Biotechnology and Competing in Capabilities*

* As part of project: "Globalization, Changing Market Structure and the Biotechnology Sector"

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July 25, 2009

Motivation

- Empirical Motivation
- Theoretical Explanations
  - Product Life-Cycle Theory
  - Transactions Cost Economies
  - Competency (Capability) Theory
  - Strategic Interaction Motives

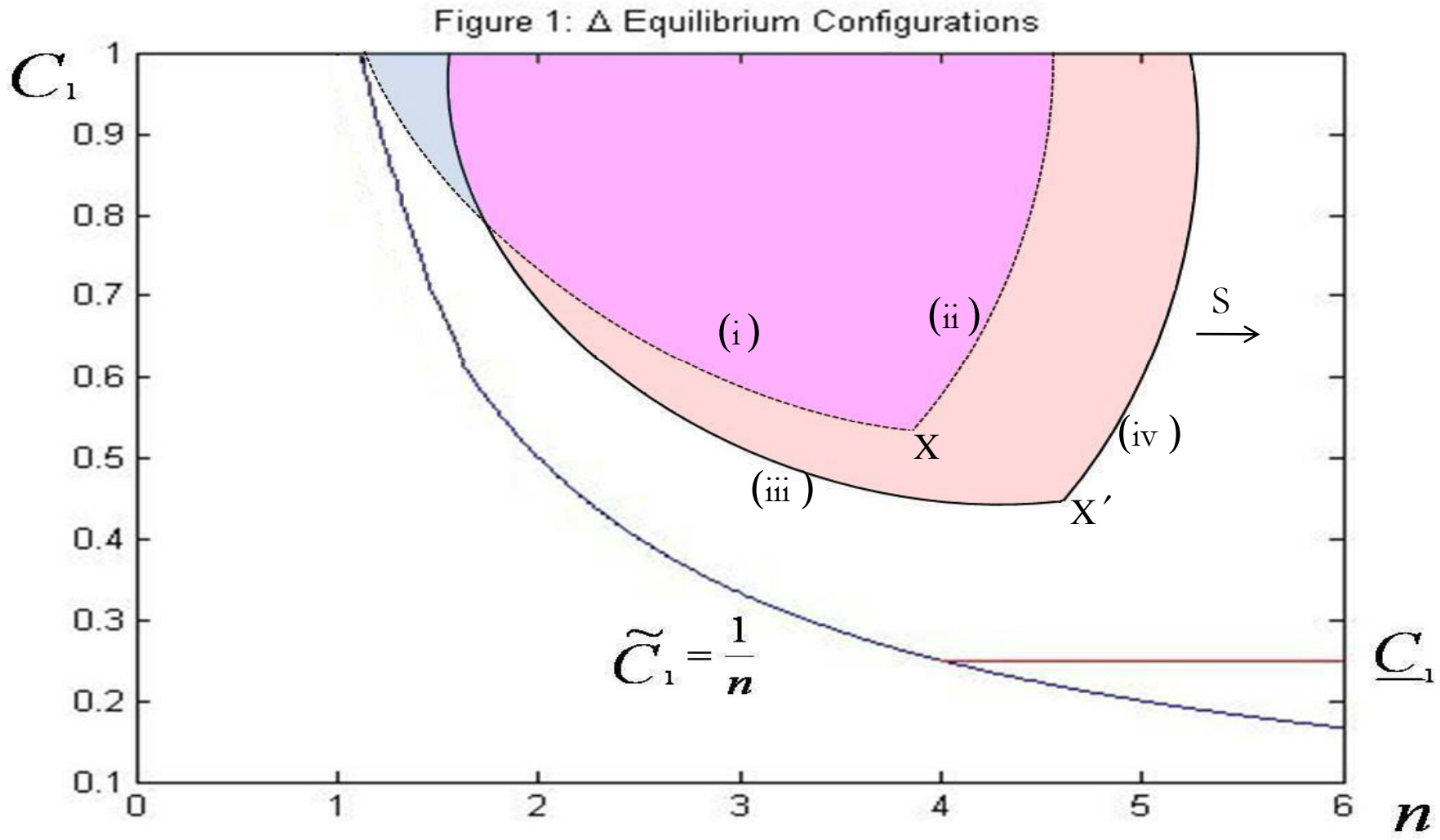
Competing in Capabilities

- Relevant Stylized Facts
  i. Endogenous sunk costs (R&D expenditure)
  ii. Complementary technologies
  iii. Strengthening of property rights
- Sutton's (1998, 2007) "Bounds" Model
  - Vertical product differentiation (quality/"capability")
  - Escalation of sunk R&D expenditure (innovation)
  - Lower bound on convergence (concentration)

Licensing, Market Structure, and Innovation

- Incorporate ability of firms to license technological capabilities to competitors
- Two mechanisms by which firms can improve their competence along a research trajectory:
  i. R&D expenditure
  ii. Licensing
- Lower levels of industry concentration compared to Sutton's "capability" model
  - Feasible under well-defined property rights
  - Changes the incentives of firms to innovate

Graphical Illustration



Equilibrium Configurations

- Sutton's conditions:
  - (i) Stability Condition ("Arbitrage Principle") $F_0 \hat{v}^\beta \geq \frac{1}{k^\beta} S\pi(k\hat{u}|\mathbf{u})$
  - (ii) Viability Condition ("Survivor Principle") $S\pi(\hat{u}|\mathbf{u}) \geq F_0 \hat{v}^\beta$

$$\Rightarrow S\pi(\hat{u}|\mathbf{u}) \geq \frac{1}{k^\beta} S\pi(k\hat{u}|\mathbf{u}) \quad \forall k$$

- Licensing conditions:
  - (iii) Stability Condition $F_0 \hat{v}^\beta \geq \frac{1}{k^\beta} S\pi(k\hat{u}|\acute{\mathbf{u}}) + \frac{1}{k^\beta} Z(k\hat{v})$
  - (iv) Viability Condition $S\pi(\hat{u}|\acute{\mathbf{u}}) + Z(\hat{v}) \geq F_0 \hat{v}^\beta$

$$\Rightarrow S\pi(\hat{u}|\acute{\mathbf{u}}) \geq \frac{1}{k^\beta} S\pi(k\hat{u}|\acute{\mathbf{u}}) + \frac{1-k^\beta}{k^\beta} Z(\hat{v}) \quad \forall k$$

Future Plans

- Formalize "capabilities" model with licensing
- Numerical simulation for both "capabilities" models for agricultural biotechnology (data)
- Use simulation results to predict industry structure and level of innovation following:
  - The introduction of next generation GM crops
  - An exogenous increase in market size associated with increased international trade in biotechnology
  - Exogenous changes regulatory and intellectual property regimes