Chapter 20

INDUSTRIAL ORGANIZATION AND INTERNATIONAL TRADE

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Contents

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1. Introduction

In retrospect, it seems obvious that the theory of international trade should draw heavily on models of industrial organization. Most of world trade is in the products of industries that we have no hesitation in classifying as oligopolies when we see them in their domestic aspect. Yet until quite recently only a handful of papers had attempted to apply models of imperfect competition to international trade issues. Indeed, in 1974 Richard Caves still felt that a lecture on the relationship between trade and industrial organization needed to begin with an apology for the novelty of the idea.

Only in the last decade have we seen the emergence of a sizeable literature that links trade theory and industrial organization. This new literature has two main strands. One is fundamentally concerned with modelling the role of economies of scale as a cause of trade. To introduce economies of scale into the model requires that the impact of increasing returns on market structure be somehow taken into account, but in this literature the main concern is usually to get the issue of market structure out of the way as simply as possible – which turns out to be most easily done by assuming that markets are characterized by Chamberlinian monopolistic competition. The first section of this chapter summarizes the main insights from this approach.

Since this chapter is aimed primarily at an audience of industrial organization (IO) researchers rather than trade theorists, however, most of it will be devoted to the second strand in recent literature, which views imperfect competition as the core of the story rather than an unavoidable nuisance issue raised by the attempt to discuss increasing returns. Here there are four main themes, each represented by a section of the chapter. First is the relation between trade policy and the market power of domestic firms. Second is the role of price discrimination and "dumping" in international markets. Third is the possibility that government action can serve a "strategic" role in giving domestic firms an advantage in oligopolistic competition. Fourth, there is the question of whether industrial organization gives us new arguments in favor of protectionism. A final section of the chapter will review some recent attempts at quantifying these theoretical models.

Generality in models of imperfect competition is never easy to come by, and usually turns out to be illusory in any case. In this survey I will not even make the attempt. Whatever is necessary for easy exposition will be assumed: specific functional forms, constant marginal cost, specific parameters where that helps. And at least one part of the tradition of international trade theory will be retained: much of the exposition will be diagrammatic rather than algebraic.

2. The monopolistic competition trade model

2.1. Origins of the model

The monopolistic competition model of trade began with an empirical observation: neither the pattern of trade nor its results seem to accord very well with what traditional trade models would lead us to expect. The most influential of trade models is the Heckscher–Ohlin–Samuelson model, which tells us that trade reflects an interaction between the characteristics of countries and the characteristics of the production technology of different goods. Specifically, countries will export goods whose production is intensive in the factors with which they are abundantly endowed – e.g. countries with a high capital–labor ratio will export capital-intensive goods. This model leads us to expect three things. First, trade should typically be between complementary countries – capital-abundant countries should trade with labor-abundant. Second, the composition of trade should reflect the sources of comparative advantage. Third, since trade is in effect an indirect way for countries to trade factors of production, it should have strong effects on income distribution – when a country trades capital-intensive exports for labor-intensive imports, its workers should end up worse off.

What empirical workers noticed in the 1960s was that trends in world trade did not seem to accord with these expectations. The largest and rapidly growing part of world trade was trade among the industrial countries, which seemed fairly similar in their factor endowments and were clearly becoming more similar over time. The trade between industrial countries was largely composed of two-way exchanges of fairly similar goods – so-called "intra-industry" trade. Finally, in several important episodes of rapid growth in trade – notably formation of the European Economic Community and the Canadian–U.S. auto pact – the distributional effects turned out to be much less noticeable than had been feared.

From the mid-1960s on, a number of researchers proposed a simple explanation of these observations. Trade among the industrial countries, they argued, was due not to comparative advantage but to economies of scale. Because of the scale economies, there was an essentially arbitrary specialization by similar countries in the production of different goods, often of goods produced with the same factor intensities. This explained both why similar countries traded with each other and why they exchanged similar products. At the same time, trade based on increasing returns rather than indirect exchange of factors need not have large income distribution effects. Thus, introducing economies of scale as a determinant of trade seemed to resolve the puzzles uncovered by empirical work.

