Ad-hoc Expert meeting – UNCTAD

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Ship-owner response to carbon taxes: Industry and environmental implications

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Agenda

1. Rational
2. Findings
3. Conclusions

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1. Rational

1. The impact of environmental maritime policies depends, to a large extent, on the reaction of ship-owners to the new policies (DNV + UNCTAD 2021)
2. This reaction is to a large extent explained by the sensitivity of trade (transport quantities) to maritime transit time and cost.
3. This is often neglected in analysis, although elasticity can be significant for some markets
4. For EEXI + high case scenario: +10% avg in MTC =-0.4% for Agriculture trade and -1.6% for Food & Beverage trade.

Idea: Use available data (DNV + UNCTAD + CEPII + World Bank + Clarksons) on grain and soybean market to assess:

1. how sensitive is trade to maritime transport cost and transit time (augmented gravity model) for grain and soybean;

2. how these elasticities influence the choice of ship-owners on optimal speed, level of trade and emission.

3. How the level of taxation may change the optimal choice.

2. Findings. *Trade (volume) is elastic to maritime transit time and cost*

Gravity model estimates for grain and soybean export volume (in tonnes).

	Grain						Soybeans					
	OLS		OLS_FE		PPML_FE		OLS		OLS_FE		PPML_FE	
Log d_{ij}	−1.066***		−1.629***		−0.872***		−0.374		−1.131***		−1.563***	
	(−8.51)		(−9.03)		(−4.74)		(−1.40)		(−2.93)		(−6.41)	
$CONT_{ij}$	1.535***	1.431***	1.645***	1.506***	1.136***	1.166***	0.923	0.935	2.009	2.425**	0.852*	1.663***
	(4.02)	(3.82)	(2.92)	(2.91)	(2.62)	(2.72)	(1.18)	(1.38)	(1.58)	(2.45)	(1.69)	(3.86)
$LANG_{ij}$	0.077	0.531	0.010	0.481	0.038	0.470	0.468	0.797*	0.321	0.722	0.443	0.422*
	(0.20)	(1.46)	(0.02)	(1.11)	(0.13)	(1.41)	(0.89)	(1.76)	(0.40)	(1.06)	(1.46)	(1.76)
CLY_{ij}	1.424**	1.024*	0.876	0.532	1.472***	1.117**	−1.300	−0.676	−2.580*	−1.534	−3.436**	−1.467*
	(2.40)	(1.92)	(1.03)	(0.60)	(2.87)	(2.31)	(−1.36)	(−0.90)	(−1.67)	(−1.49)	(−2.01)	(−1.73)
Log $Time_{ij}$		−0.980***		−1.393***		−0.917***		−0.925***		−1.220***		−0.944***
		(−8.33)		(−8.09)		(−4.25)		(−3.91)		(−4.01)		(−4.48)
Log $Cost_{ij}$		−1.298***		−1.445***		−0.785***		−1.538***		−1.663***		−0.876***
		(−8.37)		(−8.14)		(−4.78)		(−9.13)		(−7.05)		(−3.50)
Log Yi	0.804***	0.658***					0.682***	0.421***				
	(17.62)	(13.36)					(12.12)	(6.94)				
Log Ej	0.713***	0.641***					0.464***	0.242***				
	(15.29)	(14.37)					(8.88)	(4.43)				
Constant	2.824***	−6.660***	−2.093	−14.035***	−6.817***	−12.777***	−2.239	−7.018***	−6.041	−14.686***	−7.325***	−16.121***
	(2.64)	(−11.90)	(−1.12)	(−9.87)	(−3.72)	(−14.53)	(−0.91)	(−7.73)	(−1.38)	(−6.05)	(−4.28)	(−15.92)
Exporter-FE	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES
Importer-FE	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES
Observations	680	680	680	680	683	683	314	314	314	314	314	314
R-squared	0.435	0.497	0.602	0.650	0.805	0.839	0.487	0.660	0.667	0.775	0.987	0.992

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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Illustrative exemple of impact of trade-time elasticity on ship-owners' decision

