Golden Imports and the Three Borers: Balancing the Benefits and Unintended Consequences of International Trade

Trade and Forest Invasives Working Group Report

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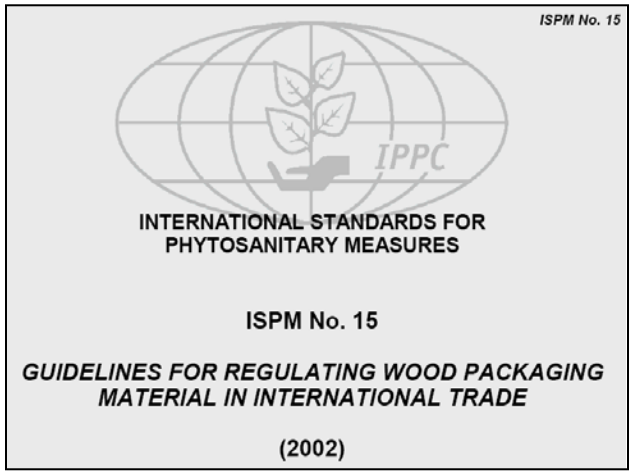
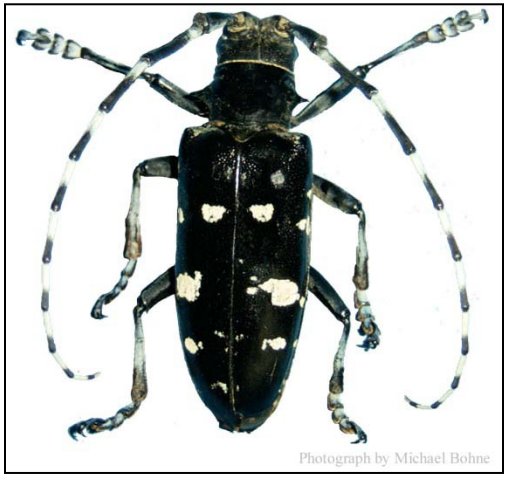
Intro and overview

- NCEAS Working Group
  - economic and ecological impacts of forest pests
  - benefits and costs of sanitary and phytosanitary (SPS) policies
- SPS policy case study:
  - ISPM 15 impacts in the United States
    - Adopted→2002, full enforcement→2006
    - Bark and wood boring insect arrivals
    - Trade effects





