Lecture 10: Trade and Monopolistic Competition

14.581: International Economics I

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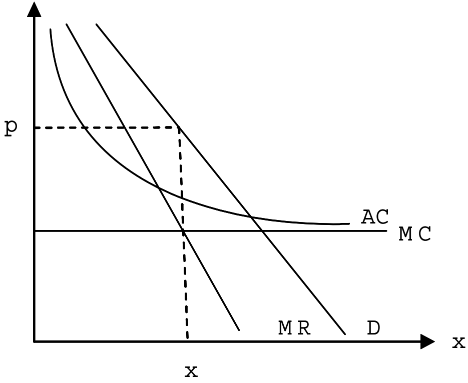
Introduction

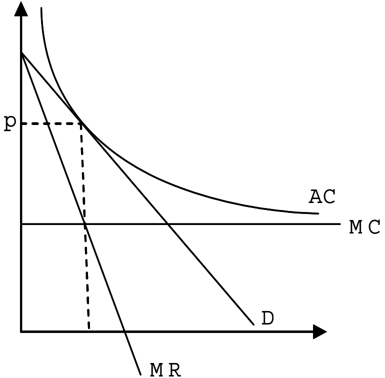
- In the last lecture, we developed a model in which increasing returns and imperfect competition was sufficient to generate two-way flows in identical products. Some caveats:
  - the microfoundations of such approach have been questioned;
  - it is not clear what the model has to say about the size of two-way flows as a function of country characteristics;
  - observed two-way intraindustry trade flows are concentrated in sectors where output is not homogenous (see Balassa, 1964);
- In this lecture, we will discuss models that place product differentiation at center stage.
  - even within industries, firms may produce differentiated varieties of the industry's output;
  - if consumers value "variety" or there is heterogenous tastes over varieties, on aggregate several varieties will be consumed;
  - with increasing returns to scale, production of an individual variety will be concentrated in a given location;
- These features will lead to intra-industry trade, and as we'll see can also generate large volumes of trade between similar countries.

Monopolistic Competition

- As in the previous lecture, the presence of internal economies of scale will imply a departure from the perfect competition paradigm.
- In order to minimize this departure, the literature has considered a particular form of competition, due to Chamberlain (1933), called monopolistic competition. Its distinctive features are:
  1. Each firm has some market power in the sense that it faces a downward sloping demand curve;
  2. There is a large number of firms so that a price change by a *single* firm has no effect on the level of demand faced by the rest of the firms;
  3. There is free entry so that firms' profits are driven down to zero.
- Note that price direct price competition in a given variety would lead to marginal cost pricing and negative profits
  - so a firm has no incentive to exactly duplicate an existing brand.

Free Entry at Work





Product Differentiation

- Where does the downard sloping demand come from?
- Several approaches to product differentiation have been proposed. The most popular one is the "love-for-variety" approach of Dixit and Stiglitz (1977).
- Let there be I sectors or goods and denote by Ω_i the set of varieties of good i; denote by $\omega_i \in \Omega_i$ a particular variety.
- Preferences of a representative consumer are of the form

$$U = U\left[u_1(\cdot), u_2(\cdot), ..., u_I(\cdot)\right]$$

with

$$u_i = u_i\left(C_{i1}, C_{i2}, ..., C_{i\omega}, ..., C_{in}\right)$$

- We will assume both $U(\cdot)$ and $u_i(\cdot)$ are increasing in its arguments and homothetic.
- Particularly example: constant-elasticity of substitution (CES) case with a continuum of varieties:

$$u_i = \left[\int_0^{n_i} x_i(\omega)^{\alpha_i} d\omega\right]^{1/\alpha_i}, \ 0 < \alpha < 1, \qquad (1)$$

Product Differentiation (cted.)

- The elasticity of substitution across varieties is then constant and given by $\sigma_i = 1/\left(1-\alpha_i\right)$.
  - as $\alpha_i \rightarrow 1$, $\sigma_i \rightarrow \infty$ and varieties become perfect substitutes (u_i linear in $x_i(\omega)$);
  - as $\alpha_i \rightarrow 0$, $\sigma_i \rightarrow 1$ and we go to the Cobb-Douglas case;
  - $\alpha_i < 0$ is ruled out for reasons that will become clear.
- Notice the "love-for-variety" feature. Under perfect symmetry, $x_i(\omega) = x_i$ for all ω, and

$$u_i = n_i^{1/\alpha_i} x_i = n_i^{(1-\alpha_i)/\alpha_i} \cdot \underbrace{(n_i x_i)}_{\text{"real" spending}} .$$

- Aside: the approach has also been used in production theory to argue that producers may prefer a larger variety of inputs (e.g., more specialized inputs) because they yield higher productivity.
- How do you solve this demand system? If $U(\cdot)$ is weakly separable, then two-stage problem:
  1. choose $x_i(\omega)$'s to maximize u_i subject to $\int_0^{n_i} p_i(\omega)\, x_i(\omega)\, d\omega \leq E_i$;
  2. choose E_i to maximize $U(\cdot)$ subject to $\sum_{i=1}^{I} E_i \leq E$.

