

Answer Key Problem Set 3

Ricardo Cavazos and Robert Santillano *
Department of Agriculture and Resource Economics
University of California at Berkeley

October 25, 2006

1 Question 1

For each of the following examples, explain whether this is a case of external or internal economies of scale:

- (a) Most musical instruments in the United States are produced by more than a dozen factories in Elkhart, Indiana.

External Economies of Scale. When many factories are concentrated in a particular location they can save on a variety of specialized services necessary for daily operations, labor and input markets. Being in a single town also implies they may learn from each other's production decisions.

- (b) All Hondas sold in the United States are either imported or produced in Marysville, Ohio.

Internal Economies of Scale. Honda is a big firm which produces its cars in large facilities with computerized and predetermined processes. Therefore, the marginal cost for an additional car is small, implying the firm faces a decreasing average cost curve.

- (c) All airframes for Airbus, Europe's, only producer of large aircraft, are assembled in Toulouse, France.

Internal Economies of Scale. Airbus is a large firm, competing only with Boeing, which can expand production and achieve lower costs at the same time. This is because the cost of producing another airframe is small once you have the machinery, facilities, and people. This implies the average cost curve for Airbus is downward sloping.

*Please contact us at cavazos@are.berkeley.edu or rsantillano@berkeley.edu if you have any questions, find any errors, or typos in the answers.

- (d) Hartford, Connecticut, is the insurance capital of the northeastern United States.

External Economies of Scale. Similarly to (a), being concentrated in a particular location allows them to save on a variety of specialized services necessary for daily operations, labor and input markets.

2 Question 2

In perfect competition, firms set price equal to marginal cost. Why isn't this possible when there are internal economies of scale?

When internal economies of scale are present, the Average Cost (AC) curve always slopes down. A necessary condition for this to happen is that the Marginal Cost curve is always below the AC curve. This happens whenever there are sunk fixed costs and MC is either constant or downward sloping. If a firm in this situation would set its price equal to marginal cost it would find itself in a situation where the AC would be greater than the price. Therefore, this firm would incur economic losses. This situation is unsustainable in the long-run and the firm would have to shutdown. The following figure illustrates such a situation.

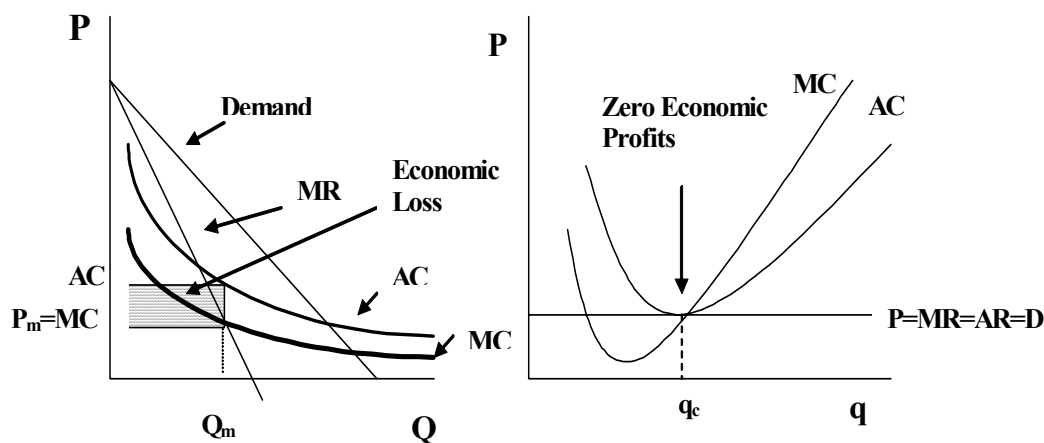


Figure 1. Firm with internal economies of scale and Firm in perfect competition

The left panel of Figure 1. presents a firm showing internal economies of scale. Note that if the firm sets its price equal to marginal cost then it would incur in economic losses. On the other hand, the right panel of Figure 1. shows a firm in perfect competition. This firm would set price equal to marginal cost because price is equal to marginal revenue and to determine the optimal quantity marginal revenue has to equal marginal cost.

3 Question 3

Suppose the widget industry operates in the home country, such that each firm's sales of widgets is given by:

$$X = S \left[\frac{1}{n} - b(P - \bar{P}) \right]$$

where X is firm sales, S is total industry sales, n is the number of firms, P is the price charged by the firm, and \bar{P} is the average industry price. Note that if all firms charge the same price, then $X = \frac{S}{n}$.