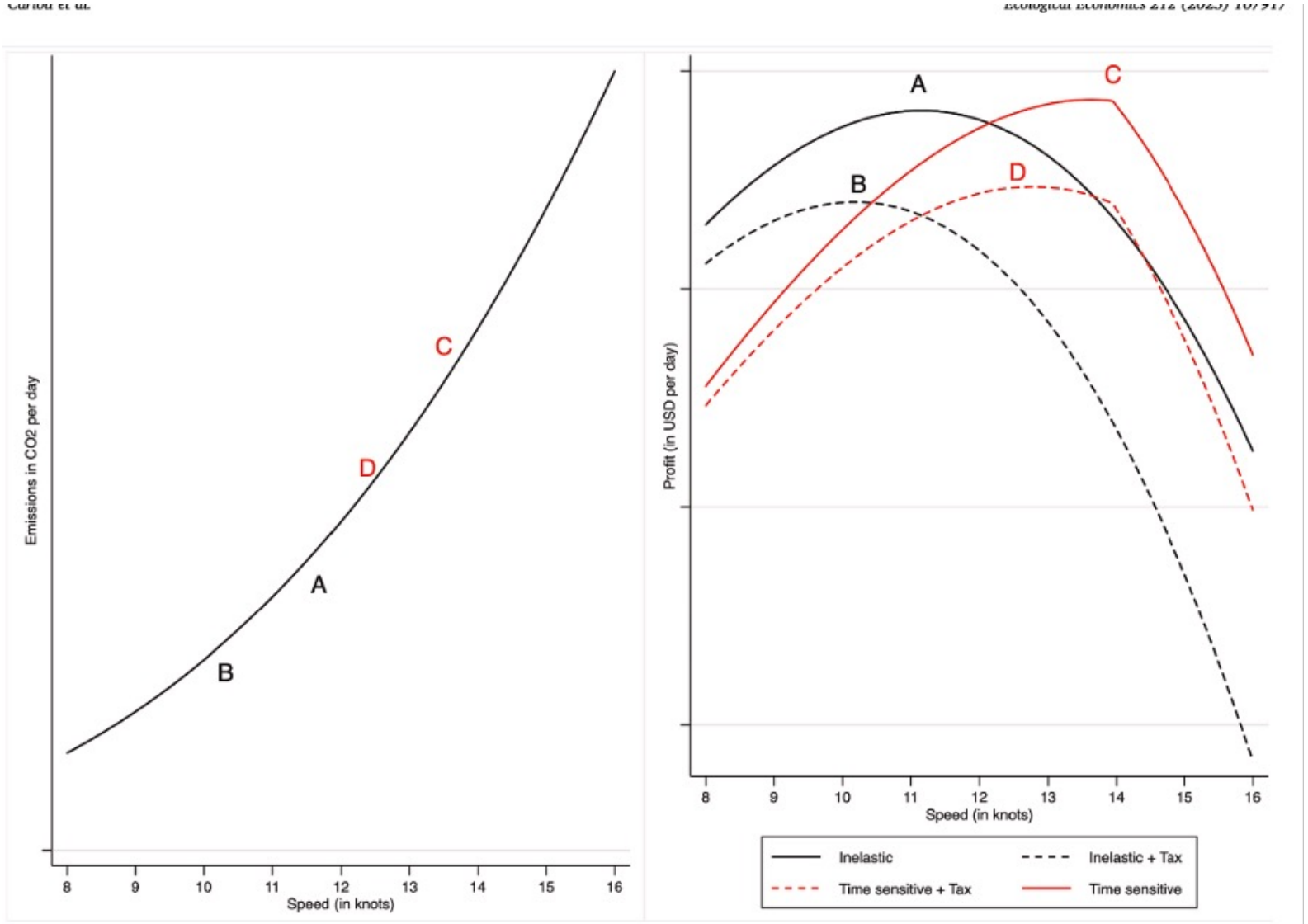

Fig. 1. Emission- and profit-speed relationships with time sensitive demand.