The problem, of course, was that at the time there was no good way to introduce economies of scale into a general equilibrium trade model. Without being embedded in a formal model, the theory of intra-industry trade could not

become part of mainstream international economies. The crucial theoretical development thus came in the late 1970s, when new models of monopolistic competition were seen to allow a remarkably simple and elegant theory of trade in the presence of increasing returns. This marriage of industrial organization and trade was first proposed independently in papers by Dixit and Norman (1980), Krugman (1979), and Lancaster (1980). It was further extended by Helpman (1981), Krugman (1980, 1981), Ethier (1982), and others. Now that a number of years have gone into distilling the essentials of this approach, it is possible to describe in very compact form a basic monopolistic competition model of trade.

2.2. The basic model

Consider a world economy in which all countries share a common technology. There are two factors of production, capital and labor. These factors are employed in two sectors, Manufactures and Food.

Food we will take to be a homogeneous product, with a constant returns technology and thus a perfectly competitive market structure. Manufactures, however, we assume to consist of many differentiated products, subject to product-specific economies of scale. There is assumed to be a suitable choice of units such that all of the potential products can be made to look symmetric, with identical cost and demand functions. Furthermore, the set of potential products is assumed to be sufficiently large, and the individual products sufficiently small, that there exists a free-entry noncooperative equilibrium with zero profits.

Much effort has gone into the precise formulation of product differentiation. Some authors, including Dixit and Norman (1980), Krugman (1979, 1980, 1981), and Ethier (1982) follow the Spence (1976) and Dixit–Stiglitz (1977) assumption that all products are demanded by each individual, and thus build product differentiation into the utility function. Others, including Lancaster (1980) and Helpman (1981), follow the Hotelling–Lancaster approach in which the demand for variety arises from diversity of tastes. The Hotelling–Lancaster formulation has the advantage of greater realism, and leads to somewhat more plausible formulation of the nature of the gains from trade. However, it is quite difficult to work with. The Spence–Dixit–Stiglitz approach, by contrast, while less convincing, lends itself quite easily to modelling. (A "rock-bottom" model of trade along these lines is given in the Appendix.) Fortunately, it turns out that for the purposes of describing trade it does not matter at all which approach we take. All we need is the result that equilibrium in the Manufactures sector involves the production of a large number of differentiated products, and that all profits are competed away.

Now under certain circumstances, which will become clear shortly, international trade allows the world economy to become perfectly integrated, that is, to

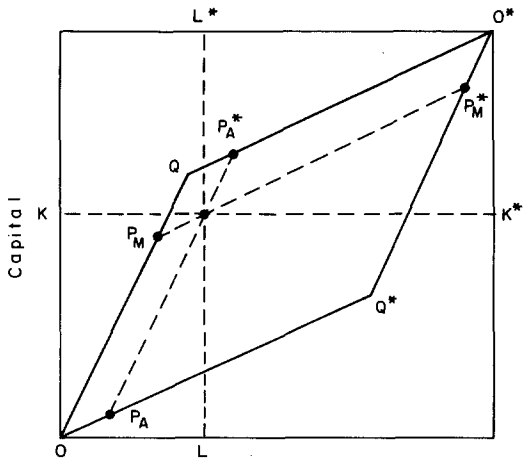

Figure 20.1

achieve the same outcome that would occur if all factors of production could work with each other freely. Associated with this integrated equilibrium outcome would be a set of resource allocations to the two sectors, goods prices, factor prices, and so on. Figure 20.1 represents some key features of such an equilibrium. The combined factor endowments of two trading countries are shown as the sides of a box. With full employment this endowment will be exhausted by the resources used in the two sectors. We let OQ be the resources used in Manufactures, and QO^* be the resources used in Food. Thus, Manufactures is assumed to be capital-intensive.

Will trade actually lead to this integrated economy outcome? As Dixit and Norman (1980) have shown, the answer depends on whether it is possible to allocate the integrated economy's production among the trading countries in such a way as to fully employ all factors of production while each country produces non-negative amounts of every good. This has a simple geometric interpretation. Suppose that there are two countries, Home and Foreign. Let us measure Home's resources from the point O, and Foreign's from O^*. Then the division of the world's resources among countries can be represented by a point in the box. If the endowment point is E, for example, this means that Home has a capital stock OK and a labor force OL, while Foreign has a capital stock O^*K^* and a labor force O^*L^*. Since E is above the diagonal, Home is capital-abundant, Foreign labor-abundant.