Female Asian longhorned beetle

Acknowledgements

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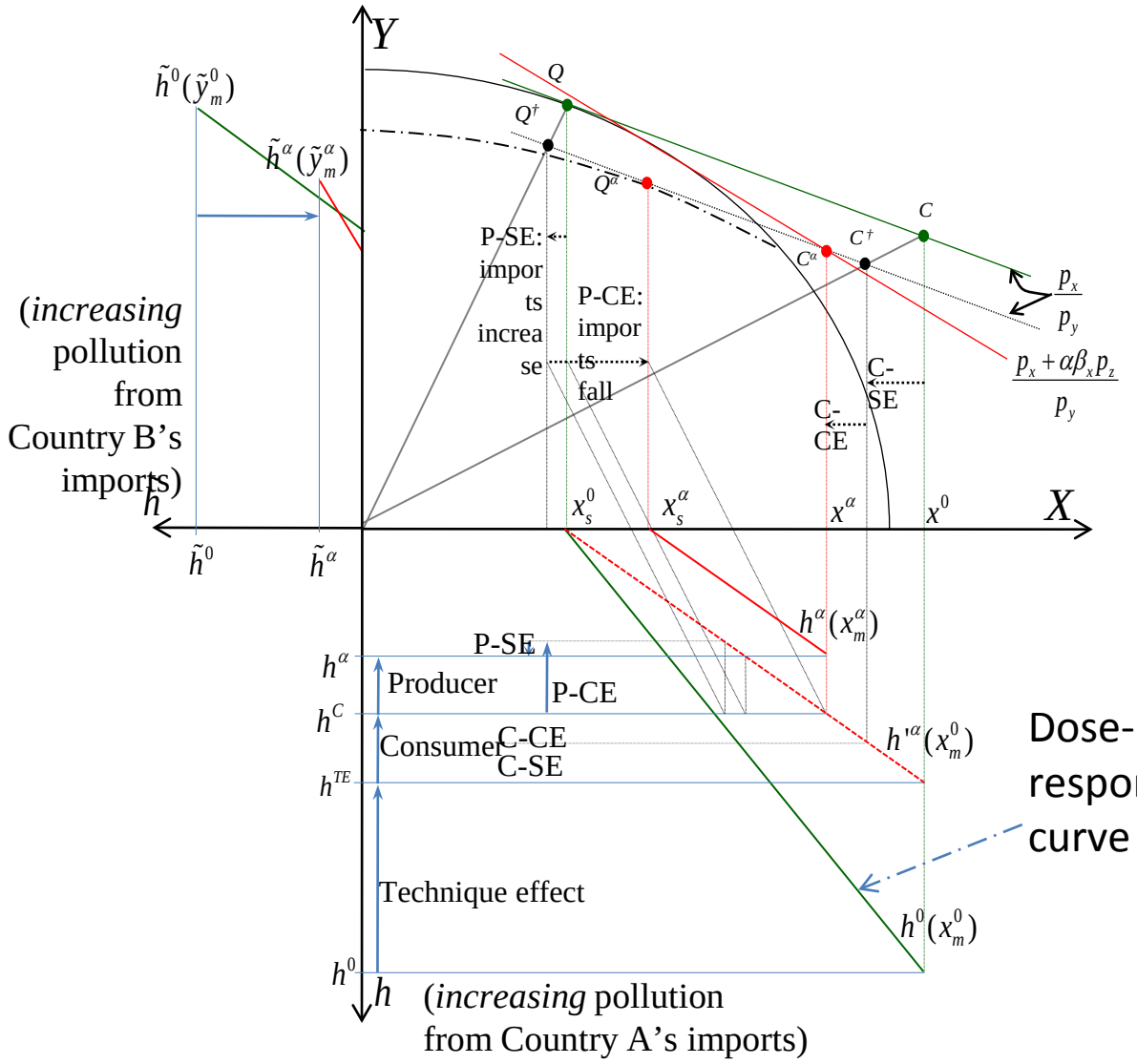
Overview

I. Economics: theoretical international trade model
II. Economics: numerical estimation of the lost gains from trade
III. Ecology: the dose-response curve of biological invasions
IV. Efficacy: assessing changes in the approach rate

I. Economics: theoretical international trade model

- Well studied→ *production*-related pollution effects of international trade
- Less attention→ *direct* environmental impacts of *transport* in a global general equilibrium framework
  - trade is an important direct source of environmental change due to externalities of transportation services
    - E.g. greenhouse gases (GHGs) and the invasive species (UNEP 2005)
  - Margolis et al. (2005): ship pollution and "(i)nvasive species are among a relatively small group of market failures the source of which is trade itself"

A Change in SPS Treatment Stringency



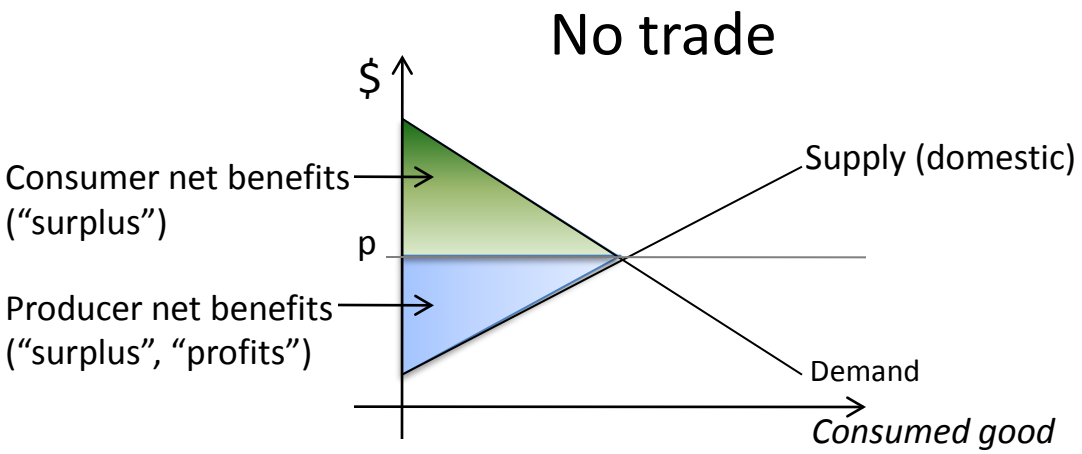
The primary and secondary effects ("general equilibrium" effects) are complex…