(a) Suppose the pricing rule is $P = c + \frac{1}{(bn)}$

and the average cost is given by: $AC = c + n \left(\frac{F}{S} \right)$

where c is the marginal cost and F is the fixed cost. In economic terms, what is the no entry/no exit condition? Solve for the equilibrium number of firms (call it n_0).

The no entry/no exit condition is exactly at the point where there are zero profits. This happens whenever price equals average cost. At this point there are no incentives for firms to enter or exit the particular market. Therefore, in order to obtain the equilibrium number of firms we would set price equal to average cost and solve for n . We have the following:

$$\begin{aligned} P &= AC \\ c + \frac{1}{(bn)} &= c + n \left(\frac{F}{S} \right) \\ n^2 &= \frac{S}{bF} \\ n_0 &= \sqrt[2]{\frac{S}{bF}} \end{aligned}$$

With the equilibrium number of firms, n_0 , we can now substitute into our pricing rule and determine the price at which the good is going to be sold. We have the following:

$$\begin{aligned} P &= c + \frac{1}{(bn)} \\ &= c + \frac{1}{(bn_0)} \\ P_0 &= c + \frac{1}{\left(b \sqrt[2]{\frac{S}{bF}} \right)} \end{aligned}$$

(b) Graph the equilibrium situation. Now show graphically what happens if the market size halves (let's say because trade barriers between the home country and another country are erected) from S_0 to S_i ($S_i = 0.5 * S_0$).

Intuitively, when the market size halves production has to be cutdown and this will make the whole AC curve in this industry shift up and to the left. This is so because each firm has to reduce production. With a downward sloping individual average cost curve when production is reduced each firm moves to the left and up on their average cost curve. Let's look at this situation graphically.

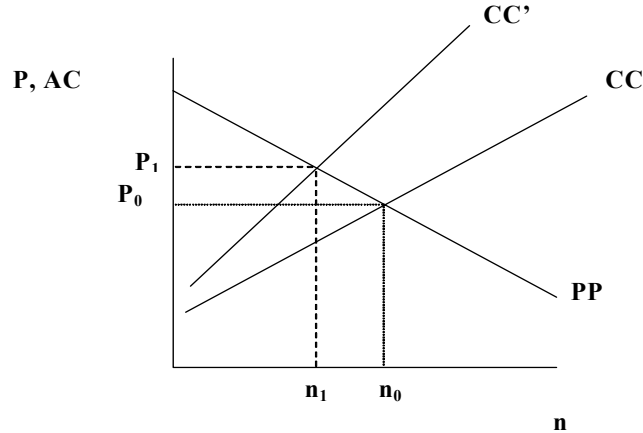


Figure 2. Optimal number of firms

The figure above shows the initial equilibrium situation depicted by the point (n_0, P_0) , this initial equilibrium is the outcome of setting the pricing rule equal to the pricing rule. Once the trade barriers are imposed the market size halves and the cost curve, denoted CC moves up and to the left. The equilibrium is attained at the point (n_1, P_1) , this is the intersection of the new cost curve CC' with the pricing rule, PP.

- (c) Solve for the new number of firms (call it n_1) in terms of n_0 ? Using the pricing rule solve for the new price level (in terms of n_0).

Once more we would take our pricing rule and the new average cost equation, substituting for S_i , and set them equal to each other. We have the following:

$$\begin{aligned}
 c + \frac{1}{(bn)} &= c + n \left(\frac{F}{0.5 * S_0} \right) \\
 n^2 &= \frac{0.5 * S_0}{bF} \\
 n &= \sqrt{\frac{0.5 * S_0}{bF}} \\
 &= \sqrt[2]{0.5} \cdot \sqrt{\frac{S}{bF}} \\
 n_1 &= \sqrt[2]{0.5} n_0
 \end{aligned}$$

To determine the new price we would substitute the new number of firms, n_1 , into our pricing rule. We have the following:

$$\begin{aligned}
 P &= c + \frac{1}{(bn)} \\
 &= c + \frac{1}{(bn_1)} \\
 P_1 &= c + \frac{1}{(\sqrt[2]{0.5bn_0})}
 \end{aligned}$$

Price has to increase and the number of firms has to decrease.

