Homework

Monopolistic Competition and Increasing Returns

ECO-13101 Economia Internacional I (International Trade Theory)*

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Question 1: Increasing Returns and Pro-Competitive Gains

Consider an industry, say oil, where a monopolist is the unique producer in the Home country. Home demand for oil is given by the following linear inverse demand function

$$P = a - bQ \ ,$$

where P is the price of oil and Q is the quantity demanded. The monopolist faces the following total cost: $TC = F + cQ$. F is the fixed cost and c is the constant marginal cost of production. Assume that $a > c$.

1. Set up the problem of choosing the profit maximizing level of production Q for the monopolist. Solve for the optimal Q. Solve for the implied optimal monopoly price. Compute the difference $P - c$. Is this positive or negative? Why?

   Now suppose that there is a second country, Foreign, which is identical to Home and in which oil is also produced by a monopolist facing the same inverse demand function $P = a - bQ$. Foreign firm also faces the identical total cost function. Assume that the oil produced by the two firms is identical from the point of view of consumers. Initially, there are prohibitive trade barriers between the two countries, so the equilibrium in each market is as described above, and hence the equilibrium price is identical in both markets.

2. Now suppose that a process of trade integration removes all trade barriers. Will the Foreign oil producer have an incentive to also sell oil in the Home market? Why or why not?

   Denote by Q^* the quantity sold by the Foreign oil producer in the Home market and by Q the quantity sold by the Home oil producer in the Home market. Let us focus for now on the equilibrium in the Home market.

3. Set up the problem of choosing the profit-maximizing level of production Q for the Home firm. Make the Nash assumption that the Home Firm takes Q^* as an exogenous

parameter when choosing a Q to maximize its profits. Express the optimal Q as a function of parameters and Q^*. (*Hint: the inverse demand function is now $P = a - b(Q + Q^*)$*).

4. Set up the problem of choosing the profit-maximizing level of production Q^* for the Foreign firm. Following the same steps as in the previous part, express the optimal Q^* as a function of parameters and Q.

5. Using your answers in the previous two parts to solve for Q, Q^*, and P as functions of the parameters.

6. Interpret the effects of trade integration from the point of view of consumer welfare at Home, by comparing the autarky output (Q) with the free trade output $(Q + Q^*)$ and the autarky price with the free trade price.

Question 2: Monopolistic Competition and Gains from Product Diversity

Consider an economy with the following utility function

$$U = \sum_{i=1}^{n} X_i^{\alpha} \quad ,$$

where X_i represents the consumption of good i, $0 < \alpha < 1$ is a constant, and n is the number of goods produced in the economy. n is going to be endogenously determined. Each good that is produced is subject to diminishing marginal utility, and so the consumer would always rather have one unit each of two goods, say X_1 and X_2, rather than two units of either. Labor is the only factor of production and the endowment of labor is $\overline{L}$. Assume that labor is the numeraire, i.e. wage $w = 1$.

1. Set up the consumer's utility maximization exercise, and use the first order conditions to show that the demand for good i is given by

$$X_i = \frac{\overline{L}}{p_{xi}^{\sigma} P} \quad ,$$

where p_{xi} is the price of good i in terms of labor, $\sigma = \frac{1}{1-\alpha}$ and $P = \sum_{j=1}^{n} p_{xj}^{-\alpha\sigma}$.

2. Assuming that P is constant (i.e. there are many X producers and each producer treats P as being unaffected by its decision to choose a price), show that the elasticity of demand for good i is given by

$$e_i = -\frac{dX_i}{dp_{xi}}.\frac{p_{xi}}{X_i} = \sigma = \frac{1}{1-\alpha} \quad .$$

3. Suppose production of each good i has the following total cost function

$$TC_{xi} = F + MC_{xi}.X_i \quad ,$$

where F is fixed cost and MC_{xi} is the constant marginal cost of producing good i and X_i is the output of good i (which by market clearing for good i is equal to the demand for good i). Set up the firm's (producing good i) profit maximization exercise and use the first order condition to obtain an expression for the price of good i. (*Hint - first obtain the expression for total revenue and then using expressions for total revenue and total cost obtain the expression for profits. The firm chooses price and not output.*)

4. Assuming free entry and exit, profit for the firm is driven to zero, i.e. price is equal to average cost. Use the expression for price obtained in previous part to obtain the following expression for the output (also demand)

$$X_i = \frac{\alpha F}{MC_{xi}(1-\alpha)} \quad .$$

5. Use the expression for X_i obtained in the previous part to obtain an expression for TC_{xi}. Show that the total cost is the same for every good i. The total cost of producing n goods must be equal to the total value of labor in the economy ($w\bar{L} = \bar{L}$). Use this to obtain an expression for the number of goods, n.

6. What would happen to product diversity (the number of goods produced), n, if the endowment of labor $\bar{L}$ were to double? Based on your answer, what can you say about the effect of trade between two such economies (identical) on product diversity?

Question 3: Mexico and its Competitors in the US Market

Download the data for Homework 3 from the course webpage. The data is on imports of

United States (US) for 4 digit SITC product codes from a 9 countries - Canada (CAN), China (CHN), Germany (DEU) France (FRA), Great Britain (GBR), Italy (ITA), Japan (JPN), South Korea (KOR), and Mexico (MEX). These are the top 9 trading partners of US. In addition World (WLD) is also included as partner, and the imports of US from World are the total imports of the US from the entire world. The data is for 4 years - 1993, 1999, 2007, and 2013. For all exercises that follow drop the codes 9310 and 9610.

1. Plot the share of every exporter except World in US's total imports (summed across all products) for each year.

2. Now divide every country's share in US total imports for each year by that country's share in 1993. This would allow us to look at the growth in the market shares relative to 1993. How did Mexico's market share change after NAFTA? Which country's share has risen the fastest over the entire-time period.

3. Now exclude any product codes that start with 1 or 2. These codes capture agricultural products and raw materials. The products that remain will represent the manufactures. From here on we will focus only on manufactures trade.

   (a) Repeat exercises 1 and 2. How did Mexico's market share in the US change after NAFTA? Which country's share has risen the fastest over the entire-time period.

   (b) When did China become a WTO member? How did China's entry into WTO affect other countries market shares in the US? Focus, especially, on Mexico describing evolution of its market share in the US.

   (c) Draw a bar graph, for each year separately, showing the number of product for which Mexico has: (i) a higher rank than China in the share of total imports of the US, and (ii) a lower rank than China in the share of total imports of the US. Describe the change that you observe.

   (d) List Mexico's top 10 products, by share in U.S. total imports, in 1993. Compare this to the top 10 products of Mexico in 1999. How did NAFTA affect the composition of Mexico's exports?

(e) What was China's share in the U.S. imports for the the top 10 products of Mexico in 1999? What was China's share in the same product categories in 2007? What happened to Mexico's share in the same product categories in 2007? Describe the changes you observe. Did China's entry into WTO affect Mexico's share in the U.S. market?

(f) List Mexico's top 10 products (by share in U.S. total imports) to the U.S. in 2013. How has Mexico's exports composition changed between 2007 and 2013? Do the same exercise for China. Describe the changes that you observe.