Dose-response curve

SE: scale effect

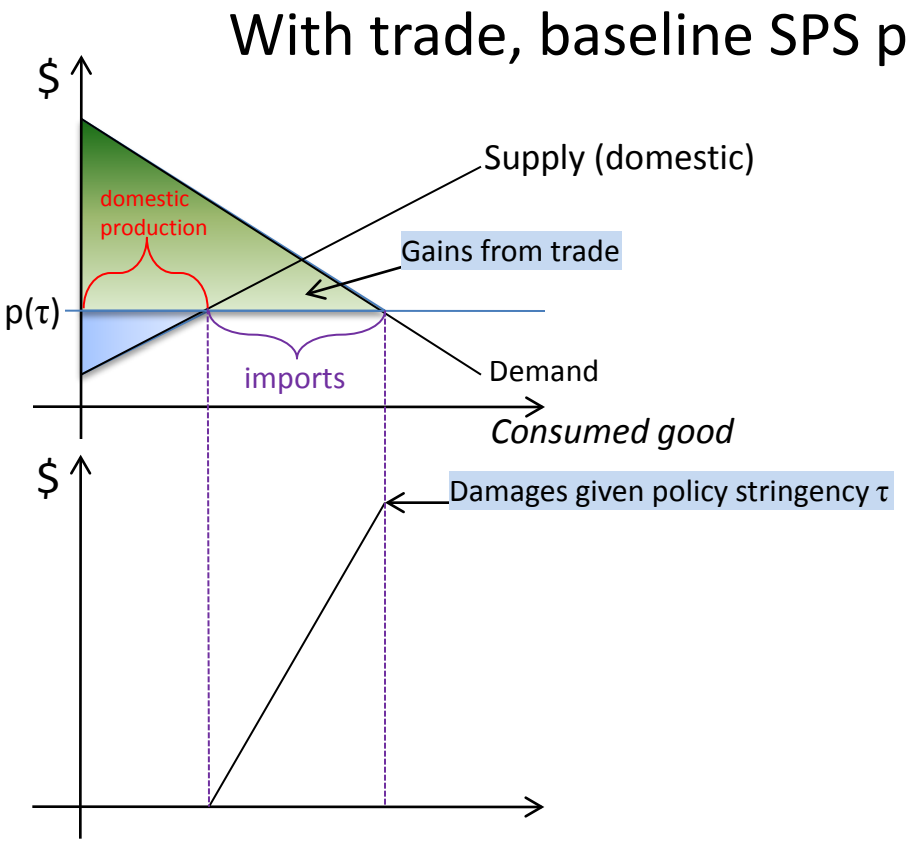
CE: composition effect

Partial Equilibrium Effect of an Increase in SPS Treatment Stringency



A simpler model conveys much of the intuition…