4 Question 4

Consider a monopolist in partial equilibrium who initially faces the demand curve D_1 shown below, and whose marginal cost is constant at c .

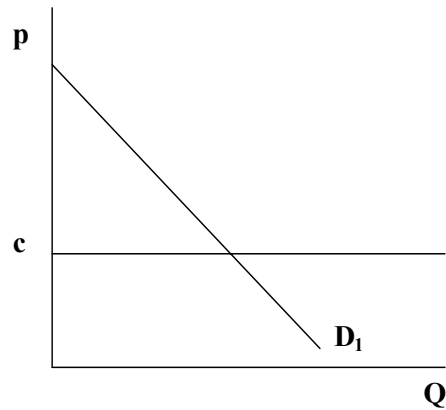


Figure 3. Monopolist

- (a) Construct the profit maximizing equilibrium for this monopolist.

The monopolist would equalize Marginal revenue to Marginal Cost. The intersection of these two curves would determine the optimal quantity to produce, call it Q_m . To determine the price, the monopolist would evaluate this new found optimal quantity, Q_m , on the demand curve and determine the corresponding price, call it P_m .

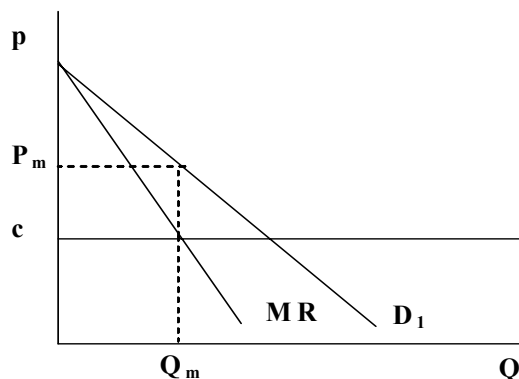


Figure 4. Optimal outcome for monopolist

- (b) Suppose now that the demand curve becomes everywhere more elastic, but continues to pass through the same price-quantity point that you found to be optimal in part (a). (That is, if the profit-maximizing monopolist was producing Q_1 and selling it for p_1 in part (a), quantity Q_1 still has price p_1 on the new, more elastic, demand curve.) Construct the new equilibrium for the monopolist and compare it to the old, in terms of quantity, price, and profit.

When a demand curve becomes more elastic it means the curve becomes flatter. A more elastic demand curve means that there are more imperfect substitutes for that particular good. In this case, we are forcing the new demand curve to go through the old quantity, price pair. However, this by no means implies the equilibrium will be at the old price quantity pair. Remember the optimization rule the monopolist uses, i.e. marginal revenue equals marginal cost. The new, more elastic, demand curve has a different marginal revenue curve associated with it. This new marginal revenue curve will also be flatter than the old marginal revenue curve. The new marginal revenue curve will cross the marginal cost at a point that is to the right of the original optimal quantity. Therefore, the new optimal quantity, call it Q_{me} , will be greater than the old quantity, Q_m , and the associated price with Q_{me} , call it P_{me} , will be lower than the original P_m . Finally, the profits will be higher for the firm with more elastic demand *given* that the demand curve passes through the initial equilibrium point and also assuming that the average cost curve is identical for the two cases. The logic behind this counter-intuitive point is that since the old equilibrium price and quantity are still part of the new demand curve, then the new firm has the option to choose output to achieve this price and quantity pair. However, this is not the profit-maximizing choice. Therefore, the profit achieved at the old equilibrium is less than that achieved at the new equilibrium. The Figure below shows the outcome.

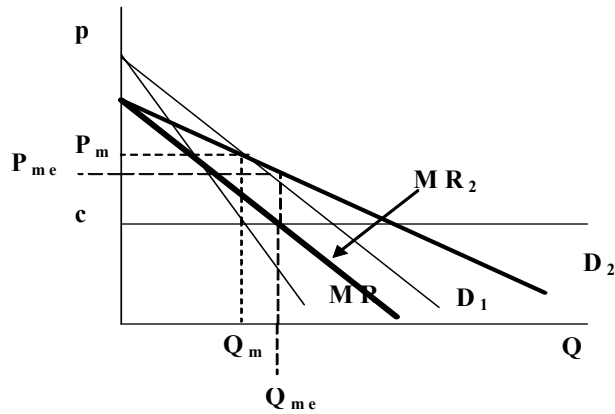


Figure 5. Effect of more elastic demand curve

- (c) Explain what your answer to part (b) could have to do with international trade.

