

Slides for Chapter 9: Open Economy Models with Imperfect Competition and Scale economies

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9.1 A two-country oligopoly model (X skilled-labor intensive)

Results - trade costs lead to:

(1) inefficiency: entry and lower output per firm

(2) reciprocal dumping

(3) higher welfare per capita and output per firm, higher real price for skilled labor in larger country.

(4) higher welfare per capita and output per firm, higher real price for both factors in skilled-labor-abundant country.

9.2 A two-country monopolist-competition model

Results - trade costs lead to:

- (1) no change in output per firm, welfare loss from unbalanced consumption of domestic versus foreign varieties
- (2) higher welfare per capita, lower price index, and higher real price for skilled labor in larger country
- (3) higher welfare per capita, lower price index, and higher real price for both factors in skilled-labor-abundant country.

9.3 Monopolistic competition with horizontal multinationals

Partial-equilibrium models give good insight, but have limitations from the point of view of trade theory and policy.

(1) no role for factor prices and factor endowments, no reverse effect of the introduction of mnes on factor prices.

(2) no role for entry and exit in response to liberalization.

In this section, we study how endogenous multinational firms are introduced in a general-equilibrium context.

Start with two sectors, one factor: monopolistic-competition, national and horizontal (2-plant) firms.

$$U = \left[\sum_i X_i^\alpha \right]^{\frac{0.5}{\alpha}} Y^{0.5} \quad \sigma = \frac{1}{1 - \alpha} \quad L = np_x X + p_y Y$$

If you solve the optimization problem, the consumer's demands for X varieties and Y are

$$Y = \frac{L}{2p_y} \quad X_i = p_i^{-\sigma} \left[\sum_i p_i^{1-\sigma} \right]^{-1} \frac{L}{2} \quad nX = \frac{L}{2p_x}$$

Marginal cost Y , marginal cost X , and fixed costs of an X variety:

$$mc_y \quad mc_x \quad fc_x$$

Large group monopolistic competition: firms view [] as fixed, so demand for an individual variety is iso-elastic

marginal revenue is given by $p_x(1 - 1/\sigma)$

Autarky equilibrium is given as the solution to:

Inequality	Definition	Complementary Variable
$p_y \leq mc_y$	pricing for Y	Y
$p_x(1 - 1/\sigma) \leq mc_x$	pricing for X	X
$(p_x/\sigma)X \leq fc_x$	pricing for n (free entry)	n
$L/(2p_y) \leq Y$	demand/supply Y	p_y
$L/(2p_x) \leq nX$	demand/supply X variety	p_x
$(mc_y)Y + n(mc_x)X + n(fc_x) = L$	demand/supply L	w

This model can be solved analytically and yields:

$$X = (\sigma - 1) \frac{fc_x}{mc_x} \quad n = \frac{L}{2\sigma fc_x} \quad nX = \frac{(\sigma - 1)}{\sigma} \frac{L}{2mc_x}$$

Now suppose that, while trade is prohibitive, each firm can establish a second plant in the other country for an additional fixed cost.

The fixed cost for a two-plant firm is given by βfc_x , $2 > \beta > 1$.

Multi-plant economies of scale due to non-rival nature of knowledge capital.

Replace fc_x with βfc_x and replace L with $2L$; the *total* two-country output of an X variety and *total* varieties are now:

$$X = (\sigma - 1)\beta \frac{fc_x}{mc_x} \quad n = \frac{L}{\beta \sigma fc_x}$$

Each country gets half of each X variety: *single-country totals* are

$$X = \frac{(\sigma - 1)}{2} \beta \frac{fc_x}{mc_x} \quad n = \frac{L}{\beta \sigma fc_x} \quad nX = \frac{(\sigma - 1)}{\sigma} \frac{L}{2mc_x}$$

Note that nX is the same as it was in the domestic-firm case:

$$U = (nX^\alpha)^{\frac{0.5}{\alpha}} Y^{0.5} = (n^{1-\alpha} n^\alpha X^\alpha)^{\frac{0.5}{\alpha}} Y^{0.5} = n^{\frac{1-\alpha}{\alpha} \cdot 0.5} \left[(nX)^{0.5} Y^{0.5} \right]$$

The term in square bracket on the right-hand side is unchanged with multinationals.