What can we now say about the world's production? The answer is that as long as the resources are not divided too unequally – specifically, as long as E lies inside the parallelogram OQO^*Q^* – it is possible to reproduce the production of

the integrated economy without moving resources from one country to the other. We can determine the allocation of production between the countries by completing parallelograms. Thus, Home will devote resources OP_M to Manufactures, OP_A to Food; Foreign will devote $O^*P_M^*$ and $O^*P_A^*$ to Manufactures and Food, respectively.

Now it is immediately apparent that a redistribution of resources from one country to another will have a strongly biased effect on the distribution of world production. Suppose, for example, that Home were to have more capital and Foreign less. Then it is clear that Home would produce more Manufactures and *less* Food – a familiar result for trade theorists. It follows, given identical demand patterns, that capital-abundant Home will be a net exporter of Manufactures and a net importer of Food. Thus, at the level of *interindustry* trade flows conventional comparative advantage continues to apply.

Where economies of scale and monopolistic competition enter the story is in *intra*industry specialization. When production of Manufactures is split between Home and Foreign, economies of scale will imply that output of each individual differentiated product is concentrated in one country or the other. Which country produces which products is indeterminate (in a fundamental sense – see the Appendix), but the important point is that within the Manufactures sector each country will be producing a different set of goods. Since each country is assumed to have diverse demand, the result will be that even a country that is a *net* exporter of Manufactures will still demand some imports of the manufactures produced abroad.

The resulting pattern of trade is illustrated in Figure 20.2. There will be two-way "intraindustry" trade within the manufacturing sector, as well as conventional interindustry trade. The former will in effect reflect scale economies and product differentiation, while the latter reflects comparative advantage. We can notice two points about this pattern of trade. First, even if the countries had identical resource mixes (i.e. if point E in Figure 20.1 were on the diagonal) there will still be trade in Manufactures, because of intraindustry specialization.

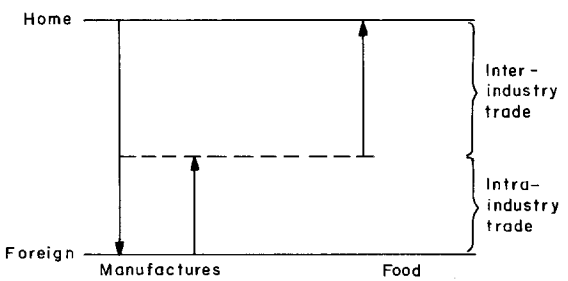

Figure 20.2

Second, the more similar the countries are in their factor endowments, the more they will engage in intra- as opposed to interindustry trade.

2.3. *Extensions of the model*

A number of authors have applied the monopolistic competition approach to models that attempt to capture more complex insights than the one we have just described. Many of these extensions are treated in Helpman and Krugman (1985); here I describe a few of the extensions briefly.

Intermediate goods: Ethier (1982) has emphasized that much intraindustry trade is in reality in intermediate goods. Models that reflect this are Ethier (1982), Helpman (1984) and Helpman and Krugman (1985, ch. 11). As it turns out, this extension makes little difference.

Nontraded goods: Helpman and Razin (1984) and Helpman and Krugman (1985, ch. 10) introduce nontraded goods into the model. Again, this does not make much difference. The major new implication is that differences in the size of national markets can give rise to new incentives for factor mobility.

Market size effects: Krugman (1980), Helpman and Krugman (1985), and Venables (1985b) develop models in which transport costs make the size of the domestic market an important determinant of trade. Specifically, countries tend other things equal to export the products of industries for which they have large domestic markets.

Multinational firms: Helpman (1985) and Helpman and Krugman (1985) develop models in which it is assumed that economies of scope and/or vertical integration lead to the emergence of multi-activity firms. Within the monopolistic competition framework it is then possible to let comparative advantage determine the location of activities, allowing models that describe both trade and the extent of multinational enterprise.

Alternative market structures: Helpman and Krugman contains some efforts to extend the insights of the monopolistic competition model beyond the highly special Chamberlinian large-group market structure. The insights survive essentially intact when the structure is instead assumed to be one of "contestable markets" in the manner of Baumol, Panzar and Willig (1982). [Helpman and Krugman (1985, ch. 4).] A much more qualified set of results occurs when the structure is instead assumed to be one of small-group oligopoly. [Helpman and Krugman (1985, chs. 5 and 7).]

