtCO<sub>2</sub>eq in EU, rise 4 MtCO<sub>2</sub>eq outside → net cut: 2 MtCO<sub>2</sub>eq.
- Agriculture not covered by ETS or CBAM; discussed later.

# Changes in Ag. GHG Emissions in 2030 in the EU vs. Reference Scenario



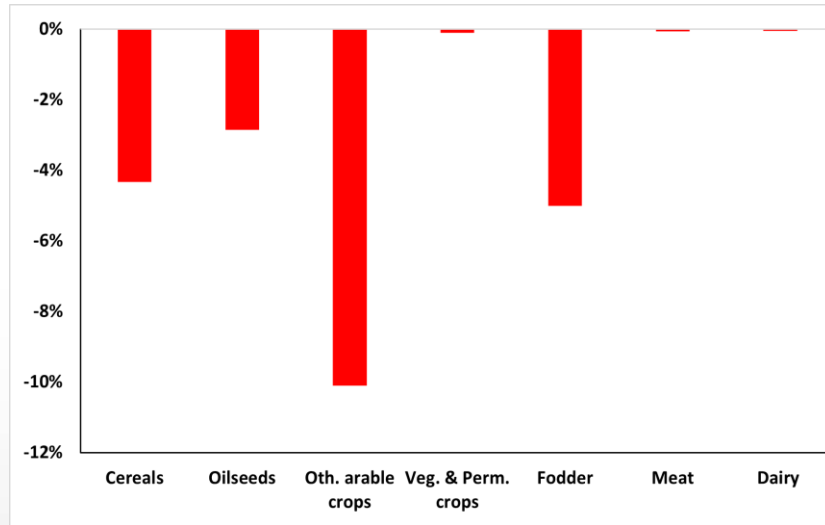
- Higher mineral N fertilizer prices cut EU agricultural GHGs by 5.4% (22.1 MtCO<sub>2</sub>eq).
- Much of this comes from lower N<sub>2</sub>O emissions.
- N surplus in the EU drops by ~15% by 2030.
- Gaseous N losses fall by 21%.
- N runoff drops by 27%; soil N surplus falls by 20%.
- Emissions cuts partly come from tech adoption.
- CBAM drives uptake of nitrogen-efficient technologies.

# Changes in Mineral Fertilizer Use at the NUTS2 Level (Per ha of UAA) in 2030 vs. Reference Scenario



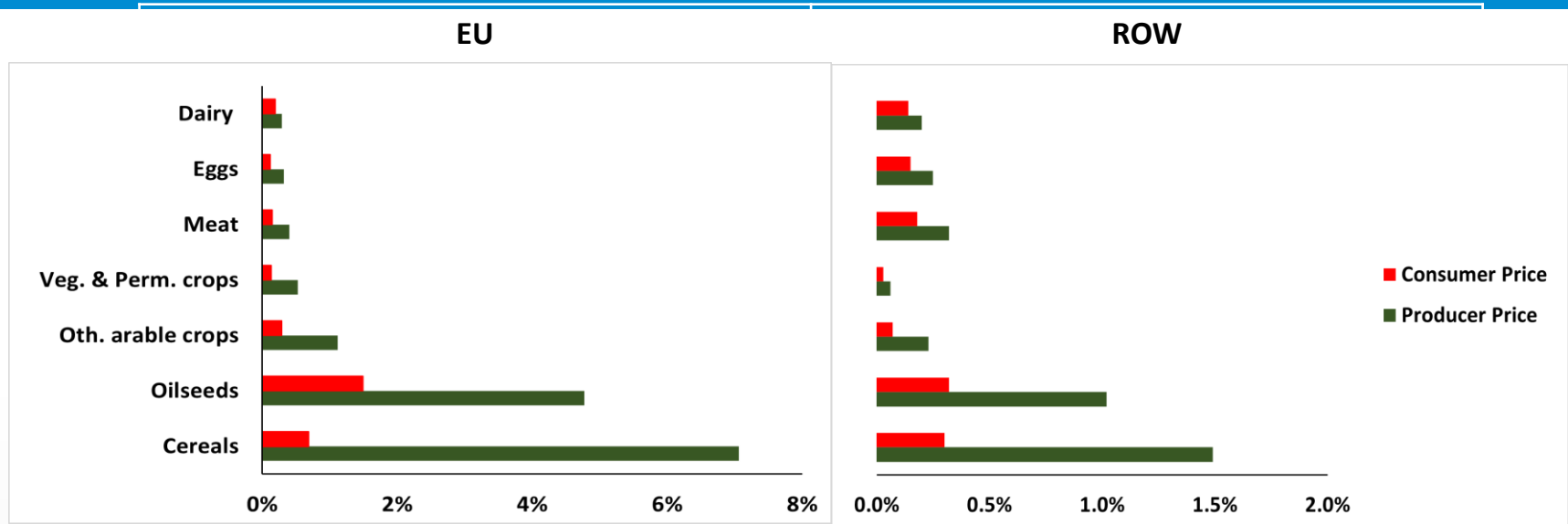
- EU mineral N fertilizer use drops by 22% (–13 kg/ha UAA).
- Manure use changes little, acting as a substitute.
- Regions with high baseline use of mineral N fertilizer reduce the most.
- Mixed farming areas can substitute mineral N with manure.
- Regions without organic alternatives face greater challenges.
- Smallholder-dominated regions reduce use more sharply.
- Areas with high baseline fertilizer prices show stronger reductions.