Illustrative exemple of impact of trade-cost elasticity on ship-owners' decision

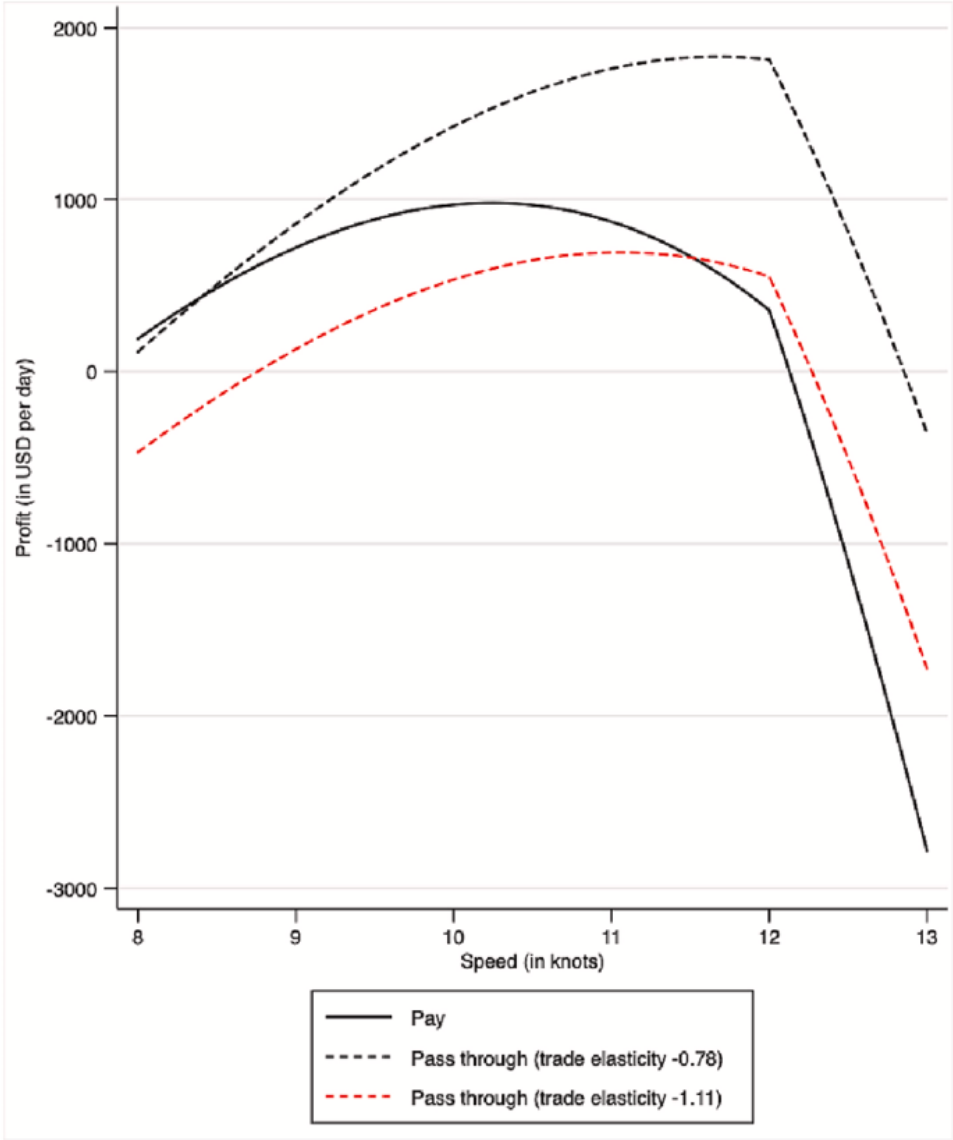

Fig. 2. Profit-speed relationship assuming a higher trade-cost elasticity: U.S. grain exports with tax at 150 USD per tonne of fuel.

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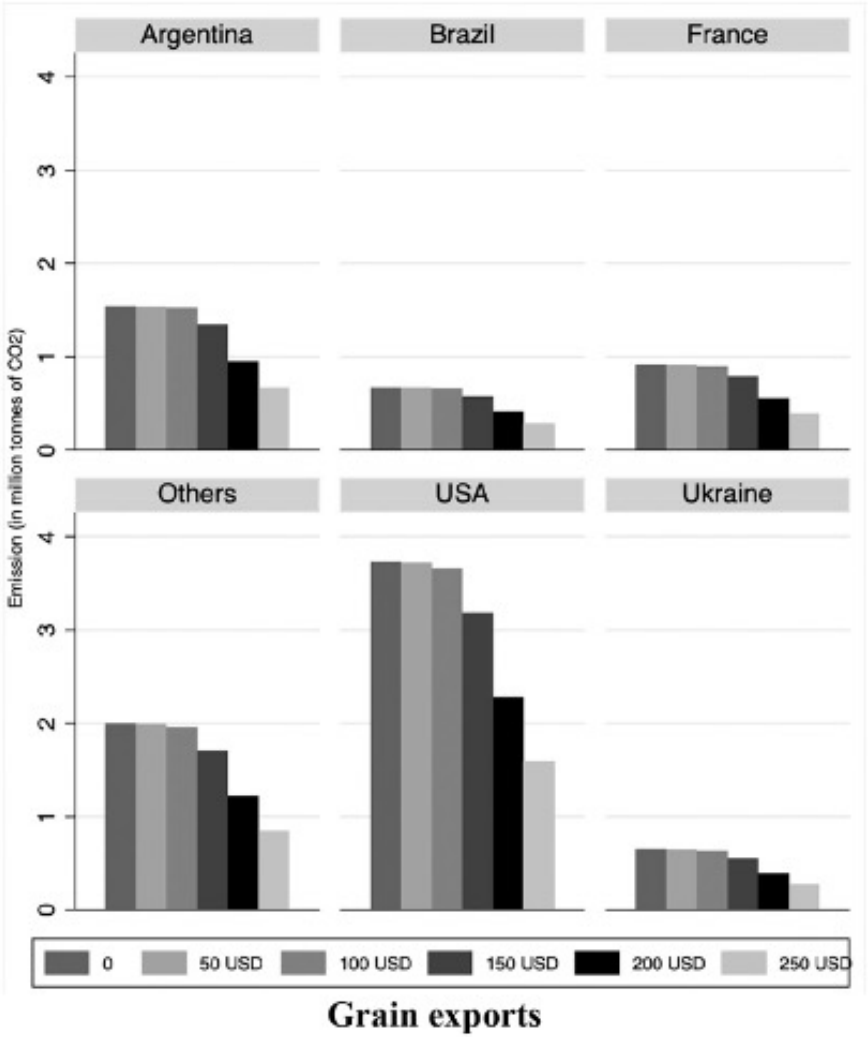
Simulation of impact of trade-elasticity and tax level on emissions' level (without change in trade = supply adjustment with more vessels to compensate reduced speed)