When a country opens up to international trade it allows for foreign produced products to come into its domestic markets. This makes the demand curves faced by all domestic firms to become more elastic because there are more possible substitutes for each domestically produced good. Recall that the Price Elasticity of Demand provides information about the number of possible substitutes for any particular good. If the Price elasticity is high, i.e. very elastic then that particular good has many substitutes and quantity is very sensitive to small price changes. On the other hand, if the Price Elasticity of Demand is low, i.e. inelastic then quantity is not responsive to small price changes. Another effect of a country opening up to trade is that trade increases competition among firms. Domestic firms are now competing against foreign firms and this fact forces prices down and an increment in quantity, creating an increase in consumer surplus.

5 Question 5

Explain why the gains from trade with imperfect competition may be larger than they are with perfect competition. Does it therefore follow that, if a country is going to trade in any case, it would be better off if its industries are imperfectly competitive instead of perfectly competitive, so as to enjoy those larger gains? Explain and illustrate using production possibility frontiers and indifference curves.

One of the benefits of increased trade openness most often cited by economists is that it reduces the market power of domestic firms by exposing them to international competition. This effect is beneficial regardless of whether there was market power in the potential export or import sector. Thus, aside from the usual gains from trade, there are gains from reducing the market distortion

that is caused when firms exercise their market power and restrict supply in order to raise prices. This does not mean that if a country is going to trade anyway it would be better off if its industries are imperfectly competitive. The larger gains from trade in the context of imperfect competition occur because the country is coming up from a lower initial (pre-trade) utility, not because they are able to achieve a higher post-trade utility. The lower pre-trade utility caused by some firm or firms having market power is illustrated in Figure 6.

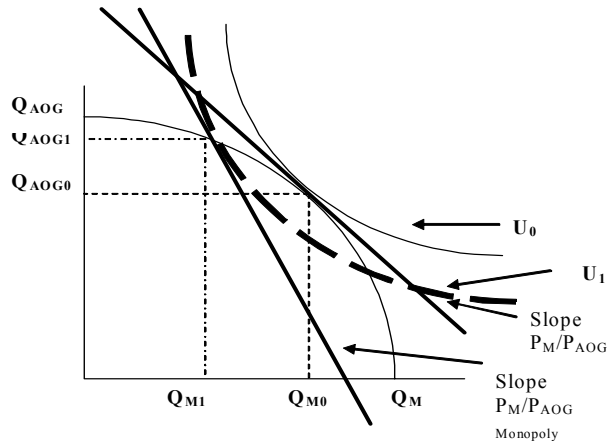


Figure 6. Perfect vs Imperfect Competition

In Figure 7, we add the budget constraint and utility achieved with trade under the assumption that trade has completely eliminated the market power of the monopolist. So a country with initially imperfectly competitive markets gains the difference between U_1 and U_2 , while a country with initially perfectly competitive markets would only gain the difference between U_0 and U_2 . All the same, both countries are equally well off from trade, so it is not preferable to begin with imperfect competition.

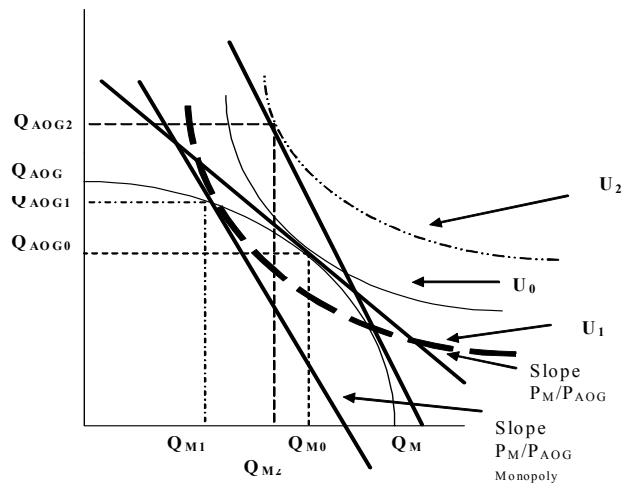


Figure 7. Opening to trade