2.4. *Evaluation*

The monopolistic competition model has had a major impact on research into international trade. By showing that increasing returns and imperfect competi-

tion can make a fundamental difference to the way we think about trade, this approach was crucial in making work that applies industrial organization concepts to trade respectable. In effect, the monopolistic competition model was the thin end of the IO/trade wedge.

From the point of view of IO theorists, however, the monopolistic competition trade model may be the least interesting part of the new trade theory. In essence, theorists in this area have viewed imperfect competition as a nuisance variable in a story that is fundamentally about increasing returns. Thus, the theory has little to teach us about industrial organization itself. By contrast, the other strand of the new trade theory is interested in increasing returns primarily as a cause of imperfect competition, and it is this imperfect competition that is the main story. Thus, it is this second strand which will occupy the rest of this survey.

3. Protection and domestic market power

Many economists have noted that international trade reduces the market power of domestic firms, and argued that conversely protection increases domestic market power. The interest of trade theorists has been centered on two extensions of this argument. First is the proposition that the effects of protection depend on the form it takes – specifically, that quantitative restrictions such as import quotas create more domestic market power than tariffs. This proposition was first demonstrated by Bhagwati (1965) in a model in which a domestic monopolist faces competitive foreign suppliers; only with recent work by Krishna (1984) has the analysis been extended to the case where both domestic and foreign firms are large agents. More recently still, Rotemberg and Saloner (1986) have argued that when collusive behavior is backed by the threat of a breakdown of that collusion, import quotas may actually perversely increase competition.

The second proposition is that protection, by initially generating monopoly rents, generates excessive entry and thus leads to inefficiently small scale production. This proposition, originally proposed by Eastman and Stykolt (1960), is backed by substantial evidence, and has been modelled by Dixit and Norman (1980).

3.1. Bhagwati's model

Consider an industry in which one firm has a monopoly on domestic production, but is subject to competition from price-taking foreign suppliers. Why the domestic market structure should differ from that in the rest of the world is left unexplained; presumably there are unspecified economies of scale that are large relative to the domestic market but not relative to the world market. Although

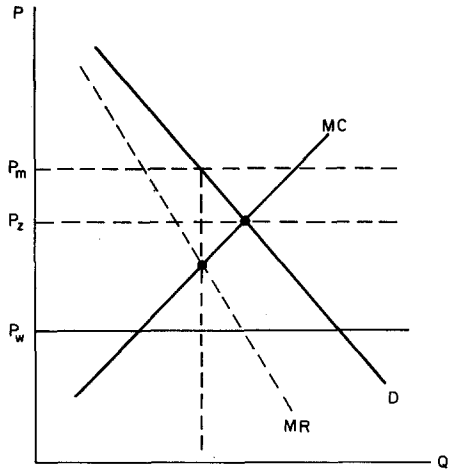

Figure 20.3

economies of scale may explain the existence of the monopoly, however, the marginal cost curve is assumed to slope upward. Foreign supply is assumed for simplicity to be perfectly elastic. [This differs slightly from Bhagwati, who allowed for upward-sloping foreign supply; nothing crucial hinges on the difference. Also, Corden (1967) analyzed the case when domestic marginal cost is downward sloping. In this case any tariff sufficient to establish the domestic firm also eliminates imports.]

Figure 20.3 can be used to analyze the effects of tariffs in this model. In the figure, D is the domestic demand curve facing the monopolist, MC the monopolist's marginal cost curve. P_w is the world price, i.e. the price at which imports are supplied to the domestic market. P_z is the price that would obtain if all domestic demand were supplied by the monopolist but the monopolist were to behave as a price taker. P_m is the price the monopolist would charge if there were no import competition.

Consider first the case of free trade. The domestic firm cannot raise the price above P_w, so the profit-maximizing strategy is to set marginal cost equal to P_w, producing Q_0. In this case the monopolist has no monopoly power.

Now suppose the government imposes a tariff. The effect is to raise the price at which imports will come into the market. As long as the tariff-inclusive import price lies between P_w and P_z, however, it remains true that the domestic firm acts like a price-taker, setting output where price equals marginal cost.