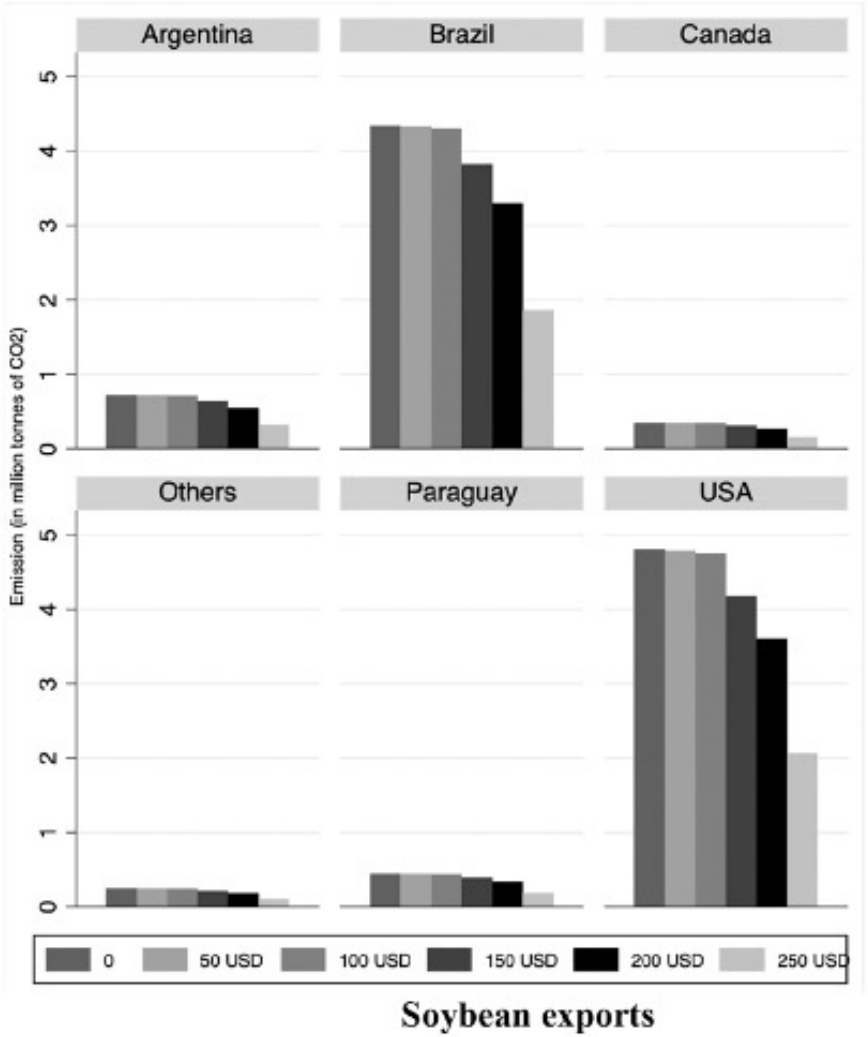


Fig. 3. Reduction in carbon emissions (in million tonnes of CO2) with supply adjustment.

3. Conclusions

1. When trade is not sensitive to time and cost, we can expect a positive impact from a tax => The ship-owners pass-through the tax without any impact on trade and ship-owners slow down the speed of the vessel (reduction in emissions).

2. When trade is sensitive to time and cost and when the tax is small (less than 100 USD for soybean and grain), the ship-owner may have interest in paying the tax and do not change the speed => no impact on emissions (same speed and trade level).

3. When trade is sensitive to time and cost and the tax is high (more than 100 USD for soybean and grain), the ship-owner may have interest in passing through the tax and to reduce the speed => large impact on emissions and on trade (long-term.

=> this may be enough to trigger a change in technology to limit compliance costs (new propulsion or fuel) and/or to limit the impact of the decrease in speed (e.g. routing; wind propulsion or assistance…).

Thank you for listening

Next ?

Paper to be presented at

International Association of Maritime Economists Conference 2023 – Long Beach (5-8 Sept. 2023)

Impact of maritime taxation for

(19 different agricultural trade x 150 countries)

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