

# Coordination and Commitment in International Climate Action: Evidence from Palm Oil

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# Roadmap

Motivation

Import tariffs model

Empirical strategy - IO model

Results

Discussion and results

# What to do about weak domestic regulation in high-emission production?

- ▶ Palm oil plantations are responsible to  $\approx 5\%$  of global emissions, mostly from deforestation in Malaysia and Indonesia.
- ▶ Limited domestic incentives to regulate it
  - ▶ Huge source of revenue that has lifted millions out of poverty (Edward 2019).
  - ▶ Malaysia and Indonesia subsidise and incentivise it.
- ▶ Central governments, even if they want to, may find it especially difficult to commit in the long term (Burgess et al. 2019) and to enforce legislation (Burgess et al. 2012).
- ▶ Role for *import tariffs* to help internalize the externalities associated with palm-driven deforestation's carbon emissions.

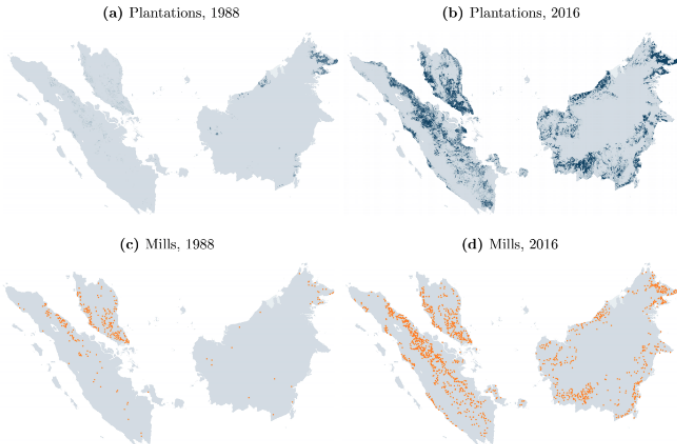
# Palm oil trade

**Table 1:** Palm oil production and consumption by country (1988-2016)

	Production	Consumption	Exports	Imports
Indonesia	0.44	0.14	0.41	0.00
Malaysia	0.40	0.06	0.48	0.02
European Union	0.00	0.12	0.00	0.17
China	0.00	0.11	0.00	0.15
India	0.00	0.12	0.00	0.16
Rest of world	0.16	0.45	0.10	0.50

# Change in oil palm plantation coverage

**Figure 2:** Palm oil plantations and mills over time



Data on plantations come from [Xu et al. \(2020\)](#) and [Song et al. \(2018\)](#), and data on mills come from the World Resources Institute and the Center for International Forestry Research. The study area is Sumatra and Kalimantan of Indonesia and all of Malaysia, covering 83% of global palm oil production.

# Challenges and opportunities of import tariffs

## ► Opportunities

- Do not depend on local governments' enforcement.
- Under both coordination and commitment, highly effective (56% emissions reduction compared to 64% under Pigouvian tax).
- "If importers (credibly) threaten to coordinated tariffs, then a domestic Pigouvian tax becomes appealing."

## ► Challenges

- Leakage due to lack of international coordination
- Limited commitment because emissions come from sunk investments.
- Their interaction: Imperfect coordination makes commitment more difficult.
- Beyond the scope this paper: doesn't disincentivise alternative drivers of deforestation.

# Leakage

- ▶ Three main primitives
  - ▶  $\epsilon^S$ : Elasticity of supply
  - ▶  $\epsilon^{Du}$ : Elasticity of demand in unregulated market
  - ▶  $\epsilon^{Dr}$ : Elasticity of demand in regulated market

$$\tilde{\tau}_t^C = \left( \frac{\epsilon_t^S}{\epsilon_t^S - \frac{Q_{t+1}^{uo}}{Q_{t+1}^o} \epsilon_{t+1}^{Du}} \right) e < \tilde{\tau}_t^{\text{FB}}$$

- ▶ No problem if unregulated demand is very inelastic  $|\epsilon^{Du}| \rightarrow 0$  or if supply is very elastic  $|\epsilon^S| \rightarrow \infty$ .