In a competitive industry, a tariff that raised the import price to P_z would be prohibitive, and any increase in the tariff beyond that level would have no effect – there would be "water in the tariff". Here the monopoly position of the

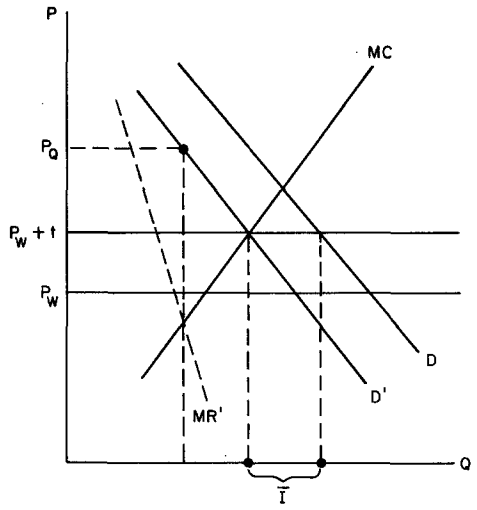

Figure 20.4

domestic firm matters. A tariff that raises the price above P_z allows the firm to raise its own price to the same level, something that will be profitable as long as the tariff price is below P_m. That is, even when no imports actually occur, the *threat* of imports keeps the monopolist from exercising its monopoly power fully, and raising an already prohibitive tariff therefore leads to domestic price increases. It also follows that such tariff increases actually *reduce* domestic output.

Now consider the effects of an import quota. In perfectly competitive models a quota is equivalent in its effects to a tariff that limits imports to the same level. Once we have domestic market power, however, an important difference emerges. A monopolist protected by a tariff cannot raise its price above the tariff-inclusive import price without losing the domestic market to imports. By contrast, a firm sheltered by quantitative restrictions need not fear increased imports, and is free to exercise its market power. The result is that an import quota will lead to a higher domestic price and lower domestic output than an "equivalent" tariff, defined as a tariff that leads to the same level of imports.

Figure 20.4 illustrates the nonequivalence of tariffs and quotas. As before, D is the domestic demand curve, MC marginal cost, P_w the world price. We compare a tariff t that reduces imports to $\bar{I}$, and an import quota that restricts imports to the same level.

With a tariff, the domestic firm simply sets marginal cost equal to $P_w + t$. With the equivalent quota, however, the firm now faces the demand curve D', derived by subtracting $\bar{I}$ from the domestic demand curve D. Corresponding to D^1 is a

marginal revenue curve MR'. The profit-maximizing price with the quota is therefore P_Q; the quota leads to a higher price and lower output than the tariff.

Bhagwati's model produces a clear and compelling result. Better still, it yields a clear policy message: if you must protect, use a tariff rather than a quota. There are, however, two troubling features of the model. One is the asymmetry between domestic and foreign firms; we would like foreigners also to be modelled as imperfectly competitive. The other is the lack of any model of the process of entry that leads to imperfect competition. Both features have been the subject of recent research, the first most notably by Krishna (1984), the second by Dixit and Norman (1980).

3.2. Krishna's model

To get away from an arbitrary asymmetry between a domestic monopolist and price-taking foreign firms, it seems natural to examine a duopoly. We can let there be a single domestic firm that supplies the market with local production, and a single foreign firm that exports to the market. Collusion is of course possible, but as a modelling device we would prefer to assume noncooperative behavior. (For some possible implications of collusion, however, see below.)

In modelling noncooperative oligopolies, the choice of strategy variables is crucial. The two main alternatives are of course the Cournot approach, in which firms take each others' outputs as given, and the Bertrand approach, in which prices are taken as given. In analyzing the effects of protection, both approaches turn out to be problematic. The Cournot assumption fails to capture Bhagwati's insight regarding the difference between quotas and tariffs; the Bertrand assumption fails to yield a pure strategy equilibrium.

The problem with the Cournot approach may be simply stated. Bhagwati's model argued that a quota creates more market power than a tariff because the domestic firm knows that an increase in its price will lead to an increase in imports. In the Cournot approach, however, the domestic firm is assumed to take the level of imports as given in any case; so a quota and a tariff that leads to the same level of imports once again have equivalent effects on the domestic firm's behavior.

If Bhagwati's argument for a lack of equivalence between tariffs and quotas is right, however – and most international economists feel that it is – then this approach is missing an important insight. The alternative is a Bertrand approach. What Krishna shows is that this leads to unexpected complexities.

