

Chapter 11

IMPERFECT COMPETITION AND INCREASING RETURNS I: OLIGOPOLY

11.1 General discussion of increasing returns and non-comparative-advantage gains from trade.

In the previous chapter and also in Chapter 2 (e.g., Figures 2.6 and 2.7), we noted that increasing returns to scale, or scale economies for short, offer the opportunity for gains from trade even for identical economies. Trade and gains from trade can occur without any comparative advantage basis for trade. Trade economists believe that scale economies offer an important explanation for the observation of large volumes of trade between similar economies that we observe in trade data.. In this Chapter and in the next, we will analyze these idea in a more thorough fashion.

In this chapter, we will focus on a case where there are two industries, one producing a good under conditions of perfect competition and constant returns to scale, and a second good under conditions of increasing returns to scale. This IRS good is assumed to be homogeneous, meaning the goods produced by different firms are identical from the consumers' point of view. In the next chapter, we assume that each firm in the IRS sector produces a good that is differentiated from those of its rival firms. In order to avoid some possible confusion, we partly depart from our usual notation here and denote the competitive good as Y and the IRS homogeneous good as X . This will prove useful in the next section when we have different varieties of X .

We will assume that the X firms have technologies in which there is an initial fixed cost of entering production and then a constant marginal cost of added output. We assume a single factor of production L (call it labor) which must be divided between the Y and X sectors and among firms in the X sector. Marginal cost is denoted by mc and total cost (tc) and average cost (ac) for an X firm are as follows:

$$tc = mcX + fc \quad ac = \frac{tc}{X} = mc + \frac{fc}{X} \quad (11.1)$$

where mc and fc are *constants* (parameters), measured in units of labor. Figure 11.1 shows the cost curves of a single firm. It is important to note that average cost is always falling with increased output and it becomes close to marginal cost, but never quite equal to marginal cost. In mathematical terminology, average cost is a rectangular hyperbola, going to infinity as X goes to zero and approaching mc as X goes to infinity.

The consequences of this type of technology for competitive conditions, sometimes referred to as market structure are rather profound. Specifically, this type of increasing-returns technology cannot support perfect competition as a market outcome. This is typically explained by a proof by contradiction. Suppose that there are many small firms such that each firm regards market price as exogenous. If price equaled marginal cost as assumed in competitive theory, then each firm would be making losses since average cost is greater than marginal cost, so this cannot be an equilibrium. Suppose then that the competitive price exceeds marginal cost but again is viewed as a constant by each firm. Then each or any firm knows that once it produces enough output, price will exceed average cost and so profits become positive. But the firm should not stop there, it would maximize profits at the constant price by producing an infinite output and so should expand without bounds. But this cannot be an equilibrium and contradicts the assumption that firms are small. Thus the technology shown in (11.1) and Figure 11.1 is inconsistent with perfect competition.

The equilibrium outcome (assuming an equilibrium exists) must be one in which only a small number of firms are able to survive in equilibrium. Competitive will be imperfect, with each firm having

influence over market price. The consequences of the technology in Figure 11.1 are shown for a single monopoly X firm in Figure 11.2. Also assume a very simple technology for Y , such that one unit of L produces exactly one unit of Y : $Y = L_y$. Y and L must have the same price and we will use L and therefore Y as numeraire, giving them a price of one. \bar{L} is the economy's total endowment of L .

The production frontier for the economy, discussed briefly in Chapter 2, runs from \bar{Y} to Y^1 to X^1 in Figure 1 where \bar{Y} to Y^1 is the fixed cost fc measure in units of Y which is of course also units of L in this special case of $Y = L_y$. Suppose that the monopoly equilibrium is at point A in Figure 11.2, where the output of Y and X are Y^0 and X^0 . Then the average cost of producing X at point A is given by the total amount of labor needed for X divided by the output of X .

$$ac = \frac{\bar{L} - L^0}{X^0} = \frac{\bar{Y} - Y^0}{X^0} \quad (11.2)$$

But note that this is the slope of the dashed line in Figure 11.2, the line running from point A to the end of the production frontier \bar{Y} . The consequence of this is that, if the monopoly X firm is to at least break even, then the price line at equilibrium A must be at least as steep as the dashed line giving average cost. Such a price is shown at p^a in Figure 11.2, where p gives the price of X in terms of Y (and therefore in terms of L).