Denoting the autarky value of n as n_a and then since the new value is $n_m = (2/\beta)n_a$, then the ratio of utility in the multinational regime to autarky is given by

$$\frac{U_m}{U_a} = (n_m/n_a)^{\frac{1-\alpha}{\alpha} \cdot 0.5} = (2/\beta)^{\frac{1-\alpha}{\alpha} \cdot 0.5} > 1$$

If $\beta = 1.5$ and $\alpha = 0.75$ (an elasticity of substitution of 4 between X varieties), then this ratio is 1.05:

there is a 5 percent gain in per-capita welfare (10 percent gain in utility from X) from introducing horizontal multinationals.

Horizontal multinationals improve welfare by exploiting firm-level scale economies; that is, the non-rival property of knowledge-based assets.

Return to the domestic-firm case, and assume that X can be traded at the (gross) trade cost t ($t = 1 +$ (iceberg melt rate)).

Returning to the utility function, the demand for an individual domestic variety can be re-written using the price index e :

$$X_i = p_i^{-\sigma} e^{\sigma-1} \frac{L}{2} \quad e = \left[\sum_j p_j^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

$p_i X_{ij}^d$ is the revenue received by the exporter and X_{ij}^d/t are the number of units arriving in the importing country

The price per unit in the importing country must be $p_i t$
 ($p_i X_{ij}^d = (p_i t) X_{ij}^d/t$).

$$e_i = \left[N_i^d p_i^{1-\sigma} + N_j^d (p_j t)^{1-\sigma} + N_i^h p_i^{1-\sigma} + N_j^h p_i^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

where the superscript d denotes domestic or national firm and m denotes a two-plant horizontal multinational, and subscripts i and j denote the two countries.

Consider *identical countries*.

Assuming that marginal cost of production is the same for both domestic and multinational firms,

the pricing equation in the model says that all varieties will have the same (domestic) prices in equilibrium.

Assuming that the relevant firm types are active in equilibrium, the demand functions for the various X varieties sold in country i are:

$$X_{ii}^d = X_{ii}^h = X_{ji}^h = p_i^{-\sigma} e_i^{\sigma-1} L/2 \quad X_{ji}^d/t = (p_j t)^{-\sigma} e_i^{\sigma-1} L/2$$

where the second equation can also be written as:

$$X_{ji}^d = p_j^{-\sigma} t^{1-\sigma} e_i^{\sigma-1} L/2 \quad X_{ji}^d = p_j^{-\sigma} \phi e_i^{\sigma-1} L/2$$

where ϕ is the “phi-ness” of trade: $\phi = 1$ ($t = 1$) is free trade, $\phi = 0$ ($t = +\text{inf}$) is autarky.

Zero profit conditions for d and m firms located in country i are markup revenues equal fixed costs:

$$(p_i/\sigma)X_{ii}^d + (p_i/\sigma)X_{ij}^d \leq fc_x^d$$

$$(p_i/\sigma)X_{ii}^m + (p_i/\sigma)X_{ij}^m \leq fc_x^m = \beta fc_x^d$$

Using the demand functions for X_{ij} and X_{ij} above, these are:

$$p_i^{1-\sigma} e_i^{\sigma-1} L/2 + p_i^{1-\sigma} t^{1-\sigma} e_j^{\sigma-1} L/2 \leq \sigma fc_x^d$$

$$p_i^{1-\sigma} e_i^{\sigma-1} L/2 + p_i^{1-\sigma} e_j^{\sigma-1} L/2 \leq \sigma fc_x^m = \beta fc_x^d$$

Suppose that we pick values of parameters such that national and multinational firms can both just break even in the two identical countries.

Then the ratio of the two zero-profit conditions give us the critical relationship between trade costs and fixed costs for indifference.

$$\frac{(1 + t^{1-\sigma})}{2} = \frac{fc_x^d}{\beta fc_x^d} \quad 2 > (1 + t^{1-\sigma}) = \frac{2}{\beta} > 1$$

$$1 + \phi = 2/\beta$$

Indifference between national and multinational firms

Higher trade costs allow for lower firm-level scale economies (higher β) for firms to be indifferent as to type.

Freer trade (larger ϕ) require a higher level of multi-plant economies of scale (knowledge non-rivalness or jointness) to suppose multinationals.

No multinationals in free trade unless added cost of a second plant is zero ($\beta = 1$).