Krishna considers a market in which a domestic and foreign firm produce imperfect substitutes (an assumption that is necessary if Bertrand competition is not to collapse to marginal cost pricing). In the absence of quantitative trade restrictions, that is, either under free trade or with a tariff, Bertrand competition

can be treated in a straightforward fashion. Each firm determines a profit-maximizing price given the other firm's price; given reasonable restrictions, we can draw two upward-sloping reaction functions whose intersection determines equilibrium.

But suppose that an import quota is imposed. This creates an immediate conceptual problem, which in turn leads to a problem in the understanding of equilibrium.

The conceptual problem is how to handle the possibility of excess demand. Suppose that at the prices set by the domestic and foreign firms, domestic consumers demand more foreign goods than the import quota allows. What happens? Krishna assumes, plausibly, that an unspecified group of middlemen collects the difference between the price charged by the foreign firm and the market-clearing consumer price. That is, incipient excess demand is reflected in an increased "dealer markup" rather than in rationing.

This now raises the next question, which is how to interpret Bertrand competition in this case. Which price does the domestic firm take as given, the foreign factory price or the dealer price? Here Krishna assumes, again sensibly, that the domestic firm takes the foreign factory price rather than the dealer price as given. This means that the domestic firm recognizes its ability to affect the consumer price of foreign substitutes when the import quota is binding.

But this seemingly innocuous assumption turns out to imply a basic discontinuity in the domestic firm's response function. The domestic firm in effect has two discrete pricing options: an "aggressive" option of charging a low price that limits imports to less than the quota, or a "timid" option of retreating behind the

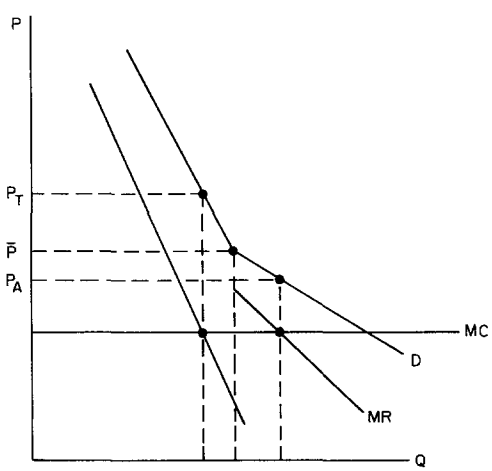

Figure 20.5

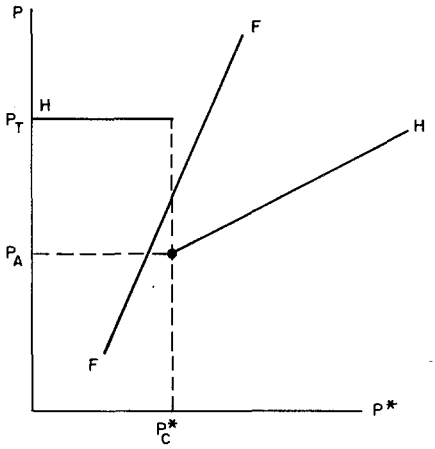

Figure 20.6

quota and charging a high price. A small rise in the foreign firm's price can shift the domestic firm's optimal response from "timid" to "aggressive".

Figure 20.5 illustrates the point. It shows the demand curve and the associated marginal revenue curve facing the domestic firm for a given foreign firm factory price. The price $\bar{P}$ is the price at which the quota becomes binding. That is, at a domestic firm price above $\bar{P}$ there is an incipient excess demand for imports, which is reflected in dealer markups that the domestic firm knows it can affect. By contrast, at prices below $\bar{P}$ the dealer price of imports is taken as given. That is, at prices below $\bar{P}$ the domestic firm takes the prices of the imported substitute as given, while at prices above $\bar{P}$ it believes that increases in its own price will increase the prices of the substitutes as well. The result is a discontinuity in the slope of the perceived demand curve, which is steeper just above $\bar{P}$ than it is just below; and hence a discontinuity in the *level* of the marginal revenue curve, which jumps up at the quantity corresponding to $\bar{P}$.

What is clear from the figure is that there are two locally profit-maximizing domestic prices: the "timid" maximum P_T, and the "aggressive" maximum P_A. Which maximum is global depends on the price charged by the foreign firm. The profitability of the timid option is unaffected by what the foreign firm does, but the higher the foreign price, the more profitable the aggressive option.