A crucial point is that the market equilibrium involves a market failure: the market outcome is not optimal. The optimum would be a tangency between an indifference curve and the production frontier, implying price equal to marginal cost, but we have shown that this is impossible because it involves the firm making losses. With increasing returns to scale that are "internal" to individual firms as we are assuming here, returns to scale are going to be inherently bound up with imperfect competition. Too little X is produced at too high a price.

That is a rather long preliminary that now allows us to get to the heart of the issue: the opportunity to trade is going to offer economies the possibility of pro-competitive gains from trade. Countries will gain from the benefits of increased competition that makes firms produce more at lower average costs (higher productivity) and lower prices. We will focus on putting together two identical economies. Within this setting we consider two cases, one in which the number of firms is fixed before and after trade opens up and one in which there is free entry or exit of firms in response to trading opportunities.

11.2 Pro-competitive gains: the basics

Any discussion of imperfect competition must start with some assumption about how firms react to one another, since each firm is going to be large relative to the market. In this chapter, we are going to assume what is called Cournot-Nash (or Cournot for short) competition in which firms pick a quantity as a best response to their rivals' quantities. Cournot equilibrium occurs when each firm is making a best response to its rivals' outputs. Algebraically, this will be modeled as each firm picking an output quantity holding rivals' outputs constant.

Revenue for a Cournot firm i and selling in country j is given by the price in j times quantity of the firm's sales. Price is a function of all firms' sales.

$$R_{ij} = p_j(X_j)X_{ij}. \quad \text{where } X_j \text{ is total sales in market } j \text{ by all firms} \quad X_j = \sum_i X_{ij} \quad (11.3)$$

Cournot conjectures imply that $\partial X_j / \partial X_{ij} = 1$; that is, a one-unit increase in the firm's own supply is a one-unit increase in market supply. Marginal revenue is then given by the derivative of revenue in (11.3) with respect to firm i's output (sales) in j.

$$\frac{\partial R_{ij}}{\partial X_{ij}} = p_j + X_{ij} \frac{\partial p_j}{\partial X_j} \frac{\partial X_j}{\partial X_{ij}} = p_j + X_{ij} \frac{\partial p_j}{\partial X_j} \quad \text{since } \frac{\partial X_j}{\partial X_{ij}} = 1 \quad (\text{Cournot}) \quad (11.4)$$

Now multiply and divide the right-hand equation by total market supply and also by the price.

$$\frac{\partial R_{ij}}{\partial X_{ij}} = p_j + X_{ij} \frac{\partial p_j}{\partial X_j} = p_j + p_j \frac{X_{ij}}{X_j} \left[\frac{X_j}{p_j} \frac{\partial p_j}{\partial X_j} \right] \quad (11.5)$$

The term in square brackets in (11.5) is just the inverse of the price elasticity of demand, defined as the proportional change in market demand in response to a given proportional change in price. This is negative, but to help make the markup formula clearer we will denote minus the elasticity of demand, now a positive number, by the Greek letter $\eta > 0$. We can then write (11.5) as

$$\frac{\partial R_{ij}}{\partial X_{ij}} = p_j \left[1 - \frac{X_{ij}}{X_j} \frac{1}{\eta_j} \right] \quad \eta_j \equiv - \left[\frac{p_j}{X_j} \frac{\partial X_j}{\partial p_j} \right] \quad (\text{elasticity of demand}) \quad (11.6)$$

The term X_{ij}/X_j in (11.6) is just firm i's market share in market j, which we can denote by s_{ij} . Then marginal revenue = marginal cost is given by:

$$mr_{ij} = p \left[1 - \frac{s_{ij}}{\eta_j} \right] = mc_i \quad (11.7)$$

Marginal revenue in Cournot competition turns out to have a fairly simple form as shown in (11.7). The term s_{ij}/η_j is referred to as the "markup". As you will note, it looks something like the tax formulas we had in the previous chapter and indeed it is possible to think of the monopolist as putting on sort of a tax that raises price above marginal cost. If you refer back to equation (11.4) the markup relates to how much the market price falls when the firm increases its sales. When the demand elasticity is high, there is only a small fall in price when the firm expands output, and so the markup is small.