Partial Equilibrium Effect of an Increase in SPS Treatment Stringency



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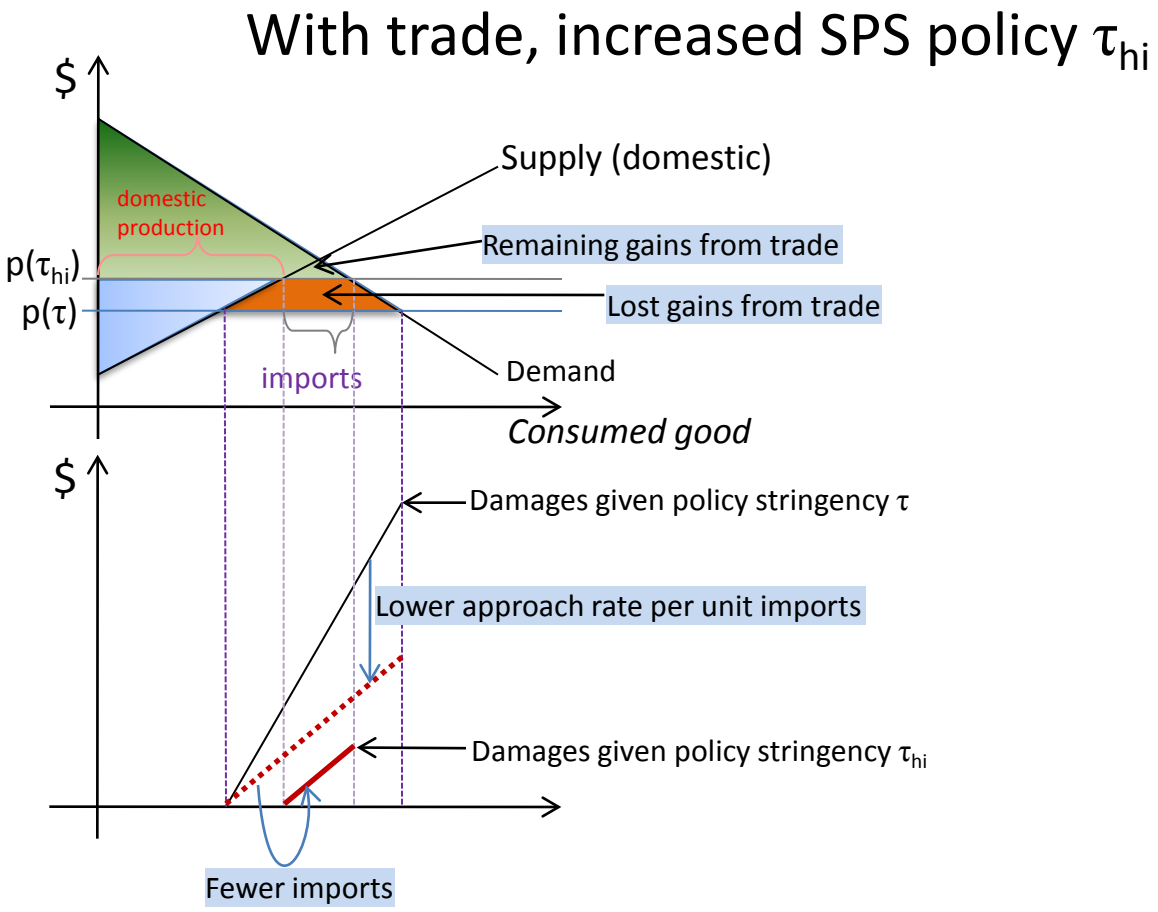

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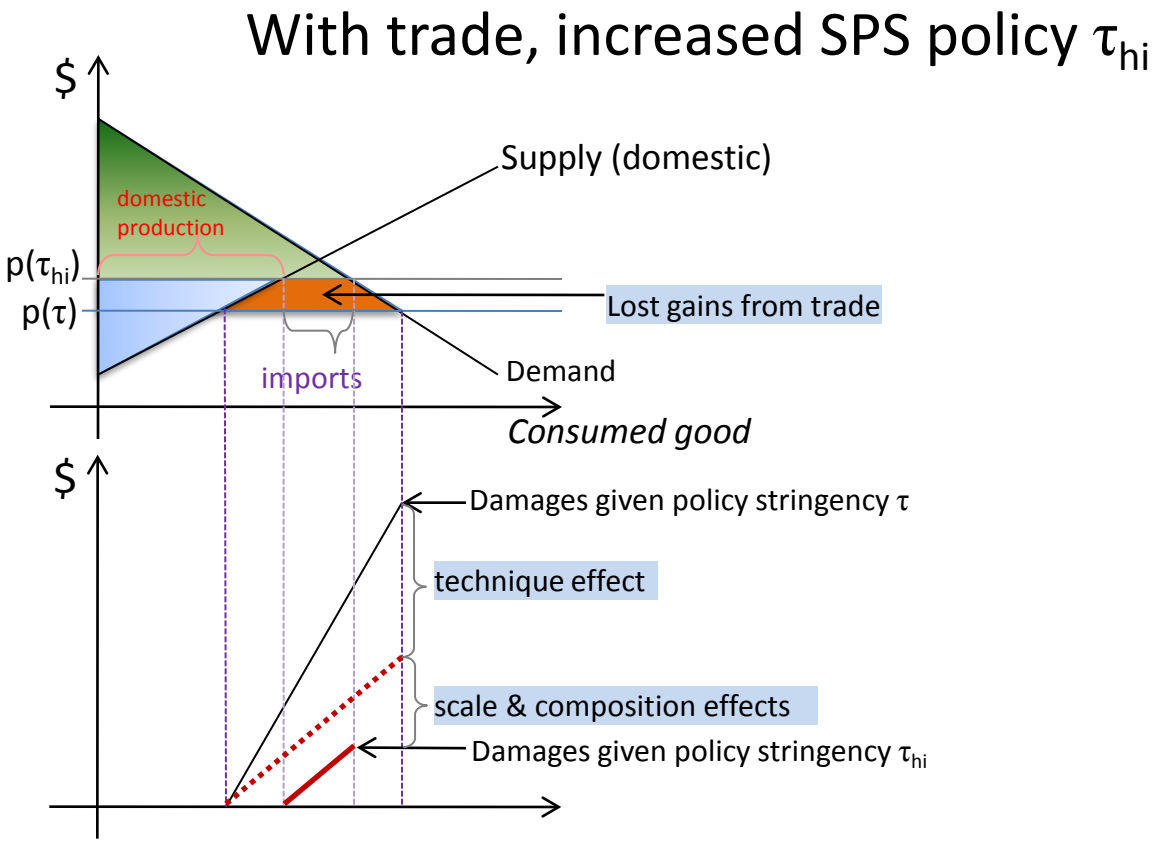