# Production Changes in the EU in 2030 vs. Reference Scenario



- EU UAA shrinks by 0.8 million ha due to higher fertilizer prices.
- Cereal production drops 4.3%; oilseeds fall 3%.
- Other arable crops cut 10%, mainly sugar beet decline (N intensive).
- Grassland extensification and less fodder maize reduce fodder by 5%.
- Set-aside and fallow land rise by ~15%.
- Meat production barely affected; feed imports compensate.

# Percentage Changes in Producer and Consumer Prices in 2030 vs. Reference Scenario

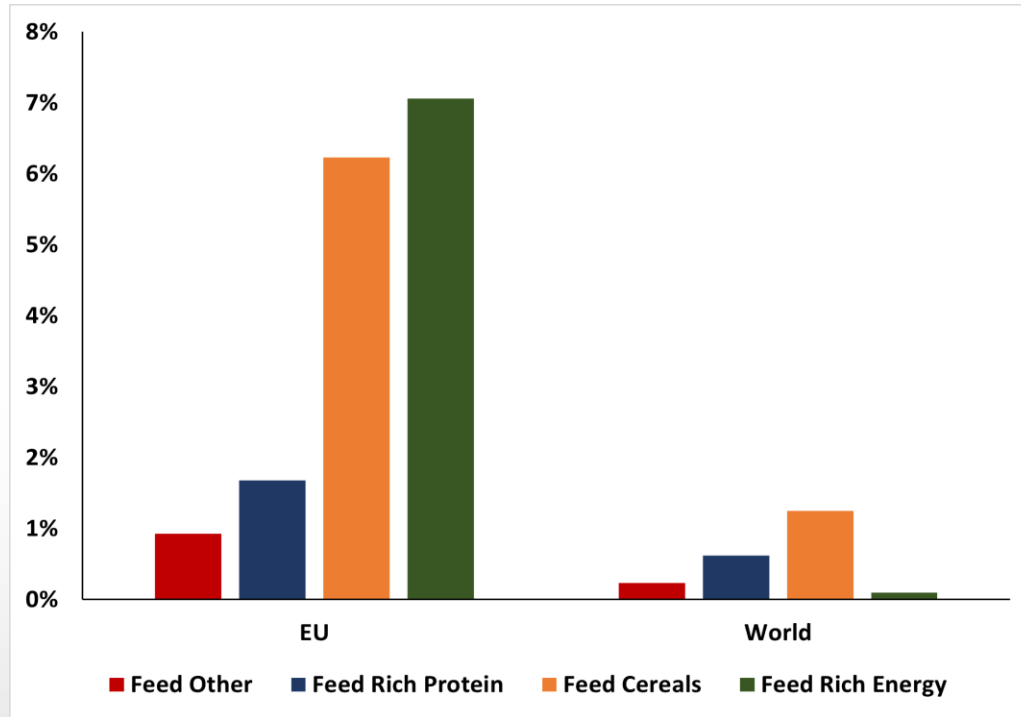


- Animal product price rises are modest.
- Producers offset feed cost hikes via more feed imports.
- Result: slight increase in global feed prices.