The role of the firm's market share is more subtle, but crucial to understanding the whole idea of pro-competitive gains. Suppose that we put two absolutely identical countries together in trade, each having just a single X producer. The firms could just continue to do what they were doing in autarky, and prices etc. would be preserved. But each firm will now understand that, if it increases output by one unit, the increase is spread over twice as many consumers and thus the price will fall by only half as much as it would if the monopolist increased supply by one unit in autarky. We sometime say that the firm now *perceives* demand as more elastic or that the *perceived elasticity of demand* η_j/s_{ij} is higher. This is reflected in (11.7) by the fact that s_{ij} goes from one in autarky to one-half when trade opens. The markup up falls, perceived marginal revenue increases, and each firm has an incentive to increase output.

Figures 11.3 and 11.4 work through the consequences of this. The production frontier shown in Figure 11.3 is the production frontier for each of the two identical countries. Point A is the autarky monopoly equilibrium in each country. When the countries are put together in trade, each firm perceives demand as more elastic according to (11.7) and expands output. Equilibrium is restored when the price of X is forced down so that (11.7) is again an equality for both firms with market shares both equal to one half. The new equilibrium must be at a point like T in Figure 11.3.

Note especially that this must constitute a welfare gain for both countries. Output was too low and the price was too high initially in autarky, essentially a distortion like those of the previous chapter. However, this is quite different in that it is an *endogenous* distortion and the opening of trade can be thought of as reducing that distortion. There is a welfare gain from trade (U^a to U^*) for the identical economies through a lower X price (p^a to p^*), and higher X output (A to T), and more efficient production: the average cost of a unit of X is lower, firms move down their average cost curves in Figure 11.1.

Figure 11.4 shows a somewhat different and equally important case. Suppose that there might be more than one firm in each country initially, and that firms can enter or exit until profit are zero.¹ Then, referring back to equation (11.2) and Figure 11.2, the equilibrium price must be equal to average cost, given by the line connecting the production point in Figure 11.4 with the endpoint of the production frontier \bar{Y} . Let point A in Figure 11.4 be the initial autarky equilibrium for each country and let p^a denote the autarky price: the price equals average cost reflecting the entry or exit of firms until profits are zero. The distance $\bar{Y}Y^0$ in Figure 11.4 is now the combined or sum of the fixed costs of all firm active in the market in equilibrium.

Now put the two identical economies together in free trade as before. Each firm individually has an incentive to expand output: equation (11.7) continues to apply to pricing decisions. However, when they all do this, profits will be driven negative. This will cause the exit of some firms in each country until zero profits are re-established. This is represented by the outward shift of the linear segment of the production frontier in Figure 11.4 from $\bar{Y}Y^0$ to $\bar{Y}Y^1$: resources which were being used (uselessly) in fixed costs are now freed up for actual production. The new equilibrium will be at a point such as T in Figure 11.4. Note that it is possible now for the consumption of both Y and X to increase due to the efficiency gains of a larger world output being produced by fewer firms than the total number in the two countries in autarky. Welfare in each country rises from U^a to U^* .

A typical intelligent question at this point is how firm exit is consistent with more competition? The answer is that there is some exit in each country individually, but more left in free trade in total between the two countries than were in each individual country in autarky. For example, suppose that each country has four firms in autarky. Suppose that trade forces the exit of one firm in each country, leaving three in each country. But that means that there are now six firms in total competing for the business of each consumer instead of four in autarky. Exit in each country individually is quite compatible with increased competition.

