

**US Comparative Advantage in Bioenergy:
A Heckscher-Ohlin-Ricardian Approach**

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Motivation/outline

- Brazil currently has comparative advantage in producing ethanol (Kojima *et al.*, 2007; Elobeid and Tokgoz, 2006)
- What will happen with innovation in production technology?
- Allow for possibility US becomes an exporter of ethanol
- Draw on Heckscher-Ohlin-Ricardo model (Davis, 1995), and trade in presence of external economies (Helpman and Krugman, 1985)
- Consider implications for US policy towards ethanol

Trade in ethanol

- **Basic model assumes:**
 - **2 countries: US and ROW (includes Brazil)**
 - **2 factors of production: capital and land**
 - **3 goods: 1 capital-intensive, 2/3 land-intensive**
 - **2/3 substitutes in consumption (fuel-blending), 2 using land embodied in sugarcane, 3 using land embodied in corn**
- **CRS technologies same across countries**
- **Preferences homothetic**
- **Initial equilibrium in Figure 1 - factor employment vectors for 2/3 combined – avoids dimensionality problem (Dixit and Norman, 1980)**

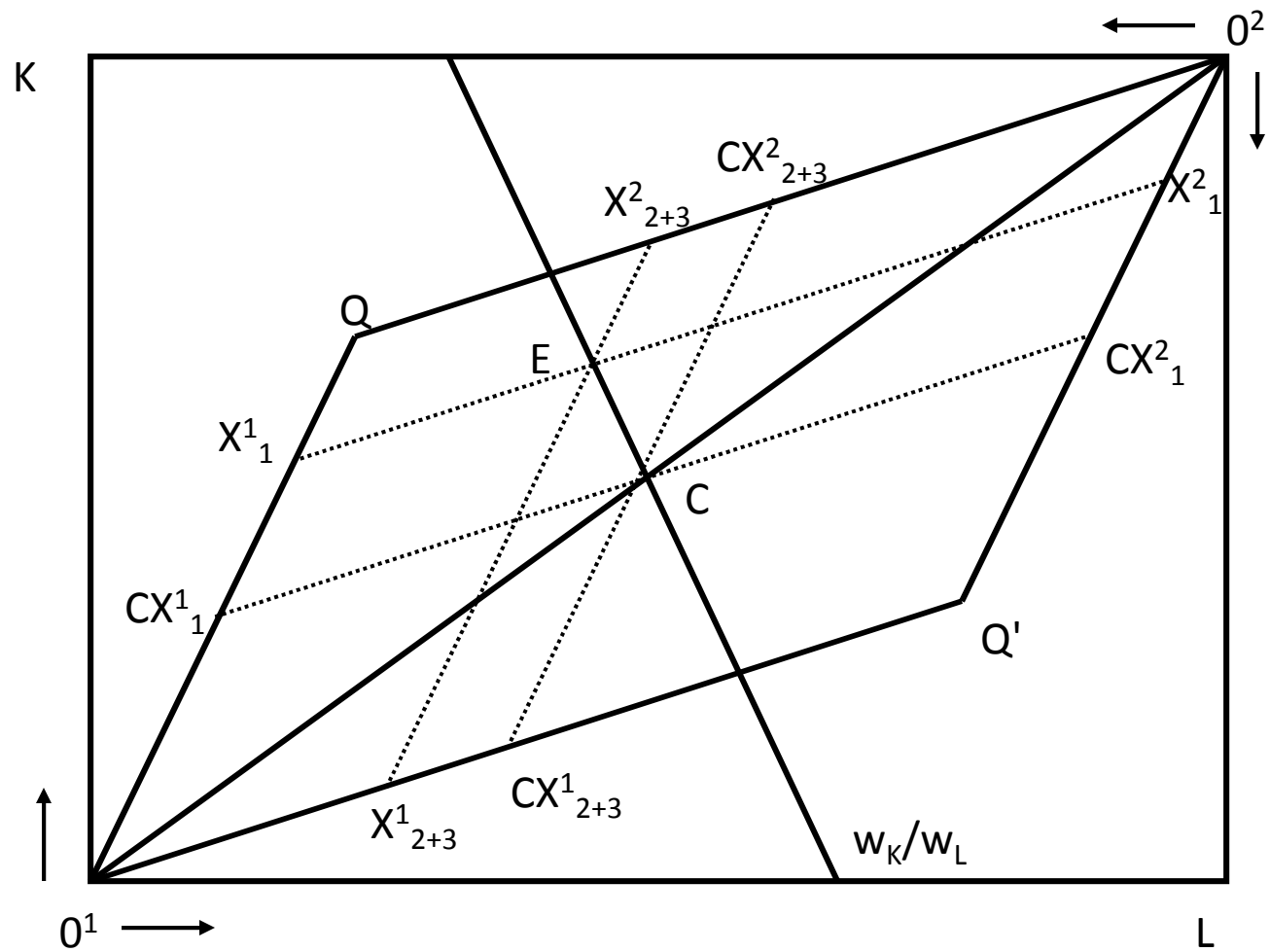


Figure 1. Comparative advantage and trade in ethanol

Technological change

- **Introduce good 4:**
 - **ethanol produced from cellulosic feedstock**
 - **capital-intensive**
 - **US has technical advantage in producing 4**