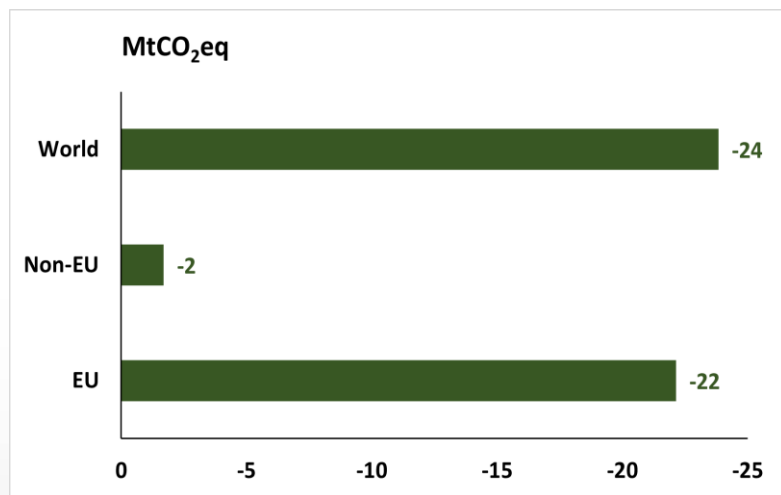
# Relative Changes in Feed Mix in the EU in 2030 vs. Reference Scenario

		Ruminants					Monogastric	
		For Dairy Production	Other Cows	Male Adult Cattle High Weight	Male Adult Cattle Low Weight	Sheep and Goat	Pig Fattening	Poultry Fattening
Tradable	Feed other	0.02%	0.51%	0.72%	0.68%	0.73%	-	-
	Feed rich protein	3.15%	8.06%	7.18%	13.13%	2.60%	0.16%	0.13%
	Feed cereals	10.13%	7.62%	5.63%	7.08%	6.98%	-0.15%	-0.21%
	Feed rich energy	5.08%	7.80%	4.87%	8.17%	3.16%	2.67%	2.47%
Non-Tradable	Grass	-8.55%	-9.23%	-10.18%	-9.38%	-5.77%	-	-
	Fodder maize	-5.14%	-11.07%	-10.34%	-9.24%	-5.57%	-	-
	Fodder root crops	4.65%	4.29%	2.73%	2.54%	4.71%	-	-
	Oth. fodder on arable land	1.59%	-0.68%	0.13%	-0.03%	6.55%	-	-

# Relative Changes of Producer Prices of Marketable Feed in the EU and in the World in 2030 vs. Reference Scenario



# Absolute Change in Agricultural Emissions in 2030 vs. Reference Scenario



- No global emission leakage from EU fertilizer price rise.
- EU agri-GHG<sub>s</sub> -22 MtCO<sub>2</sub>eq; Non-EU -2 MtCO<sub>2</sub>eq → net -24 MtCO<sub>2</sub>eq.
- Non-EU drop from lower meat, esp. beef, output.
- Driver: higher world feed prices (Slide 12).
- Crop shifts to Non-EU minor; emission intensities similar.
- EU meat 4× more efficient; relocation → leakage risk (Slide 14).

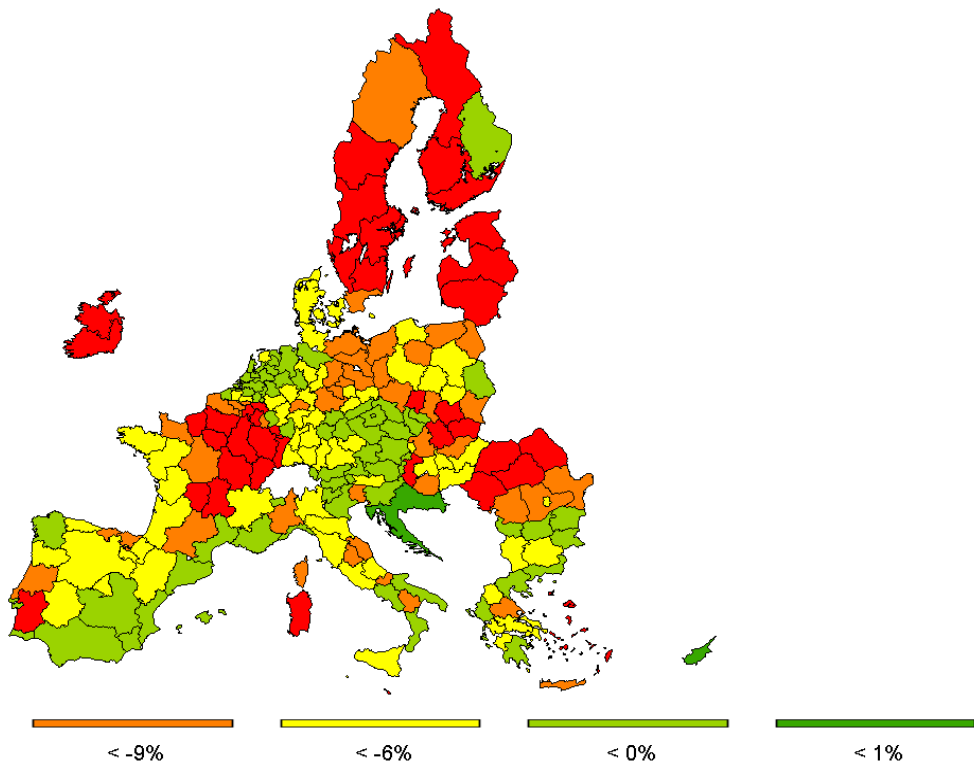
# Changes in Trade and Emission Coefficients

