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## **Achieving Climate Change and Environmental Goals without Protectionist Measures: Mission (Im)possible?**

**Fabio Santeramo, Emanuele Ferrari, and Andrea Toreti**

*Selected presentation for the International Agricultural Trade Research Consortium's (IATRC's) 2021 Annual Meeting: Trade and Environmental Policies: Synergies and Rivalries, December 12-14, 2021, San Diego, CA.*

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# Achieving Climate Change and Environmental Goals without Protectionist Measures: Mission (Im)possible?

Fabio Santeramo (University of Foggia and European University Institute)

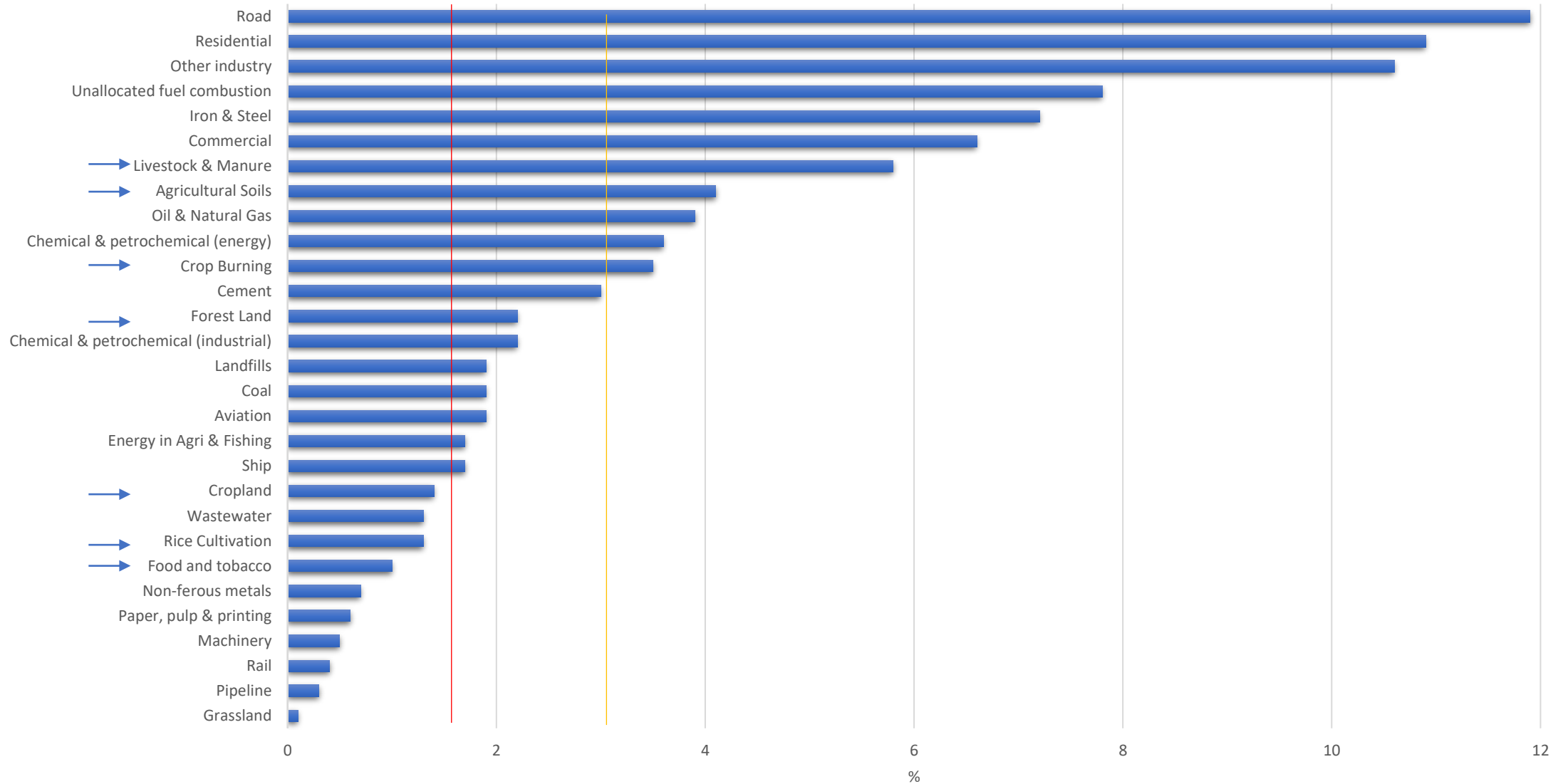
Emanuele Ferrari (Joint Research Centre, EU Commission)