# Commitment

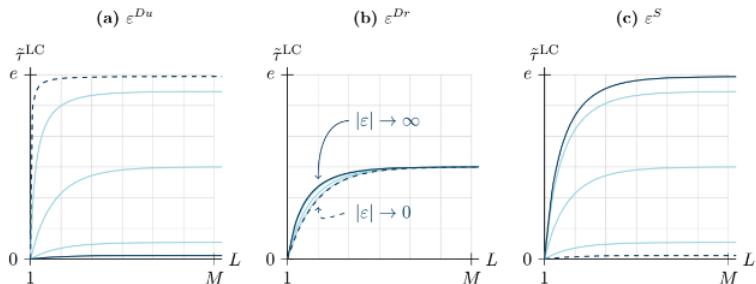
- ▶ Say importers commit to uphold tariffs for  $L$  periods at a time.
- ▶ Tariffs would be set at

$$\tilde{\tau}_t^{\text{LC}}(L) = \left( \frac{\varepsilon_t^S}{\varepsilon_t^S - \frac{Q_{t+1}^{uo}}{Q_{t+1}^o} \varepsilon_{t+1}^{Du} [1 + \Lambda(L, \varepsilon)]} \right) e$$



# Both at once

**Figure A1:** Total tariffs by leakage and commitment



For various values of each leakage-relevant elasticity – namely elasticity of unregulated demand  $\varepsilon^{Du}$ , elasticity of regulated demand  $\varepsilon^{Dr}$ , and elasticity of supply  $\varepsilon^S$  – I plot the relationship between total tariffs  $\bar{\tau}^{LC}$  and the length of commitment  $L$ . The solid navy lines show the relationship for large values of the elasticities, the dashed navy lines for small values, and the light blue lines for intermediate values. Each of the values differs by an order of magnitude. Emissions  $e$  represents the externality, and  $M$  is an arbitrarily large number.

# Empirical strategy

- ▶ **Demand side.** Two-stage almost ideal demand system.
  1. How much vegetable oil?
  2. How much palm oil out of total vegetable oil consumption?
- ▶ **Supply side.** Dynamic discrete-continuous choice to understand the benefits and costs of two types of sunk investments
  1. Building mills (extensive margin) and
  2. Clearing forest and developing plantations (intensive margin).

## Estimation results

- ▶ Domestic demand seems to be very inelastic
- ▶ Foreign demand, especially EU, is quite elastic.
- ⇒ Limited leakage to domestic market, but
- ▶ Supply is very highly determined by the sunk nature of investments. Mills cost around \$20 million to build both according to accounting estimates and model estimates.
- ▶ Plantation development costs about \$10K/hectare in NPV.
- ⇒ This makes myopic importers (governments) unwilling to impose tariffs (taxes).

# Counterfactuals

**Table 6:** Counterfactual experiments

Experiment	$\$/t$ NPV	$\Delta\%$	$\Delta\%$ surplus			
	Tax	CO <sub>2</sub>	EU	China India	Other	Indo Malay
Pigouvian domestic regulation	20,487	-64	-93	-89	-86	-43
Import tariffs: full coordination						
Full commitment	19,718	-56	-74	-70	-67	-55
Limited commitment (20 years)	19,665	-56	-73	-70	-59	-55
Limited commitment (10 years)	19,476	-55	-72	-68	-58	-55
Limited commitment (5 years)	18,639	-53	-67	-63	-54	-52
Import tariffs: EU, China, India						
Full commitment	11,573	-17	-30	-28	124	-16
Limited commitment (20 years)	11,156	-16	-28	-26	119	-16
Limited commitment (10 years)	9,882	-14	-21	-19	106	-14
Limited commitment (5 years)	6,445	-9	-3	-1	69	-9
Import tariffs: EU only						
Full commitment	6,785	-2	9	14	13	-2
Limited commitment (20 years)	6,445	-2	10	13	13	-2
Limited commitment (10 years)	5,466	-2	12	11	11	-2
Limited commitment (5 years)	3,197	-1	12	6	6	-1

## Some strengths

- ▶ Supply side
  - ▶ Novel discrete-continuous dynamic-discrete choice estimation through “Euler approach”
    1. intensive (continuous) and extensive (discrete) margins with sunk investments
    2. allows for regional unobserved states affecting payoffs
    3. linear IV regression.
- ▶ Theory (check out Bard Harstad’s work and lecture notes in his website).
- ▶ Climate Science: Deforestation of peatland soil is much worse for CO<sub>2</sub> emissions.

# Discussion

- ▶ Outside option. What is the alternative, is it no agricultural development? Would such a policy need to come hand in hand with strategies to raise the value of peatlands and forests? Is there a role for foreign trade there? International markets for NTFP? Tourism?
- ▶ Palm oil is highly productive, so switching to oil seeds with lower yields may be worse.
- ▶ Supplying firms are atomistic throughout this analysis. Spatial interactions coming from local input and labor markets and