An Example: Krugman (1980)

- Krugman (1980) considers a model in which, on the demand side, consumers have identical preferences as in (1) over varieties in a single sector.
- Technology is similar to that in Brander and Krugman (1983):
  - there is a constant marginal cost of production equal to $1/\varphi$ units of the unique factor of production, labor;
  - there is a fixed cost of production f in terms of labor.
- Market structure in the single sector is characterized by monopolistic competitition with a continuum of firms of endogenous measure n.
- Solving the utility maximization problem yields demand for each variety:

$$x_i(\omega) = \frac{E}{P}\left(\frac{p(\omega)}{P}\right)^{-\sigma}, \tag{2}$$

where

$$P = \left[\int_0^n p^{1-\sigma}(\omega)\, d\omega\right]^{1/(1-\sigma)} \tag{3}$$

is the ideal price index (minimum cost of obtaining one unit of utility).

Krugman (1980): Closed-Economy Equilibrium

- Each firm maximizes profits $\pi(\omega) = p(\omega)x(\omega) - (1/\varphi)wx(\omega) - wf$ subject to (2).
- Because firms take E and P as given (continuum assumption), we get the standard constant-markup pricing formula of a monopolist facing a constant price elasticity demand:

$$p(\omega) = \frac{\sigma}{\sigma - 1}\frac{w}{\varphi}.$$

- Now we can write the free-entry (or zero-profit) condition as $\frac{1}{\sigma}p(\omega)x(\omega) = wf$, or simply:

$$x(\omega) = (\sigma - 1) f\varphi. \quad (4)$$

- Labor market clearing implies, however, that $(f + x/\varphi)n = L$ and thus we can conclude that

$$n = \frac{L}{\sigma f}.$$

- Scale Effects: Note that large economies produce more varieties and thus achieve higher welfare levels.

Krugman (1980): Open-Economy Equilibrium

- Now suppose that the world consists of two economies, H and F, identical in all respects except for population size: L^H, L^F.
- Given constant mark-up pricing, notice that free entry will still imply that, for any variety, $x(\omega)$ is given by (4).
- Goods market clearing thus requires that all varieties be demanded in the same amount, which in light of (2) requires $w^H = w^F$ (FPE).
- Using the labor market clearing conditions one can show that

$$n^k = \frac{L^k}{\sigma f}.$$

- Note that Home consumes a fraction $L^H / \left(L^H + L^F\right)$ of the world's production of **all** varieties (two-way intraindustry trade).
- Welfare is now

$$U = (\sigma - 1) f \left(\frac{L^H + L^F}{\sigma f} \right)^{\sigma/(\sigma-1)},$$

and thus increases with trade.

General Model: Integrated Equilibrium

- Helpman and Krugman (1985) show how to embed IRS, monopolistic competition, and product differentiation in a standard multi-sector, multi-factor model.
- Consider first the equilibrium conditions for the integrated equilibrium:
  - Free-entry into the industry drives the price down to average cost:
  $$p_i = c_i\left(\bar{w}, \bar{x}_i\right) \quad \text{for all } i \tag{5}$$
  where
  $$\bar{x}_i = \frac{\bar{X}_i}{\bar{n}_i} \quad \text{for all } i. \tag{6}$$
  - Optimal pricing by the monopolist yields
  $$\frac{p_i}{MR_i\left(\bar{p}, \bar{n}\right)} \equiv R_i\left(\bar{p}, \bar{n}\right) = \theta_i\left(\bar{w}, \bar{x}_i\right) \equiv \frac{c_i\left(\bar{w}, \bar{x}_i\right)}{\partial C_i\left(\bar{w}, \bar{x}_i\right)/\partial x_i} \quad \text{for all } i. \tag{7}$$
  - Factor-market clearing requires:
  $$\sum\nolimits_{i \in I} a_{ji}\left(\bar{w}, \bar{x}_i\right) \cdot \bar{X}_i = \bar{V}_j \quad \text{for all } j. \tag{8}$$
  - While goods-clearing imposes
  $$\alpha_i\left(\bar{p}, \bar{n}\right) = \frac{\bar{p}_i \bar{X}_i}{\sum_{i' \in I}\left(\bar{p}_{i'} \bar{X}_{i'}\right)} \quad \text{for any } i. \tag{9}$$

General Model: Integrated Equilibrium (cted.)