Andrea Toreti (EU Commission)

*CP presented at the IATRC Annual Meeting*

12-14 December 2021

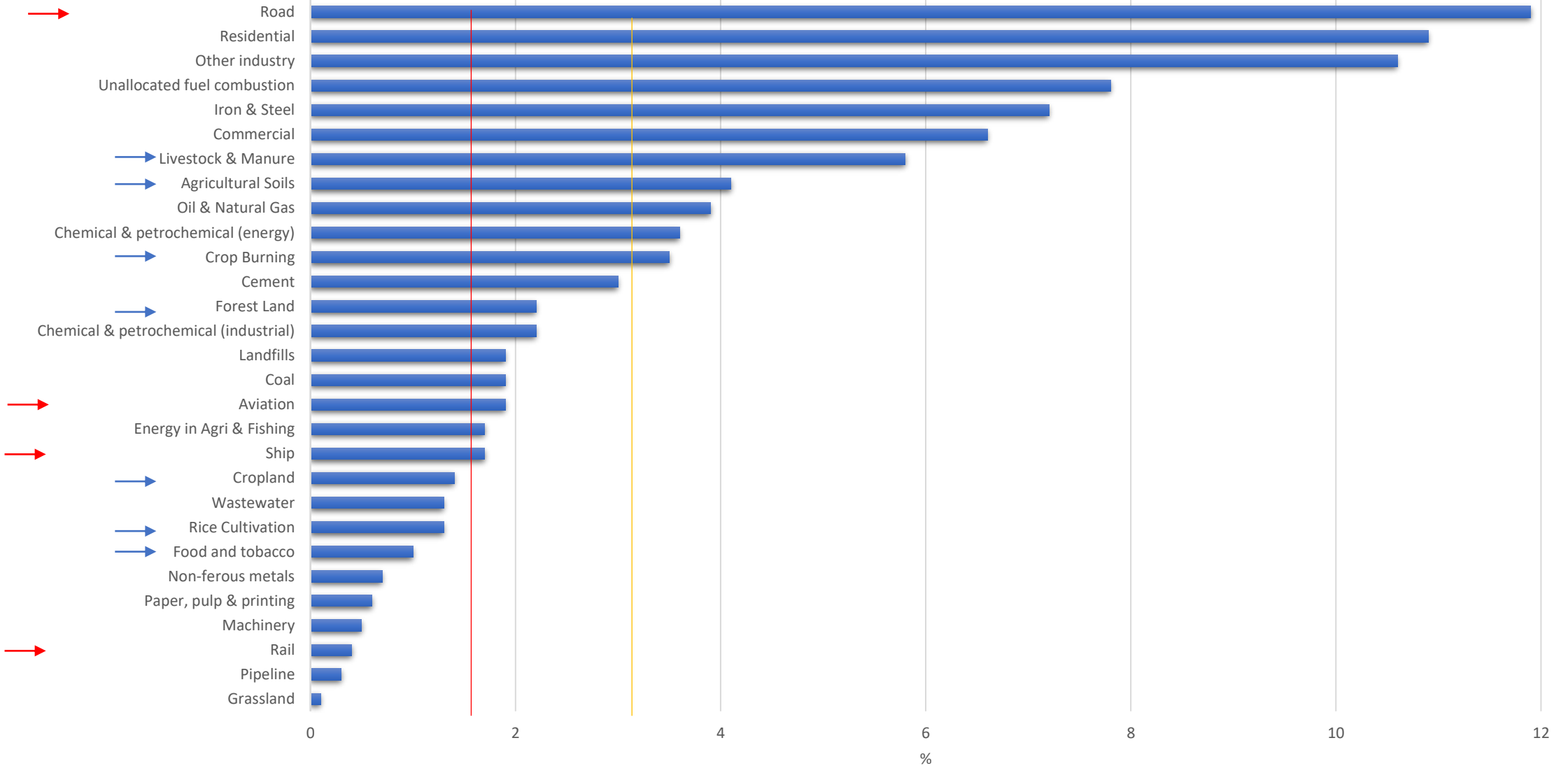
# Share of global greenhouse gas emissions



Average share of emissions: 3.4%

Median share of emissions: 1.9%

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# The (work-in-progress) CP in a nutshell

*Fact:* Growing attention to the role of trade policies in helping to achieve environmental goals in the ag-food sector.