II. Economics: Numerical Estimation of Lost Gains from Trade

- Lost gains from trade
  - Some trade is eliminated
  - Remaining trade is more expensive
- Global Trade Analysis Project (GTAP) model
  - Computable general equilibrium model
  - 27 sectors (multiple commodities using WPM)
  - 24 regions, bilateral trade

Heat treating pallets

Scenarios Considered

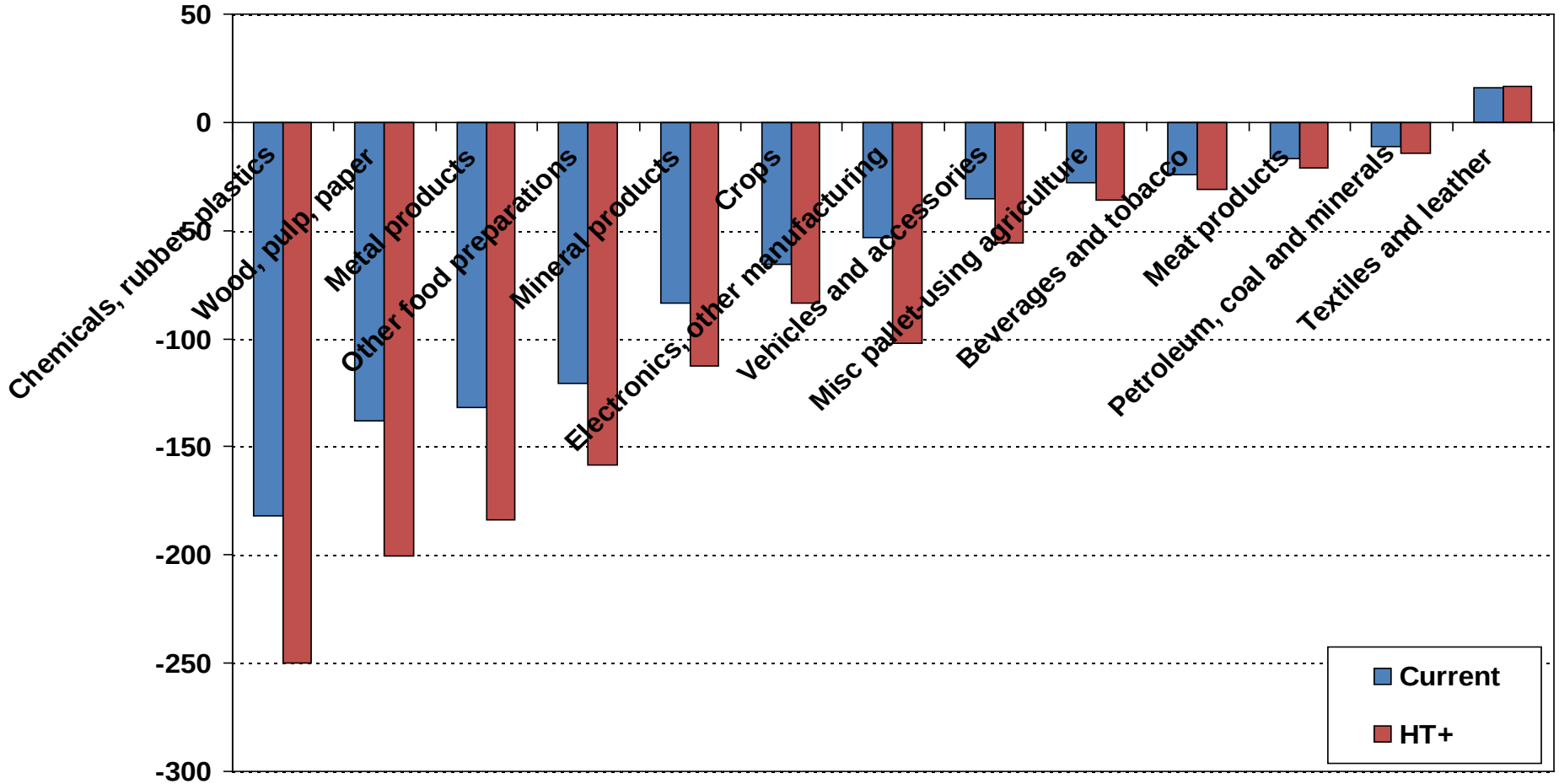
- Current IPSM 15 ("Current")
  - Heat treating the WPM to a core temp of 56^{o} for ≥ 30 minutes
  - Applied to all trade except US-Canada and US-China
  - Treatment cost – $2.00 per pallet
- Increased heat treatment ("HT+")
  - Increased core temperature and/or hold time
  - Treatment cost – additional $0.50 per pallet