## World export share

<i>Cereals</i>	EU	-12.47%
	Non-EU	2.17%
<i>Oilseeds</i>	EU	-3.87%
	Non-EU	0.36%
<i>Meat</i>	EU	-0.08%
	Non-EU	0.04%
<i>Beef</i>	EU	-0.32%
	Non-EU	0.04%
<i>Feed Cereals</i>	EU	-12.65%
	Non-EU	1.95%
<i>Feed Rich Protein</i>	EU	-1.56%
	Non-EU	0.09%
<i>Feed Rich Energy</i>	EU	-3.55%
	Non-EU	0.14%
<i>Feed Other</i>	EU	-1.46%
	Non-EU	0.25%

- EU crop/feed imports increase and exports decrease.
- Animal sector is hardly affected.
- EU is more sustainable in animal production than non-EU.

# Changes in Agricultural Income in the EU (NUTS2) in 2030 vs. Reference Scenario



EU	-7.7%
Non-Eu	0.05%

- Income declines more sharply where input costs are a larger share of output value.
- In the reference scenario, regions with steepest income loss allocate 59%-86% of output to input costs.
- Regions with low input–output ratios face smaller income losses.
- In animal-producing regions, non-tradable fodder costs rise due to grassland extensification and less fodder maize.
- Tradable feed, more expensive, increasingly replaces non-tradable fodder.

# Concluding Remarks

- **Rising fertilizer prices outside the EU increase production emissions but don't offset EU reductions.**
- **Expansion of green (hydrogen-based) fertilizers could lower production impacts and increase emission savings.**
- **A quota for green nitrogen fertilizers may boost green hydrogen demand and reduce agricultural emissions (Becker Büttner Held, 2025).**
- **Short-term competitiveness losses expected for EU fertilizer exporters and downstream sectors, even with rebates (Bellora and Fontagné, 2023).**
- **Stimulation of the conversion from conventional to organic farming Sørensen et al. (2025).**
- **Carbon leakage in the agricultural sector is minimal/none.**
- **CBAM raises EU fertilizer prices, affects regional incomes differently, suggesting targeted use of CBAM revenues for mitigation support.**
- **Focus on farm income distribution and impacts of climate mitigation policies.**
- **Electricity and transportation cost changes are not accounted for in the impact of ag. production and prices.**
- **Future trajectory of EU carbon price is a major uncertainty.**

# Acknowledgment

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[www.act4cap27.eu](http://www.act4cap27.eu)

# THANK YOU!

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## References

- Becker Büttner Held (2025): Gutachten zur rechtlichen Zulässigkeit einer Quote für die Inverkehrbringung von Stickstoffdünger auf Grundlage von grünem Ammoniak in Deutschland. Gutachten im Auftrag der Stiftung Klimaneutralität.
- Bellora, Cecilia; Fontagné, Lionel (2023): EU in search of a Carbon Border Adjustment Mechanism. In *Energy Economics* 123. DOI: 10.1016/j.eneco.2023.106673.
- Sørensen, Peter Birch; Beck, Ulrik Richardt; Berg, Asbjørn Kehlet; Christiansen, Simon; Jørgensen, Cecilie Løchte; Kirk, Jens Sand et al. (2025): The effects of unilateral climate policy towards agriculture: A case study of Denmark. In *J Agricultural Economics* 76 (1), pp. 3–23. DOI: 10.1111/1477-9552.12624.