Investigate where **“the problem”** is (i.e. impacts of ag-food on the environment), and how trade may **help addressing** the problem (i.e. how we may lower the global impacts on the environment), through **trade policies** (w/out losing the welfare gains of trade)

Threats: global (re)distribution may be undesirable or inefficient (for production), or detrimental for the environment (carbon leakage, subsidies on dirty productions, “excessive” movements of goods), trade regulations and agreements

# Economics of CC and Trade (of Ag-food products)

1. CC alters comparative advantage (production)  
*yields & land use (well known mechanisms)*
2. Link w/ trade is indirect  
(mediated by production and comparative advantage)
3. Link w/ bilateral trade has not been (fully) investigated, yet

# Climate change and agri-food trade

- **trade** favors food reallocation from surplus to deficit regions (*FAO, 2018*)
- trade as **adaptation strategy: limited** (*Costinot et al, JPE 2016*) vs **crucial** (*Gouel & Laborde, JEEM 2021*)
- trade contributes to distributing climate **welfare impacts** (*Jones & Olken, AER 2010*)
- trade is an adaptation strategy **but also impacted by CC** (*Hsiang, AnnRevResEcon 2016*)
- relevant impacts on **agri-food trade –highly sensitive** (*Mendelsohn & Massetti, REEP 2017*)
- recent discussion in the HB of Ag.Econ, chapter on trade (2021)



# Impacts of climate change on global agri-food trade

Bozzola M.<sup>1</sup>, Lamonaca E.<sup>2</sup>, Santeramo F.G.

<sup>1</sup>Queens University Belfast (UK) and ZHAW Zurich (CH)

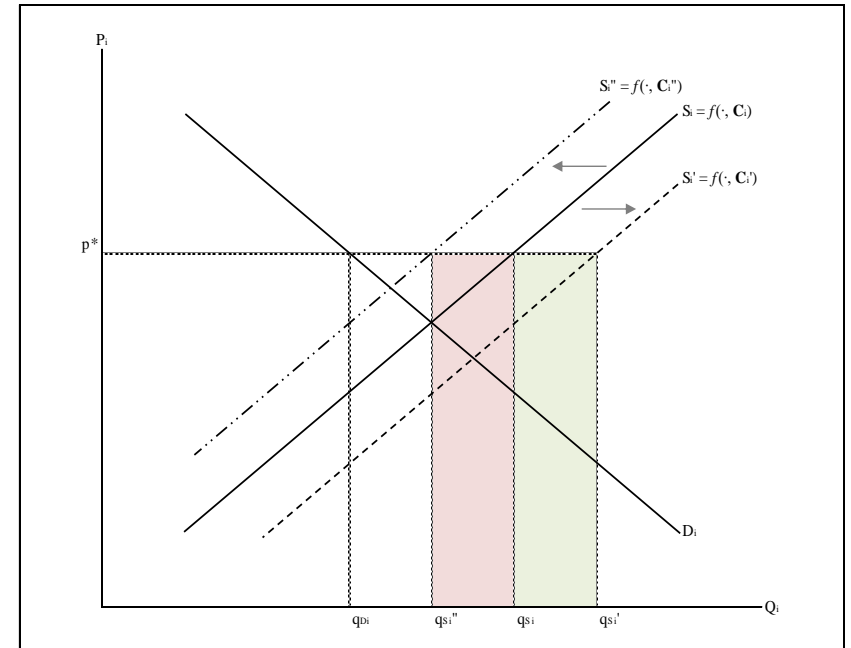
<sup>2</sup>University of Foggia (Italy)

## Changes in country's trade value due to CC

CC shifts  $S_i$  (but leave  $D_i$  unaffected)

Given exogenous  $p^*$  higher(lower) than domestic price

- if CC shifts  $S_i$  rightward, the value of exports increases (green area)
- if CC shifts  $S_i$  leftward, the value of exports decreases (red area)