The result is a home reaction function looking like *HH* in Figure 20.6. At low levels of the foreign price P^*, the domestic firm retreats behind the quota and therefore chooses a price locally independent of P^*. At a sufficiently high P^*, however, the domestic firm abruptly sallies out from behind the quota with a cut in its price.

The foreign best response function *FF* has no such discontinuity. However, if the quota matters at all, *FF* must, as shown, pass right through the hole in *HH*! Thus, no pure strategy equilibrium exists.

A mixed strategy equilibrium does exist. If the foreign firm charges P_C^*, the home firm is indifferent between P_T and P_A; by randomizing its choice of P_A and P_T with the right probabilities, the home firm can induce its competitor to choose P_C^*.

In this mixed strategy equilibrium, we notice that the foreign firm, despite its monopoly power, does not always raise its price enough to capture all of the quota rents, a result in contrast to conventional wisdom. We can also note that with some probability the quota will fail to be binding, in the sense that imports are strictly less than the quota – yet both domestic and foreign prices are unambiguously higher even in this case than under free trade.

A point stressed by Krishna is that in this duopoly case a quota can easily raise the profits of *both* firms. Consider, for example, a quota that only restricts imports not to exceed their free trade level. Clearly, if the domestic firm charges P_T, it is because this is more profitable than the free trade price, while the foreign firm will sell the same output as under free trade, yet at a higher price. On the other hand, if the domestic firm charges P_A, this "aggressive" price is still above the free trade price, so the foreign firm must be earning higher profits. (The domestic firm of course earns the same in both states.) So profitability of both firms increases unambiguously.

3.3. Protection vs. collusion

Almost all theoretical work on industrial organization/trade issues assumes that firms act noncooperatively. In industrial organization theory itself, however, there has recently been a drift toward taking the possibility of collusive behavior more seriously. The key to this drift has been the recognition that collusive behavior may be individually rational in an indefinitely repeated game, where each player believes that his failure to play cooperatively today will lead to noncooperative behavior by others tomorrow. The influential experimental work of Axelrod (1983) suggests that reasonable strategies by individuals will indeed lead to cooperative outcomes in a variety of circumstances.

Recently Davidson (1984) and Rotemberg and Saloner (1986) have proposed analyses of the effects of protection on collusion that seem to stand Bhagwati on his head. They argue that precisely because protection tends to raise profitability in the absence of collusion, it reduces the penalty for cheating on a collusive agreement. By thus reducing the prospects for collusion, the protection actually increases competition.

The case is clearest for an import quota, analyzed by Rotemberg and Saloner. To understand their argument, consider Krishna's model again, but now suppose that the two firms attempt to agree on prices higher than the noncooperative level. Suppose also that the only enforcement mechanism for their agreement is the belief of each firm that if it cheats this period, the other firm will thenceforth play noncooperatively. Then collusion will succeed only if the extra profits gained by cheating now are more than offset by the present discounted value of the profits that will subsequently be lost by the collapse of collusion. A viable price-fixing agreement must therefore set prices low enough to make cheating unappealing.

But as we saw in our discussion of Krishna's model, a quota can actually raise the profitability of both firms in noncooperative equilibrium. This paradoxically makes collusion more difficult to sustain, by reducing the penalty for cheating. If the firms manage to collude nonetheless, they may be forced to agree on lower prices in order to make their collusion sustainable. So in this case an import quota actually leads to more competition and lower prices than free trade!

Davidson considers the case of a tariff, which raises the noncooperative profits of the domestic firm but lowers that of the foreign competitor. If the result is to encourage the domestic firm to cheat, the tariff will likewise increase competition.

It remains to be seen whether this argument will shake the orthodox presumption that protection is bad for competition. The modelling of collusive behavior is still in its infancy. To me, at least, the approach taken in this new line of work seems an odd mix of ad hoc assumptions about retaliation with hyper-rational calculations by firms about the consequences of such retaliation. Yet the argument is profoundly unsettling, which means that it must be valuable (though not that it must be right!).

3.4. Protection and excessive entry

In the 1950s, during the honeymoon period of import-substituting industrialization strategies, it was often argued that economies of scale in production provided an argument for protection – a view with a lineage going back to Frank Graham. At first, the point seems obvious: protection raises the sales of domestic firms, and thus allows them to slide down their average cost curves. In an influential paper, however, Eastman and Stykolt (1960) argued that often the reverse is true. In their view, bolstered by an appeal to Canadian experience, protection typically leads to a smaller scale of production and thus reduced efficiency.