- When preferences are CES, $R_i(\cdot)$ is a constant, while when $C_i(\cdot)$ is homothetic, $\theta_i(\cdot)$ is only a function of $\bar{x}_i$ (see eq. 4 above).
- We can now define the FPE set in a manner identical to Lecture 6.

$$FPE = \left\{ \left(V^1, V^2, ..., V^K\right) \mid \exists \lambda_i^k \geq 0, \textstyle\sum_{k \in K} \lambda_i^k = 1 \text{ for all } i \right.$$
$$\left. \text{such that } V^k = \textstyle\sum_{i \in I} \lambda_i^k \bar{V}_i \text{ for all countries } k \right\}$$

- Replication of the integrated equilibrium requires that each variety is produced in only one country (because of IRS).
    - but with a continuum of varieties, this does not place any further constraints on the FPE set (with a discrete number of varieties the FPE set becomes a set of measure 0).
- The pattern of trade continues to be generally indeterminate (actually, more so now), but Vanek equation continues to hold within the FPE set.
- So what have we gained? We are now able to say something about:
    - the bilateral volume of trade;
    - the composition of trade (intraindustry vs. interindustry).
- We will explore this in more detail in the next lecture.

Introducing Transportations Costs

- Let us now go back to the $1 \times 1 \times 2$ model of Krugman (1980), but assume now that there are iceberg transport costs of exporting.
- Profits of a firm at Home are now

$$\pi^{H}(\omega) = \left[p^{H,H}(\omega) - (1/\varphi) w\right] x^{H,H}(\omega) + \left[p^{H,F}(\omega) - \tau (1/\varphi) w\right] x^{H,F}(\omega$$

- Because the elasticity of demand is unaffected by trade barriers, both domestic and export prices will be a constant markup $\sigma/(\sigma-1)$ over marginal cost
  - with the marginal cost being τ times higher for exporting.
- But then we can write the free-entry condition as

$$\frac{1}{\sigma} p^{H,H}(\omega) x^{H,H}(\omega) + \frac{\tau}{\sigma} p^{H,H}(\omega) x^{H,F}(\omega) = w^{H} f,$$

or simply

$$x^{H,H} + \tau x^{H,F} = (\sigma - 1) f \varphi. \qquad (10)$$

- Labor market clearing requires however that

$$n^{H}\left(f + x^{H,H}/\varphi + \tau x^{H,F}/\varphi\right) = L^{H}.$$

The Home Market Effect

- Using (10) and generalizing to the case of Foreign implies

$$n^k = L^k / \sigma f \quad \text{for } k = H, F. \tag{11}$$

- This is what we had before. The equilibrium is however distinct in an important way: we no longer have FPE.
- To see this, note that trade balance implies

$$n^H \tau p^{H,H} x^{H,F} = n^F \tau p^{F,F} x^{F,H} \tag{12}$$

- Now using (2) and (11) and manipulating, we also obtain

$$\frac{n^H p^{H,H} x^{H,F}}{n^F p^{F,F} x^{F,H}} = \frac{\left(L^H / L^F\right)\left(w^H / w^F\right)^{1-\sigma} + \tau^{1-\sigma}}{1 + \left(L^H / L^F\right)\left(\tau w^H / w^F\right)^{1-\sigma}} \left(w^H / w^F\right)^{-\sigma}.$$

- Let $\rho \equiv \tau^{1-\sigma} < 1$, $\lambda \equiv L^H / L^F$ and $\vartheta \equiv w^H / w^F$, then equilibrium requires

$$1 = \frac{\lambda \left(\vartheta\right)^{1-\sigma} + \rho}{1 + \lambda\rho\left(\vartheta\right)^{1-\sigma}} \left(\vartheta\right)^{-\sigma}.$$

- But for $\lambda > 1$, this can only hold if $\vartheta > 1$. The larger country has the larger wage (more attractive location to set up shop $\Longrightarrow$ higher L^d).

Home Market Effect

- In the example above, transport costs generated wage differences across countries, but no "home market effect":
  - country k's share of world varieties = country k's share of world population.
- Now consider a variant of the model in which there is a second sector producing a numeraire homogenous good one-to-one with labor.
  - suppose good is produced everywhere so we have $w^k = 1$ for $k = H, F$.
- Working with the demand function (2) and the price index (3), one can show (see HK, pp. 206-07) that

$$\frac{n^H}{n^F} = \begin{cases} 0 & \text{if } \lambda \leq \rho \\ \frac{\lambda-\rho}{1-\lambda\rho} & \text{if } 1/\rho \geq \lambda \geq \rho \\ +\infty & \text{if } \lambda \geq 1/\rho \end{cases} .$$

- So $n^H/n^F > \lambda$ if and only if $\lambda > 1$ (the larger market attracts a disproportionate share of the IRS sector).
  - in addition, $\partial\left(\frac{\lambda-\rho}{1-\lambda\rho}\right)/\partial\lambda > 1$ (see Davis and Weinstein, 2003, for evidence).
- Davis (1998) shows however that the assumption of the freely tradable homogenous good is important.

Final Remarks

- In the next lecture we will study the implication of monopolistic competition models for the structure of trade flows.
- It is important to note, however, that these models also qualify other important trade theorems:
  - Stolper-Samuelson no longer holds, in the sense that it may well be the case that all factors gain from trade (if love-for variety effect outweighs standard effect).
- Also, we have focused on love-for-variety in consumption, but we can reinterpret the model as one of love-for-variety in production:
  - welfare gains from trade are now related to productivity improvements, rather than utility gains from variety.