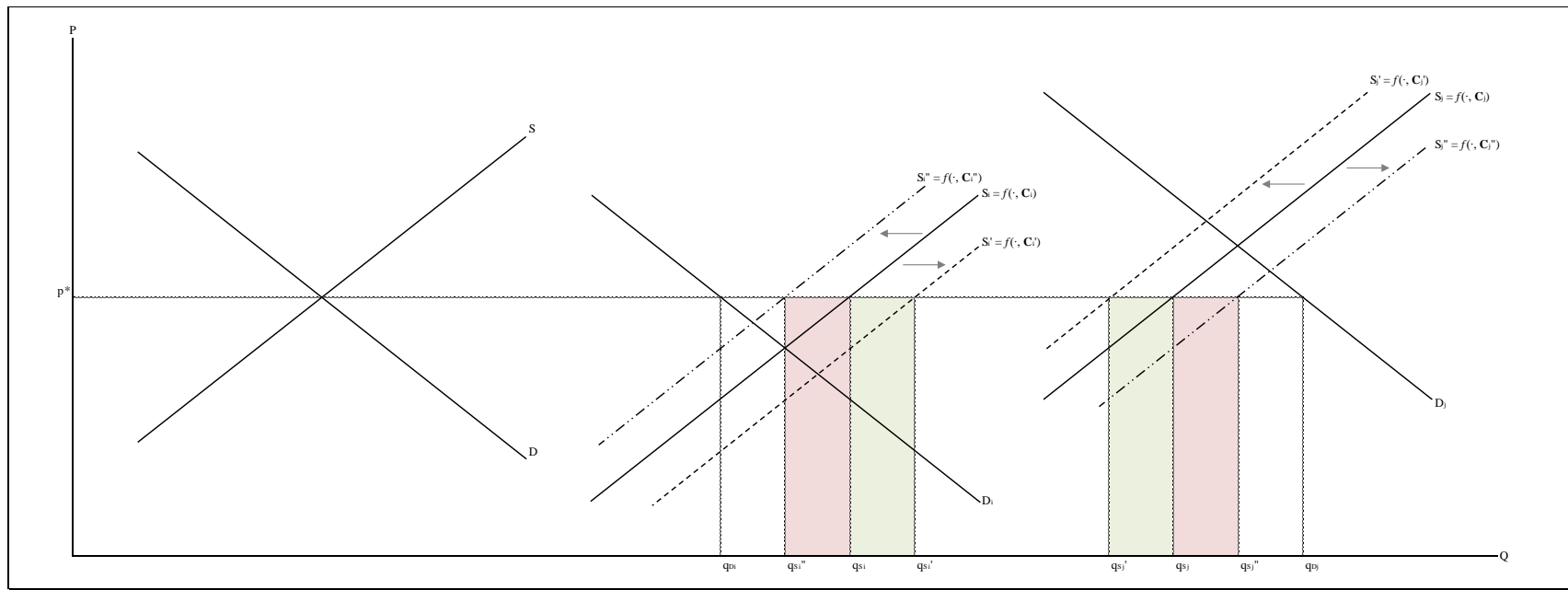
Shifts in country's aggregate agri-food supply due to CC alter trade values

# Impacts of climate change on global agri-food trade

Bozzola M., Lamonaca E., Santeramo F.G.

## Changes in the value of bilateral trade due to CC

- Exogenous  $p^*$ : higher than domestic price in  $i$ ; lower than domestic price in  $j$
- If CC shifts  $S_i$  rightward and shifts  $S_j$  leftward (green areas): bilateral trade increases
- If CC shifts  $S_i$  leftward and shifts  $S_j$  rightward (red areas): bilateral trade decreases



