"Agricultural Trade and the Environment: What Does A Ricardian Approach Offer?"

Ian Sheldon (Ohio State University)

EAAE Symposium – "Non-Trade Concerns in Agriculture"
AAEA Annual Meetings
Chicago, IL
July 31-August 1, 2017

Trade and the Environment

- **Copeland and Taylor (1994): 2-country/continuum of goods, environmental input combined with human capital, demand for standards income elastic**
- **Antweiler *et al*. (2001) switched from Ricardian to Hecksher-Ohlin set-up with "dirty" good being capital-intensive**
- **Empirical analysis: trade has little or no impact on environment (Frankel and Rose, 2005; Chintrakarn and Millimet, 2006; and Managi *et al*., 2009)**
- **No analysis of agricultural sector**

Modern Ricardian Approach

- **Eaton and Kortum (2002): key to solving Ricardian trade model - assume countries get productivity draw**
- **Model extended by *inter alia*, Waugh (2010), Fieler (2011), Costinot *et al*. (2012), and Levchenko and Zhang (2014)**
- **Applied to agricultural trade by Reimer and Li (2010), Reimer (2014), Heerman *et al*. (2015), and Xu (2015)**
- **Focus on deriving estimates of parameters of productivity distribution**

Ricardo and Agriculture

- Costinot and Donaldson (2012) note it is possible to test predictions of Ricardian model without relying on specific functional form
- Empirical strategy is to use agronomic data on how inputs (water, soil, and climate) map into output at the "field" level
- In sample of 17 crops for 55 countries, using field-level productivity data from the GAEZ project of IIASA/FAO, model has significant explanatory power
- Apply methodology to evaluating integration in US agricultural markets (Costinot and Donaldson, 2016)

Ricardo and the Environment

- **Costinot *et al*. (2016) is major effort to evaluate impact of climate change in agricultural markets, i.e., what is effect of change in comparative advantage?**
- **Use GAEZ data for 1.7 million fields and IPCC climate change forecasts for 10-crop/50-country sample to evaluate adaptation through production and trade**
- **Central result: global GDP reduced by 0.26 percent, trade adjustment being minor relative to production adjustment**
- **Results not sensitive to intra-national trade costs**

What's Missing?

- No account taken of: (i) GHG emissions by agriculture and transportation; (ii) domestic/border policies targeted at mitigation of climate change
- Policy choices (taxes/subsidies) will affect supply/demand for crop *k* in country *i*:

$$Q_i^k = \sum_{f \in F_i} s_i^f A_i^{fk} \left[\frac{(p_i^k A_i^{fk})^\theta}{\alpha_i^\theta + \sum_{l \in K} (p_i^l A_i^{fl})^\theta} \right]^{(\theta\text{-}1)/\theta} = \sum_{j \in I} \tau_{ij}^k C_{ij}^k$$

- *Scale*, *composition* and *technique* effects of adaptation to climate change?