Lecture 2: New Trade Theory

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October 23^{rd}, 2008

Introduction: Krugman's influence

- New Trade Theory and New Economic Geography

$\Rightarrow$ Trade models combining increasing returns, imperfect competition and transportation costs

- Strong influence in international trade and in other fields (international macroeconomics, international finance, development economics, etc.)
- Key element of the model: Production patterns result of a concentration/proximity trade-off:
  - Increasing returns to scale $\rightarrow$ Incentive to concentrate production in a single location
  - Transportation costs $\rightarrow$ Incentive to produce near the demand

Introduction: Transportation costs

- Transportation costs = Trade costs (tariffs and non-tariff barriers) + Frictions (Information costs, Time cost; etc.)
  - Transport cost: In 1650, it takes 358 hours to move from Paris to Marseille. In 1854, it takes 38 hours. In 2002, it takes 3 hours.
  - Tariffs on manufacturing goods in developed countries (Source: World Bank and WTO):

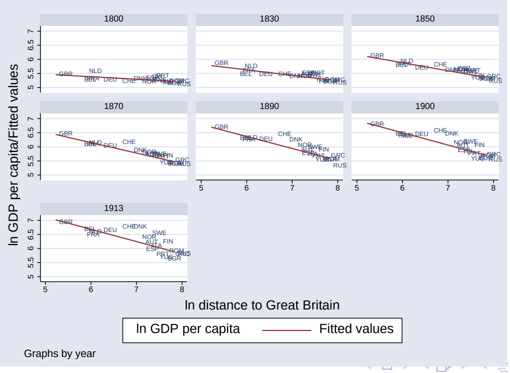
	1820	1875	1913	1925	1930	1950	1987	1998
Average tariff (%)	22	11-14	17	19	32	16	7	4,6

⇒ Since 1950, international market integration is mainly driven by the tariff and NTB decrease.

⇒ Price convergence (Findlay and O'Roorke, 2003):
  - Wheat in Liverpool 57,6% higher than in Chicago in 1870, 15,6% in 1913
  - Steel in London 75% higher than in Philadelphia in 1870, 20,6% in 1913

Introduction: Concentration of activities

- Urbanization: Urban population in Europe in 1800 = 12% population, 38% in 1900, 75% in 2000 (Bairoch, 1985)⇒ Possible because transportation costs have decreased
- Concentration of economic activities: PNB per capita of European countries as a function of distance from UK (source: Combes et al, 2008):



Introduction: Concentration of activities (2)

Introduction: Concentration of activities (3)

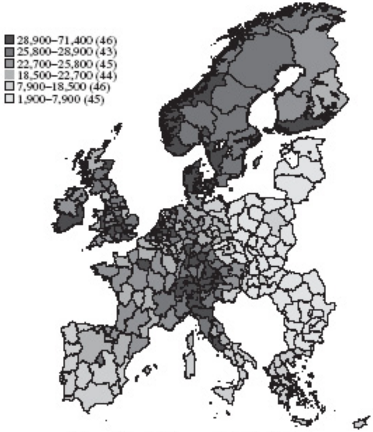


Figure 1.1. GDP per capita of the NUT2 regions of the European Union in 2004.

Introduction: Modeling agglomeration

- Several explanations can be found for the agglomeration of activities:
  - Comparative advantage (heterogeneity of space) ⇒ Ricardo
  - Agglomeration forces through nonmarket interactions among firms and/or households (informational spillovers) ⇒ Marshall
  - Pecuniary externalities under imperfect competition, associated with demand or supply linkages ⇒ Krugman
- Mechanisms:
  - Under increasing returns to scale, production takes place at only a limited number of sites
  - Under costly trade, producers have an incentive to locate nearby demand to minimize transportation costs (demand from final consumers or demand from other firms in a vertically segmented world)
  - Possibility of "circular causation" if firms concentrate where the demand is, but the market becomes larger where manufactures production is concentrated

Dixit-Stiglitz Preferences

Dixit-Stiglitz Preferences

$$U = C_M; \quad C_M = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} ; \quad \sigma > 1$$

- N number of available varieties
- c_i consumption of variety i
- σ elasticity of substitution between varieties :

$$\frac{\partial c_j / c_{j'}}{\partial p_{j'} / p_j}$$

  Higher when goods become more substitutable
- Remark: In terms of a continuum of varieties:

$$C_M = \left(\int_{i=0}^{N} c_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$$

Indirect utility function

- Indirect utility function: Maximal utility when faced with a price level p and an amount of income w. Represents the consumer's preferences over market conditions. A consumer's indirect utility $V(p, w)$ can be computed from its utility function $U(c)$ by first computing the most preferred bundle $c(p, w)$ by solving the utility maximization problem; and second, computing the utility $U(c(p, w))$ the consumer derives from that bundle.

$$V = \frac{E}{P_M}$$

- P_M is the "ideal" price index associated with the Dixit-Stiglitz preferences:

$$P_M = \left[\sum_{i=1}^{N} p_i^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