The nice outcomes (for free trade advocates at least) shown in Figures 11.3 and 11.4 have not been rigorously established, and then are a number of problems. First, the elasticity of demand which we denoted by η is generally not a constant: it will change as prices and total sales change. While the basic message is clear and some readers and professors will wish to move on, we now proceed to offer two special cases that have been widely used in the literature to more rigorously solve for the effects of trade.

11.3 Special case I: quasi-linear preferences

The first special (or rather specific) case has been widely used in industrial organization as well as in international trade. In the latter, it has been widely used to analyze what is known as “strategic trade policy”, a topic treated later in the book. It will also be used later in analyzing multinational firms.

We can keep the notation simple at first by assuming just a single monopoly firm in each country, so $n = 1$, and by normalizing the population L to the number one, so X give both total output of X , the output per firm, and the consumption per capita. Assume that the preferences of a representative consumer in each country are given by:

$$U = \alpha X - (\beta/2)X^2 + Y \quad (11.8)$$

The crucial property of these preferences are constant marginal utility for good Y and the importance of this will become clear in a minute. This linearity in Y has led some authors to call these preferences “quasi-linear”. As above, one unit of factor L is need to produce one unit of good Y , and p denotes the price of X in terms of Y or L . Let Π denote profits of the firm and L (equal to one initially) the number of workers/consumers. Profits are viewed as exogenous by individual consumers. Then the budget constraint for the representative consumer is given by income (also measured in terms of L) equals expenditure.

$$L + \Pi = pX + Y \quad (11.9)$$

Substituting from the budget constraint for good Y in (11.8), we have the consumer’s choice problem, where profits (Π_i) are viewed as exogenous by an individual consumer.

$$\text{Max}(X) U_i = \alpha X - (\beta/2)X^2 + L + \Pi - pX \quad (11.10)$$

The (inverse) demand function is given by the first-order condition, the derivative of (11.10) with respect to X , and is linear in X .

$$\frac{dU}{dX} = \alpha - \beta X - p = 0 \quad \Rightarrow \quad p = \alpha - \beta X \quad (11.11)$$

The feature of quasi-linear preferences that makes them so attractive is that demand does not depend on income and hence it does not depend on profits. This makes the model much easier to solve. On the other hand, the unattractive feature of these preferences is that the demand for X does not depend on income, there is a zero income-elasticity of demand for X , surely a totally unrealistic assumption. All added income at a fixed price for X will be spent on Y .

Consider autarky first. Let Π denote the profits of the domestic firm. These profits are revenues minus marginal costs (mc will be denote by just c) and minus fixed costs, denoted simply as f . Substituting in the demand function in (11.11) for p , we get

$$\Pi = pX - cX - f = [\alpha - \beta X]X - cX - f \quad (11.12)$$

The first-order condition for profit maximization gives:

$$\frac{d\Pi}{dX} = \alpha - 2\beta X - c = 0 \quad \Rightarrow \quad X = \frac{\alpha - c}{2\beta} \quad (11.13)$$

Now assume that two identical economies trade freely. Let the two countries and their firms be denoted with subscripts i and j . There are now twice as many consumers in the integrated world economy and the demand price depends on *per capita* consumption not on *total* world consumption. That is, world

price will be unchanged if there is twice as much output in the integrated world as there was in each country individually in autarky. We now have $L = 2$ and so the world price of X will

$$p = \alpha - \beta(X_i + X_j)/L = \alpha - \beta(X_i + X_j)/2 \quad (11.14)$$

Profits for firm i are now given by

$$\Pi_i = [\alpha - \beta(X_i + X_j)/2]X_i - cX_i - f \quad (11.15)$$

Assume Cournot competition, so each firm makes a best response to the other firm's output, maximizing profits holding the other firm's output fixed. The first-order condition for profit maximization is given by

$$\frac{d\Pi_i}{dX_i} = \alpha - \beta X_i - \beta X_j/2 - c = 0 \quad (11.16)$$

There is a corresponding equation for firm j , giving two equations in two unknowns. But since we have assumed that the countries are absolutely identical, we know that the solution will be symmetric with both firms producing the same amount in equilibrium. Exploiting this symmetry, we can solve (11.16) for the Cournot output of the firm i (equal to the country j firm's output) by setting $X_i = X_j$.