# Main findings

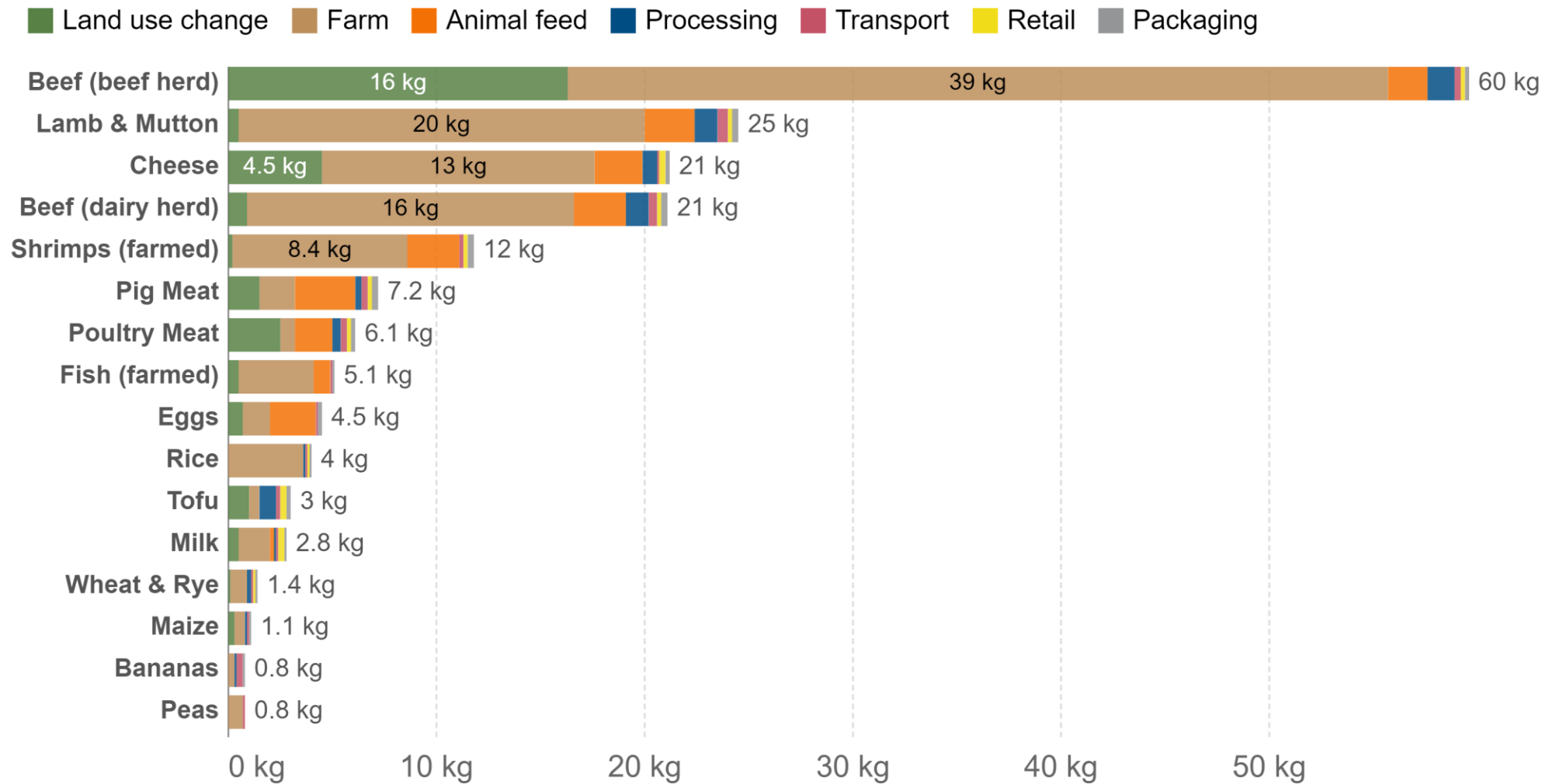
- Higher **temperatures** tend to increase exports
- Larger **differences in CC** tend to be **beneficial** for trade
  
- **CC impacts vary across countries** with different economic development
  - (i) Changes in temperature have more marked differentiated impacts for developed and developing exporters
    - Increases in temperature about 11% higher in developed than in developing countries:
      - ✓ agri-food products from developing countries generally better suited to warmer climates
      - ✓ most of net-exporters of agricultural produce (such as most of the developing exporters in our sample) may benefit from climate change (Gouel and Laborde, JEEM 2021)
  - (ii) Differences in CC matter for bilateral trade, and favor developed exporters
    - ✓ Substantial heterogeneity of climate impacts between developed and developing countries: this is consistent with findings of Dell et al. (AEJ 2012)

# Economics of CC and Trade (of Ag-food products)

1. CC alters comparative advantage (production)  
*yields & land use (well known mechanisms)*
2. Link w/ trade is indirect and complex (due to GVC)  
(mediated by production and comparative advantage)
3. Link w/ bilateral trade has not been (fully) investigated, yet  
(and need to take into account monologues or dialogues among countries)

# Food: greenhouse gas emissions across the supply chain

Greenhouse gas emissions are measured in kilograms of carbon dioxide equivalents (kgCO<sub>2</sub>eq) per kilogram of food. This means non-CO<sub>2</sub> greenhouse gases are included and weighted by their relative warming impact.