Optimal consumption

$$\mathcal{L} = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} + \lambda \left[P_M C_M - \sum_{i=1}^{N} p_i c_i \right]$$

⇒ First-order conditions:

$$c_j^{-1/\sigma} \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}-1} = \lambda p_j, \quad \forall j \in [1, N]$$

$$\lambda \left[P_M C_M - \sum_{i=1}^{N} p_i c_i \right] = 0$$

⇒ Inverse and direct demand curves:

$$c_i = \left(\frac{p_i}{P_M} \right)^{-\sigma} \frac{E}{P_M}, \quad p_i = \frac{c_i^{-1/\sigma}}{\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}}} E$$

Love-for-Variety

- The same level of expenditure spread over more varieties increases utility
- If prices are homogeneous across goods:

$$U = N^{\frac{1}{\sigma-1}} \frac{E}{p}$$

increases with N

$\Rightarrow$ Consumers love variety for variety's sake

Price setting under Bertrand competition

- Maximization program:

$$\begin{cases} \max_{p_j} [p_j c_j - w a_m c_j] \\ s.t. \quad c_j = \frac{p_j^{-\sigma}}{\sum_{i=1}^{N} p_i^{1-\sigma}} E \end{cases}$$

$\Rightarrow$ Optimal price:

$$p_j \left(1 - \frac{1}{\sigma - (\sigma - 1)s_j}\right) = a_m w$$

where $s_j = \frac{p_j c_j}{E}$ is the firm's market share

$\Rightarrow$ The perceived elasticity ($\varepsilon = \sigma - (\sigma - 1)s_j$) falls as s_j rises

$\Rightarrow$ As long as s is not zero, the degree of competition does affect pricing behaviour.

Price setting under Cournot competition

- Maximization program:

$$\begin{cases} \max_{c_j} \left[p_j c_j - w a_m c_j \right] \\ s.t. \quad p_j = \frac{c_j^{-1/\sigma}}{\sum_{i=1}^{N} c_i^{1-1/\sigma}} E \end{cases}$$

$\Rightarrow$ Optimal price:

$$p_j \left[1 - \frac{1}{\sigma} - \left(1 - \frac{1}{\sigma} \right) s_j \right] = a_m w$$

where $s_j = \frac{p_j c_j}{E}$ is the firm's market share

$\Rightarrow$ The perceived elasticity (defined by $1/\varepsilon = \frac{1}{\sigma} + \left(1 - \frac{1}{\sigma}\right) s_j$) falls as s_j rises

$\Rightarrow$ As long as s is not zero, the degree of competition does affect pricing behaviour.

Price setting under monopolistic competition

- Under monopolistic competition, each firm as a negligible share of the market ($s_j \rightarrow 0$)
- The perceived elasticity equals σ and the mark-up is constant : $\frac{\sigma}{\sigma-1}$
- Equilibrium pricing does not depend upon the typical firm's conjecture about other firms' reaction (Bertrand and Cournot conjectures produce the same result) $\Rightarrow$ Rules out pro-competitive effects
- In the discrete version, one must assume that N is large. With a continuum of varieties, s_j is automatically zero.
- The invariance of the mark-up implies mill-pricing (ex2): the firm charged the same price "at the mill' or at the factory gate, whatever the extend of shipping costs

Invariance of Firm Scale

- A fixed mark-up of price over marginal cost implies a fixed operating profit margin:

$$pq - cq = \frac{cq}{\sigma - 1}$$

$\Rightarrow$ Under fixed production costs, there is a unique level of sales that allows the typical firm to just break down (ie earn a level of operating profit sufficient to cover fixed costs):

$$q = \frac{F(\sigma - 1)}{c}$$

Scale economies, Product differentiation and the Pattern of Trade (Krugman, 1980)

Motivation

- "Standard" models explain trade as a way to increase aggregate surplus through specialization according to comparative advantage
  - $\Rightarrow$ Unable to explain intra-industry trade
  - $\Rightarrow$ No role for demand in driving international trade
- "New Trade Theory" explains international trade on differentiated varieties
- Ingredients: Increasing returns to scale, imperfect competition and international trade costs

Hypotheses

- Two regions of size L and L^*
- Two sectors: Agriculture (perfectly competitive, no trade costs) and Manufacturing (IRS, monopolistic competition, costly trade)

$$U = C_M^{\mu} C_A^{1-\mu}, \quad 0 < \mu < 1$$

- Dixit-Stiglitz preferences over differentiates varieties

$$C_M = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 1$$

- Agricultural technology: $Y_A = L_A$
- Manufacturing technology: $l_i = \alpha + \beta x_i$ (Increasing returns to scale)
- Free entry

Closed economy

- Market-clearing conditions:

$$x_i = Lc_i$$
$$L_A = LC_A$$
$$L = \sum_{i=1}^{N} (\alpha + \beta x_i) + L_A$$

- Sectoral consumptions:

$$\begin{cases} \max_{C_A, C_M} C_M^{\mu} C_A^{1-\mu} \\ s.t. \quad P_A C_A + P_M C_M \leq PC \end{cases}$$

$$\Rightarrow \quad P_M C_M = \mu PC = \mu w$$
$$P_A C_A = (1-\mu) PC = (1-\mu) w$$
$$P = \frac{P_A^{1-\mu} P_M^{\mu}}{(1-\mu)^{1-\mu} \mu^{\mu}}$$