$$X_i^* = X_j^* = 2 \frac{(\alpha - c)}{3\beta} > \frac{\alpha - c}{2\beta} = X^a \quad (11.17)$$

where the right-hand inequality is the autarky output of each firm given in (11.13). Output of each firm expands by one-third $((2/3)/(1/2) = 1/3)$ when trade opens. This is the effect shown in Figure 11.3 and it must imply mutual gains from trade for the two countries.

Now let's turn to the case of free entry and exit. Again, let's just think about one market and think of trade between two countries as doubling the size of the market. This allows us to simplify the notation.

Assume that there are L individuals (which can again be normalized to one in autarky as we did above). We will also now need to keep track of the difference between output per firm and aggregate X output. Summing over the number of firms n , per capita consumption is

$$\sum_i^n X_i/L \quad (11.18)$$

The number of firms, n , is now *endogenous*.

Demand and profits for the i th firm are then given by

$$p = \alpha - \beta \left[\sum_j X_j/L \right] \quad (11.19)$$

$$\Pi_i = p_i X_i - cX_i - f = \left[\alpha - \beta \left[\sum_j X_j/L \right] \right] X_i - cX_i - f \quad (11.20)$$

The firm's first-order condition is the derivative of (11.20) with respect to X_i , holding all of the other firm's outputs constant. Marginal revenue minus marginal cost for firm i is given by:

$$MR - MC = \alpha - 2(\beta/L)X_i - (\beta/L)\sum_{j \neq i} X_j - c = 0 \quad (11.21)$$

Now we again know that there will be symmetry in equilibrium: the output of any active firm will be the same as that of every other firm. X will denote the output of an *individual* (not aggregate) "representative firm", and n the number of firms. All firms that are active in equilibrium will produce the same amount.

$$MR - MC = \alpha - (\beta/L)(n + 1)X - c = 0 \quad (11.22)$$

The second equation we need for equilibrium is the free-entry condition that will be associated with the number of firms. Then the zero profit condition is that the profits of the representative firm are exactly zero.

$$\alpha X - (\beta/L)nX^2 - cX - f = 0 \quad (11.23)$$

Multiple (11.22) through by X .

$$\alpha X - (\beta/L)(n + 1)X^2 - cX = 0 \quad (11.24)$$

We then have two equations (11.23 and 11.24) in two unknowns, n and X . Solving these two equations in two unknowns we get

$$X = \left[\frac{Lf}{\beta} \right]^{1/2} \quad (11.25)$$

So output per firm increases with the size of the economy (L). But with price equal to average cost, this must also mean that the equilibrium price of X falls. Finally, putting (11.25) into (11.22), we can solve for n

$$n = (\alpha - c) \left[\frac{L}{\beta f} \right]^{1/2} - 1 \quad (11.26)$$

The number of firms increases with the square root of the size of the world economy. A restriction that the economies are sufficiently big such that $n > 1$ in autarky is sufficient to imply that when L doubles the number of firms less than doubles. But this in turn means that each country individually must have exit relative to the number of firms in autarky. It is much the same as our numerical example in section 11.2 above: each country has some exit yet the integrated world economy has more firms in total than the individual countries did in autarky. The situation is exactly like that shown in Figure 11.4.

In summary then, the combination of increasing returns to scale with imperfect competition means that there are gains from trade even for identical economies under the assumptions used here, regardless of whether or not there is a fixed number of firms (same in each country) or there is free entry and exit in response to the opening of trade. Note finally from Figures 11.3 and 11.4 that these gains from trade for identical economies are not associated with any net trade between the economies. Both

countries are at point T in free trade. Yet (given our assumption of costless trade) there could be a lot of two-way gross trade flows, with some consumers arbitrarily buying X from the producer in the other country. This is referred to as an intra-industry trade and there is a lot of such trade among the high-income developed countries.