Preliminary Results*

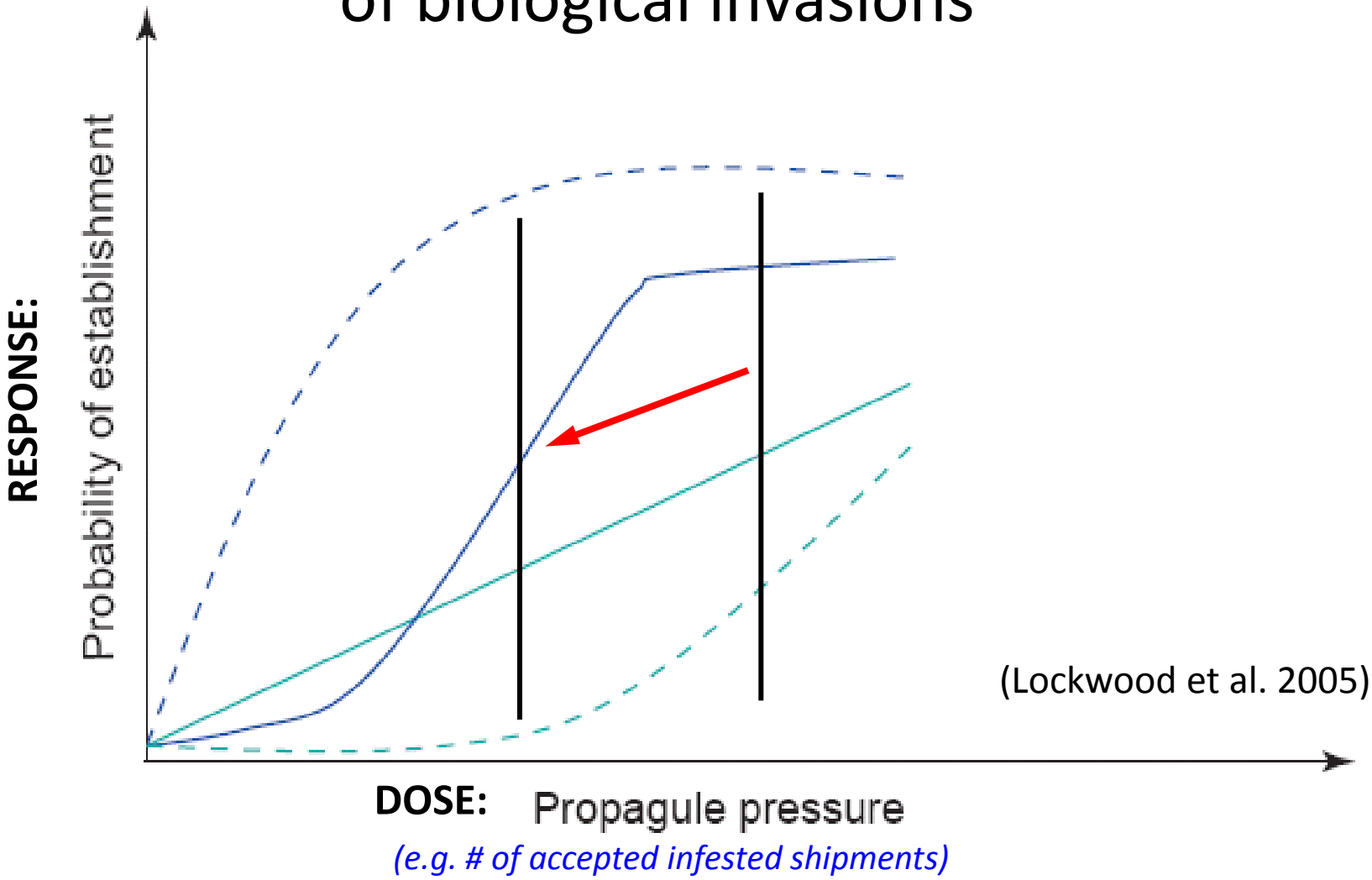
- Effect on US imports and exports
  - "Current": -0.05%; "HT+": -0.07%
  - Strong variation by sector (depending on product value and WPM cost)
    - Larger effect: Chemicals, rubber, plastics
    - Smaller effect: Sugar
- Shifts in non-WPM invasive species risk:
  - Substitution in imports of horticultural/food products
    - away from South and Central America
    - to Mexico and Canada (and to a lesser extent China)