Source: Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science.

Note: Data represents the global median greenhouse gas emissions of food products based on a large meta-analysis of food production covering 38,700 commercially viable farms in 119 countries.

OurWorldInData.org/environmental-impacts-of-food • CC BY

# Who is "the polluter"?

## ...and when is pollution emitted ?

Table 1. Agri-food emissions and global value chain participation for top emitters.

	Emissions		Tot emissions production net of exports		Tot emissions exports	
	(A)	(B)	(A)	(B)	(A)	(B)
BRA	1,201	12	1,123	-2	78	14
CAN	194	9	119	-6	76	15
CHN	802	109	790	101	12	9
EUN	571	142	380	62	191	80
IND	775	24	760	24	15	1
→ IDN	923	7	907	7	16	0
JPN	46	37	45	34	0	3
RUS	181	42	138	36	43	6
← USA	539	142	444	57	95	86

(A) refers to upstream industries (i.e., farm-gate and land use change emissions, production and trade of raw agri-food products, domestic value-added agri-food products in the global value chain); (B) refers to downstream industries (i.e., food processing and packaging emissions, production and trade of processed agri-food products, foreign value-added agri-food products in the global value chain). Million tonnes of CO2 equivalent

Source: elaboration on data from FAOSTAT and WITS.

# Stylized facts: echo, for ag-food sector, the results of Copeland et al. (2021)

# 1: Industries more exposed to **trade** are **dirtier**

# 2: Different types of pollution are correlated

# 3: **Upstream** industries are **dirtier**

# 4: **Less productive** industries and countries are **dirtier**

# 5: Emission intensities are heterogeneous across countries and industries

# 6: Most emissions growth comes from developing countries

# 7: **Trade** accounts for a **sixth to a fifth** of pollution emissions

# 8: Developed countries are **outsourcing** pollution

# 9: **Technique and composition** account for a larger share of changes in emissions

# Stylized facts: echo, for ag-food sector, the results of Copeland et al. (2021)

# 1: Industries more exposed to **trade** are **dirtier** (less trade?)

# 2: Different types of pollution are correlated

# 3: **Upstream** industries are **dirtier**

# 4: **Less productive** industries and countries are **dirtier** (more technology? and less trade?)

# 5: Emission intensities are heterogeneous across countries and industries

# 6: Most emissions growth comes from developing countries

# 7: Trade accounts for a **sixth to a fifth** of pollution emissions

# 8: Developed countries are **outsourcing** pollution (less trade?)

# 9: **Technique and composition** account for a larger share of changes in emissions (less trade?)



# Stylized facts on AfGVC:

upstream and downstream production, trade and regulations