4. Special case II: Cobb-Douglas preferences (can be skipped without loss of continuity)

One of the big limitations of the quasi-linear case is that it imposes the assumption that there is a zero income elasticity of demand for X . But surely a lot of the manufacturing and service industries that are characterized by increasing returns to scale and imperfect competition are producing goods with high income elasticities of demand. Let X again denote the output of an *individual* X firm and assume that there is a fixed number n of such firms. Y denotes the total output of Y as before. Suppose that preferences are Cobb-Douglas and given by

$$U = (nX)^\alpha Y^{1-\alpha} \quad \text{with income } (I) \text{ constraint} \quad I = \bar{L} + \Pi = pnX + Y \quad (11.27)$$

We treated this exact case earlier in Chapter 2. Continue to let the price of Y be numeraire, equal to one. We showed in Chapter 2 that the demand functions are

$$nX = \frac{\alpha I}{p} \quad Y = (1 - \alpha)I \quad (11.28)$$

In this case, if we compute the elasticity of demand for X , we will find that $\eta = 1$. This is going to greatly simplify our analysis, though note that we will need to be sure that there is more than one firm producing in each country in equilibrium; that is, the market share of a firm must be less than one in autarky in order for marginal revenue given by (11.7) to be positive. Subject to this restriction, the markup is just the firm's market share, which in turn is just $1/n$. Marginal revenue equals marginal cost is given quite simply by

$$p(1 - 1/n) = c \quad p = \frac{n}{n-1}c \quad (11.29)$$

So far, so good. But things get messy because income now matters for the demand for X and profits are part of income. This is exactly the mess that quasi-linear preferences avoids! Since X refers to the output of a single firm and, assuming all firms producing in equilibrium are identical, then nX gives total X output. Substituting the budget constraint from (11.27) into the demand function (11.28) and writing out the expression for profits, the aggregate demand for X is given by:

$$nX = \alpha(\bar{L} + \Pi)/p = \alpha(\bar{L} + n(pX - cX - f))/p \quad (11.30)$$

Rearranging the equation and making use of the second equation in (11.29) to eliminate the endogenous variable p gives us

$$(1 - \alpha)npX + \alpha n(c)X = (1 - \alpha)\frac{n^2}{n-1}(c)X + \alpha n(c)X = \alpha(\bar{L} - nf) \quad (11.31)$$

Dividing through by $n(c)$ and multiplying one term by $(n-1)/(n-1)$, we have

$$\left[(1 - \alpha) \frac{n}{n-1} + \alpha \frac{n-1}{n-1} \right] X = \frac{\alpha(\bar{L} - nf)}{n(c)} \quad (11.32)$$

and then an explicit solution for X in the case when n is fixed.

$$X = \left[\frac{\alpha(\bar{L} - nf)}{n(c)} \right] \left(\frac{n-1}{n-\alpha} \right) \quad (11.33)$$

Suppose now that we put two identical economies together, each with a fixed number of firms n . \bar{L} doubles in (11.33) and so does n relative to autarky. Then the first bracketed term on the right-hand side of (11.33) does not change: both the numerator and denominator double. But the second bracketed term increases given $\alpha < 1$. For example, let $n = 2$ in autarky and let $\alpha = 0.5$. Then the introduction of trade ($n = 2$ to $n = 4$) increases the second term from $2/3$ to $6/7$, an increase in output per firm of 29 percent. Once again, this is exactly the situation shown in Figure 11.3. Note from (11.29) that the price of X also falls as shown in the Figure.