Closed economy (2)

- Optimal consumption on each variety:

$$\left\{ \begin{array}{l} \max_{c_i} C_M = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \\ s.t. \quad \sum_{i=1}^{N} p_i c_i \leq P_M C_M \end{array} \right.$$

$$\Rightarrow \quad c_i = \left(\frac{p_i}{P_M} \right)^{-\sigma} C_M = \left(\frac{p_i}{P} \right)^{-\sigma} \frac{\mu PC}{P_M}$$

$$P_M = \left[\sum_{i=1}^{N} p_i^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

Closed economy (3)

- Optimal price in agriculture:

$$P_A = w = 1$$

- Optimal prices in manufacturing:

$$\begin{cases} \pi_i = p_i c_i L - w(\alpha + \beta L c_i) \\ s.t. \quad c_i = \left(\frac{p_i}{P_M}\right)^{-\sigma} \frac{w}{P_M} \end{cases}$$

$\Rightarrow$ Mill-pricing:

$$p_i = \frac{\sigma}{\sigma - 1}\beta$$

Closed economy (4)

- Free entry:

$$\pi_i = p_i x_i - (\alpha + \beta x_i) = 0$$
$$\Rightarrow \quad x_i = \frac{\alpha}{\beta}(\sigma - 1)$$

$\Rightarrow$ There is a unique level of sales that allows the typical firm to just break even, ie to earn a level of operating profit sufficient to cover fixed costs.

- Full-employment:

$$L = \sum_{i=1}^{N} (\alpha + \beta x_i) + L_A$$
$$\Leftrightarrow \quad N = \frac{\mu L}{\alpha \sigma}$$

Costly trade

- Trade increases the diversity of varieties available for consumption:

$$U = \left(\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}} + \sum_{i^*=1}^{N^*} c_{i^*}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 1$$

$\Rightarrow$ Positive welfare effect

- Trade is perfectly free in the homogeneous good sector $\Rightarrow$ Law of one price $P_A = P_A^*$ $\Rightarrow$ Equal wages: $w = w^*$
- "Iceberg" trade costs τ in the manufacturing sector

Costly trade (2)

⇒ Mill-pricing and full pass-through:

$$\begin{cases} \max_{p_i, p_i^*} [p_i L c_i + p_i^* L^* c_i^* - \beta(L c_i + \tau L^* c_i^*) - \alpha] \\ s.t. \quad c_i = \left(\frac{p_i}{P_M}\right)^{-\sigma} \frac{w}{P_M} \\ \qquad\quad c_i^* = \left(\frac{p_i^*}{P_M^*}\right)^{-\sigma} \frac{w^*}{P_M^*} \end{cases}$$

⇒ Optimal prices:

$$\begin{aligned} p_i &= \frac{\sigma}{\sigma - 1}\beta \\ p_i^* &= \frac{\sigma}{\sigma - 1}\beta\tau = \tau p_i \end{aligned}$$

⇒ Price indices:

$$\frac{P_M}{P_M^*} = \left[\frac{N/N^* + \tau^{1-\sigma}}{N/N^*\tau^{1-\sigma} + 1}\right]^{\frac{1}{1-\sigma}}$$

⇒ The relative price of manufacturing goods is a decreasing function of the relative number of firms located in the market.

Costly trade (3)

- Spatial equilibrium equalizing profits:

$$p_i c_i L + \tau p_i c_i^* L^* - w(\alpha + \beta c_i L + \tau \beta c_i^* L^*) = p_{i*}^* c_{i*}^* L^* + \tau p_{i*} c_{i*} L - w^* (\alpha + \beta c_{i*}^* L^* + \tau \beta c_{i*} L)$$

$$\Leftrightarrow s_n = \frac{s_L - \tau^{1-\sigma}(1 - s_L)}{1 - \tau^{1-\sigma}}$$

with $s_n = \frac{N}{N+N^*}$ and $s_L = \frac{L}{L+L^*}$

$\Rightarrow$ Home Market Effect:

$$\frac{ds_n}{ds_L} = \frac{1 + \tau^{1-\sigma}}{1 - \tau^{1-\sigma}} > 1$$

An increase in the relative size of the domestic market more than proportionally increases the relative share of firms located here.

Costly trade (4)

- Note that when wages are endogenous as in Krugman (1980) (no agricultural sector), the relative wage is sensitive to the relative size of countries $\Rightarrow$ Home Market Effect on wages: Large countries have relatively higher wages $\Rightarrow$ The size differential is offset by a wage differential which explains that, in general, agglomeration is not total.
- Consequence of the HME: In a world of IRS, countries will tend to export those kinds of products for which they have relatively large domestic demand.