* Currently under revision

Change in US Commodity Import Value (US$ million)

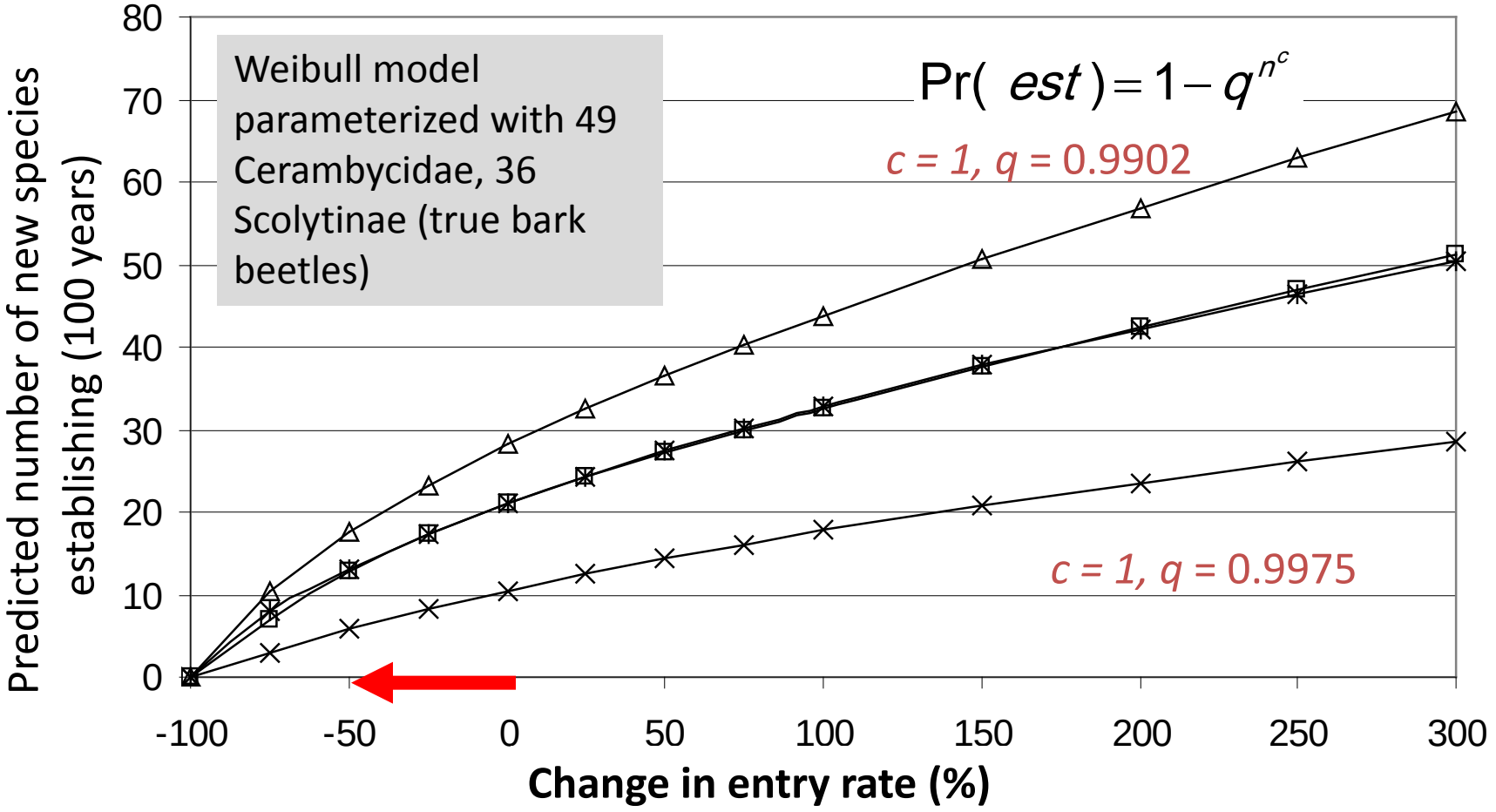


III. Ecology: The dose-response curve of biological invasions



(Lockwood et al. 2005)

Predicted number of establishments in the US, longhorned & true bark beetles, next 100 yrs



No change: **21 spp. establish** (confidence range 10 to 28)

50% reduction in entry rate: **-8 spp**. 75% reduction: **-13.4 spp.**

IV. Efficacy: Assessing changes in the approach rate from ISPM 15

- Ideal experiment:
  - "With and without treatment": Compare results from thorough U.S. port inspections of
    - Randomly selected shipments WITHOUT treatment
    - Randomly selected shipments WITH treatment
- Available data:
  - "Pre and post" policy implementation
    - Confounding factors:
      - Baseline infestation and survivorship (pest population dynamics, climate, change in the source of trade, change in source of WPM, etc)
      - Likelihood of observation (inspection effort, targeting, etc)
      - Non-discrete onset of policy

U.S. approach rate data

- Pest ID data (“interceptions” only)
  - large number of observations
  - not random
  - negative results not recorded
- AQIM data (random inspections)
  - Randomly chosen, consistently inspected
  - high statistical power if ISPM 15 effectiveness is >70%

Pest ID -- Interceptions

- Regression analysis on the effect of ISPM-15 on interceptions of WPM-associated pests
  - With coarse controls for unobserved yearly variability (fixed effects):
    - 41% drop in interceptions
  - Without fixed yearly effects:
    - *Increase* in interceptions
- Presence of significant annual unobserved variability in the infestation-discovery process
- Key weakness: not able to control for all confounding factors
  - Especially inspection effort

Changes in Approach Rate: AQIM Analysis

- 90% reduction in approach rate expected
- Power analysis of nearly 29,000 AQIM records
  - ~100% chance of detecting 90% reduction
  - ~90% chance of detecting 70% reduction
- Results
  - difference detected pre- and post-ISPM 15 was 20-40%, but not with standard significance (0.1>p>0.05)

- What does this mean?
  - ISPM 15 did not achieve expected reduction
  - Reduction masked in the data

Conclusions

- ISPM 15 has produced some reductions in pest discoveries
  - but estimated effect is not as strong as was expected
- Sampling design for program evaluation should be discussed in tandem with policy design.
  - Data should be gathered to
    - Sufficiently identify effects (even if weak)
    - Control for confounding factors (e.g. inspection effort)
  - Subject to the value of information and data-gathering costs.
- Study has created an intellectual framework for evaluating approaches to minimizing pest introductions and the relative tradeoffs with the benefits of trade