Now let us consider the free entry and exit version of the Cobb-Douglas case. The marginal revenue, marginal cost equation is unchanged.

$$p(1 - 1/n) = c \quad (11.34)$$

The free entry or zero-profit equation is given by

$$pX = cX + f \quad (11.35)$$

and, with no profit income, the demand for X is given by

$$nX = \alpha \bar{L} / p \quad (11.36)$$

Multiple (11.34) through by X and then divide (11.35) by (11.34)

$$\frac{n}{n-1} = 1 + \frac{f}{cX} \quad \Rightarrow \quad \frac{n}{n-1} - \frac{n-1}{n-1} = \frac{f}{cX} \quad (11.37)$$

which gives us output per firm.

$$X = (n-1) \frac{f}{c} \quad (11.38)$$

Multiple both sides of (11.34) by X , and substitute for pX from (11.36)..

$$p(1 - \frac{1}{n})X = p \left(\frac{n-1}{n} \right) X = \left(\frac{n-1}{n} \right) \frac{\alpha \bar{L}}{n} = cX \quad (11.39)$$

Now substitute the expression for X in (11.38) to give us a solution for n , the endogenous number of firms.

$$\left(\frac{n-1}{n} \right) \frac{\alpha \bar{L}}{n} = c(n-1) \frac{f}{c} \quad n^2 = \frac{\alpha \bar{L}}{f} \quad (11.40)$$

Take the square root of the right-hand equation to get n and then substitute this into (11.39) to get X .

$$n = \sqrt{\frac{\alpha \bar{L}}{f}} \quad X = \left[\sqrt{\frac{\alpha \bar{L}}{f}} - 1 \right] \frac{f}{c} \quad (11.41)$$

With free entry and exit, both the number of firms and the output per firm increase with the square root of the size of the market. Once again, thinking of trade as a doubling of market size, this means that there is some exit in each country individually with the opening of trade. The effects of trade for two identical economies are exactly those shown in Figure 11.4.

5. Summary: what you should know

To this point in the book, we have concentrated on determinants of trade that involve differences between countries. Gains from trade involve exploiting these differences, such as producing and exporting according to comparative advantage. Now we come to a situation in which there can exist gains from trade even between identical economies and indeed we concentrate here on precisely this case. We did touch on the role of increasing returns to scale in the previous chapter, but now we turn to a fuller analysis and assume that scale economies occur at the level of the individual firm, sometimes termed “internal” economies of scale to distinguish them from the external economies of the previous chapter.

The situation quickly becomes complicated because internal or firm-level economies of scale are not compatible with perfect competition and hence the simple tools needed to analyze competitive models need to be extended. Increasing returns to scale and imperfect competition are inherently related to one another. This requires introducing new methods and new tools to take into consideration firms with market power and the strategic interaction between such firms. In doing so, we simplified our theoretical economies in other ways, in particular on the factor market side, assuming only a single factor as in the Ricardian model of trade.

In this chapter, we focused on an industry in which firms produce a homogeneous good or alternatively the goods of the different firms are perfect substitutes. Firms compete according to the Cournot-Nash model, choosing quantities that are best responses to the outputs of other firms. Autarky equilibrium for a country is distorted, and we showed that this distortion looks a lot like a production tax as modeled in the previous chapter. Price exceeds marginal cost in market equilibrium, and too little is produced at too high a price to maximize social welfare.

We then open up two identical economies to trade and show that this generates a pro-competitive effect. In technical terms, firms perceive demand as more elastic and hence expand outputs in response to the opening of trade. But when all firms do this, industry output expands, the price and markup falls, average cost falls (or productivity improves) and social welfare increases.

We considered two versions of the model, one in which the number of firms is fixed before and after the opening of trade and one in which there is free entry and exit of firms in response to trade. The effects just mentioned in the previous paragraph are present in both cases, but the free entry/exit case is particularly interesting in that it may be possible for the identical economies to end up consuming more of

both goods, the competitive good as well as the increasing-returns good. The important lesson is that trade does not offer welfare gains just based on difference between countries, it also offers gains to very similar countries in terms of more efficient production, lower prices, and high consumption quantities.