*# 10: Downstream industries more valuable*

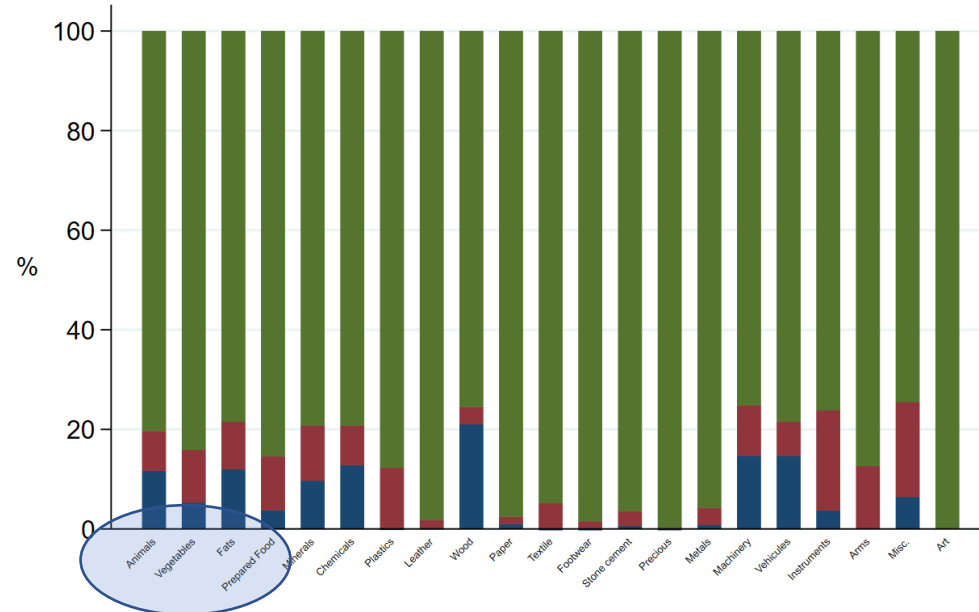
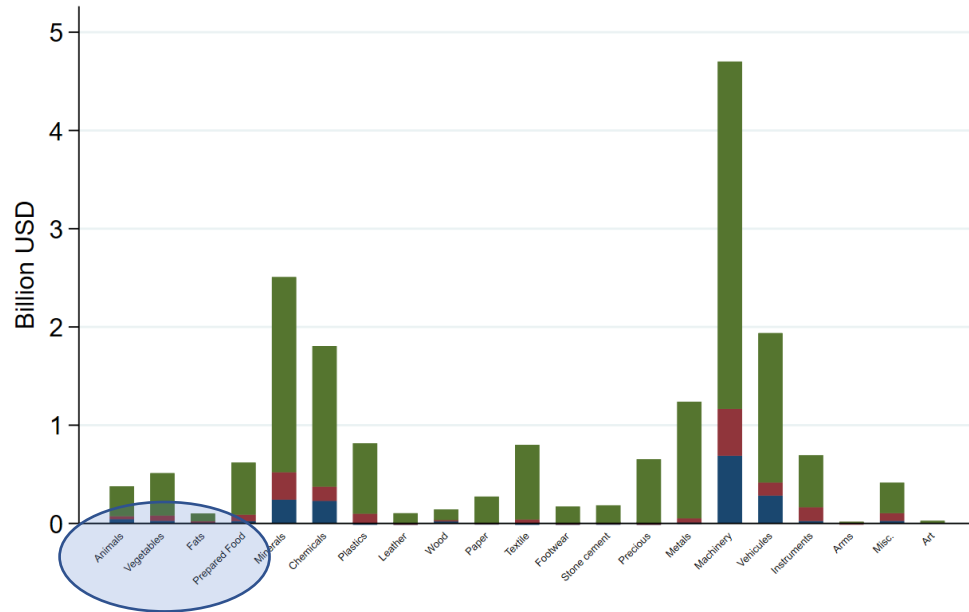
*# 11: Upstream industries benefit of domestic support and downstream industries more exposed to import tariffs*

*# 12: Developed economies tend to lead trade agreements and to include non-trade policy objectives such as environmental protection*

RTAs			RTAs co-signatories and PTAs beneficiaries									PTAs	
In force	Announced	Signatories	CAN	JPN	EUN	USA	RUS	IDN	IND	BRA	CHN	Providers	Scheme and countries
14	1	CAN										CAN	2 schemes 122 countries
18	2	JPN	in force AG, EP					beneficiary	beneficiary			JPN	1 scheme 132 countries
46	10	EUN	in force AG, EP	in force AG, EP				beneficiary	beneficiary		beneficiary	EUN	2 schemes 94 countries
14	1	USA	in force AG, EP		announced			beneficiary		beneficiary		USA	5 schemes 180 countries
12	2	RUS						beneficiary	beneficiary	beneficiary	beneficiary	RUS	1 scheme 153 countries
12	2	IDN		in force AG, EP	announced							IDN	
17	4	IND		in force AG, EP	announced			in force AG				IND	1 scheme 48 countries
9	2	BRA	announced					in force AG	in force AG			BRA	
16	3	CHN						in force AG	accession AG			CHN	1 scheme 42 countries

# On the Trade Effects of Environmentally Related Technical Measures (w/C. Emlinger and E. Lamonaca)

Notes: Environmental TBT in blue, other TBT in red, no TBT in green



Main takeaway: TBT tend to hinder trade, but TBT covering environmental issues are pro-trade

# (Ag) Trade-related policies

## National policies

### Subsidies

Domestic support

Export subsidies

## Trade policies

### Agreements

PTA

RTA

### Pricing policies

MFN tariffs

Bilateral Tariffs

### NTMs (focus on technical)

Multi

Bilateral

# The (work-in-progress) CP in a nutshell

Not all countries are contributing in the same way

Necessity to deepen the analyses on the prod-exp-(imp-process.-exp)-? chain

Need smartly integrated GVC

(possibly equally valid) instruments have different effect on trade

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