- **Equilibrium in Figure 2:**
 - **US exporter of capital-intensive 1, and specializes in 4**
 - **ROW has comparative advantage in 2/3**

- **To rationalize US exporting 4 - importing 2/3, requires more structure on demand (Flamm and Helpman, 1987)**

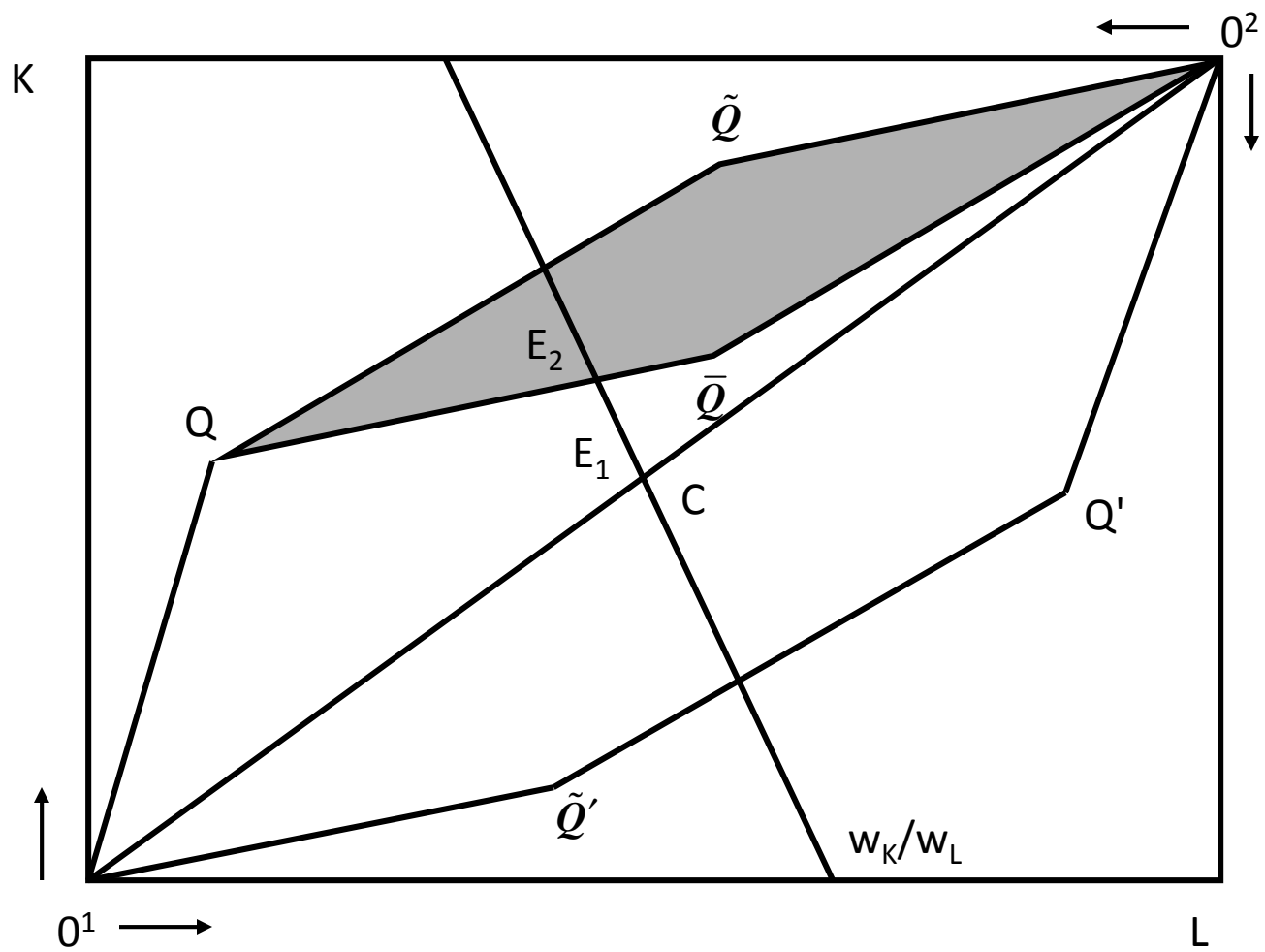


Figure 2. Specialization and trade in ethanol

External economies

- If US has head-start in 4, but technology subject to external economies of scale:
 - industry operates under *industry-specific* IRS
- Similar equilibrium to Figure 2 (Helpman and Krugman, 1985)
 - US specializes in 4, and has comparative advantage in 1
 - ROW has comparative advantage in 2/3
- Gains from trade if there is expansion in production of 4 (Kemp and Negishi, 1970)

Policy and trade in ethanol

- Previous model assumes external economies realized
- Ignores market failure, i.e., learning economies are external, firms under-producing 4 due to spillovers
- Possibly an argument for *temporary* protection of 4 through first-best subsidy (Bardhan, 1971)
- Current policies encouraging investment in 3, may stymie investment in 4, i.e., even if technology is available, instantaneous returns from 3 greater than those from 4 (Sauré, 2007)
- As well as static deadweight losses from current corn-based ethanol policies, may be future losses due to failure to realize dynamic learning economies in cellulosic-based ethanol