REFERENCES

- Brander, James A. (1981), "Intra-industry trade in identical commodities", *Journal of International Economics* 11, 1-14.
- Helpman, Elhanan. and Paul A. Krugman (1985). *Market Structure and Foreign Trade*, Cambridge: MIT press.
- Horstmann, Ignatius J. and James R. Markusen (1986), "Up the average cost curve: inefficient entry and the new protectionism", *Journal of International Economics* 20, 225-228.
- Markusen, James R. (1981), "Trade and the gains from trade with imperfect competition", *Journal of International Economics* 11, 531-551.
- Melitz, Mark J. and Gianmarco I.P. Ottaviano (2008), "Market size, trade, and productivity", *Review of Economic Studies* 75, 295-298.
- Venables, Anthony J. (1985), "Trade and trade-policy with imperfect competition - the case of identical products and free entry", *Journal of International Economics* 19, 1-19.

Endnotes

1. The assumption that firms enter or exit until profits are exactly zero means that we are allowing the number of firms to be a continuous variable and not restricted to integer values. This can be puzzling at first, but it is a common trick in economic theory. It allows the problem to be formulated as equations rather than as a difficult (or impossible) to solve integer programming problem.

Figure 11.1

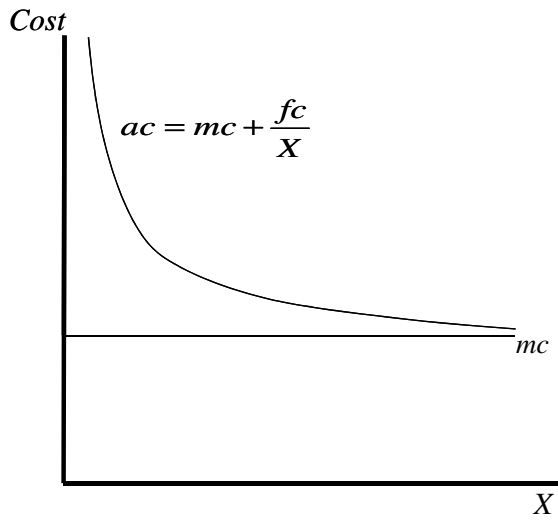


Figure 11.2

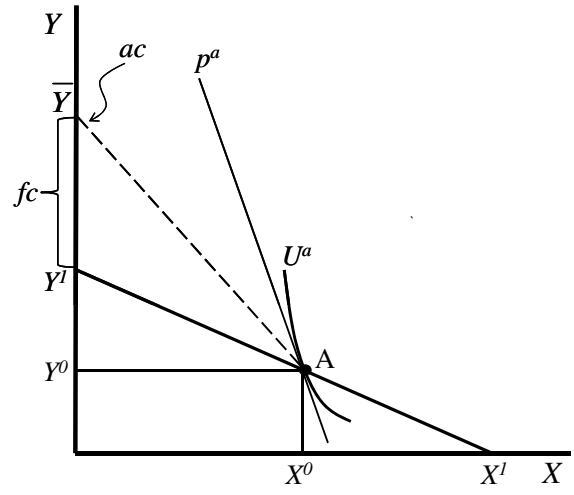


Figure 11.3

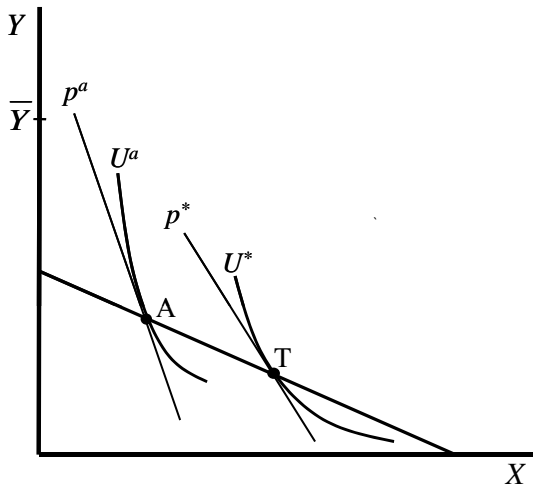


Figure 11.4