The Eastman–Stykolt view was not couched in terms of an explicit model. Basically, however, they considered the typical case to be that where the number of firms permitted by economies of scale is more than one but small enough to

allow effective collusion. Such a collusive industry will seek to raise its price to monopoly levels unless constrained by foreign competition. A tariff or quota will thus lead initially to higher prices and profits. The long-run result, however, will be entry of new firms into the industry. If integer constraints do not bind too much, this entry will eliminate profits by driving scale down and average cost up. Thus, the effect of protection is to create a proliferation of inefficiently small producers. Such proliferation is indeed one of the favorite horror stories of critics of protection in less-developed countries, with the history of the Latin American auto industry the classic case.

This original version of the inefficient entry problem depended on the assumption of collusion among domestic producers. The problem could, however, arise even with noncooperative behavior, as is clear from a model offered by Dixit and Norman (1980). They show that in a Cournot market with free entry, expanding the size of the market leads to a less than proportional increase in the number of firms, and to a fall in average cost. Since international trade in effect links together national markets into a larger world market, it would have the same result. Protection, on the other hand, fragments the world market and hence leads to a proliferation of firms and a rise in costs.

We will return to the inefficient entry problem below. It plays a key role in the debate over "strategic" trade policy, and is also central to some attempts to quantify the effects of trade policy.

3.5. Evaluation

The basic Bhagwati model of protection and market power is admirably clear and simple, and has been in circulation for long enough to have percolated into practical policy analysis. Market power analysis along Bhagwati's lines has become part of the book of analytical recipes used by the International Trade Commission [Rousslang and Suomela (1985)]. Market power considerations have now and then helped dictate the form taken by protection; for example, the trigger price mechanism on steel during the Carter Administration was deliberately designed to minimize the effect of protection on the monopoly power of both domestic and foreign firms. And perceptions of the impact of trade policy on market power seem to be playing a role in antitrust decisions: in the steel industry, for example, it appears that the Justice Department appreciates that foreign competition is less effective a discipline than import penetration would suggest thanks to import quotas and voluntary export restraints.

More sophisticated models have yet to find application. It is at this point hard to see how Krishna's model might be made operational, let alone the inverted logic of the collusion models. The one exception is the excess entry story, which

as we will see is the central element in Harris and Cox's (1984) effort to quantify the effect of protection on Canada's economy.

4. Price discrimination and dumping

The phenomenon of "dumping" – selling exports at less than the domestic price – has long been a major concern of trade legislation. It is also self-evidently an imperfect competition issue. It is therefore not surprising that the new literature on trade and IO sheds some further light on dumping as a particular case of price discrimination. More surprising, perhaps, is the fact that the new literature on dumping actually identifies a new explanation of international trade, distinct from both comparative advantage and economies of scale.

Much as in the case of protection and market power, the initial insight here comes from an asymmetric model in which a domestic monopolist confronts price-taking foreign firms. This insight becomes both enlarged and transformed when rival oligopolists are introduced. Finally, the welfare effects of trade based on dumping are of some interest.

4.1. An asymmetric model

An extremely simple model of dumping is presented by Caves and Jones (1985) and illustrated in Figure 20.7. As in the case of protection and market power, a single domestic monopolist is assumed to face a given world price P_w. We now, however, reverse the assumptions about the possibilities for trade. Before, we let the firm face import competition while disregarding the possibility of exports. Now we assume that the domestic market is somehow closed to imports, while allowing the domestic firm to export.

In the figure I have drawn a particular case, where with a price-taking domestic firm there would be neither imports nor exports. If the domestic firm acts as a monopolist, however, it will want to set marginal revenue equal to marginal cost in both the domestic and the foreign markets. Marginal revenue on the foreign market is however just P_w, so the profit-maximizing solution is the one illustrated. The firm sets a domestic price above P_w, yet it exports, "dumping" on the world market where additional sales do not depress the price received on inframarginal units.

Three points should be noted about this example. The first is that while for simplicity it has been assumed that P_w is given, this is not essential. What is important is that the firm perceives itself as facing a higher elasticity of demand on exports than on domestic sales. That is, dumping is simply international price discrimination.

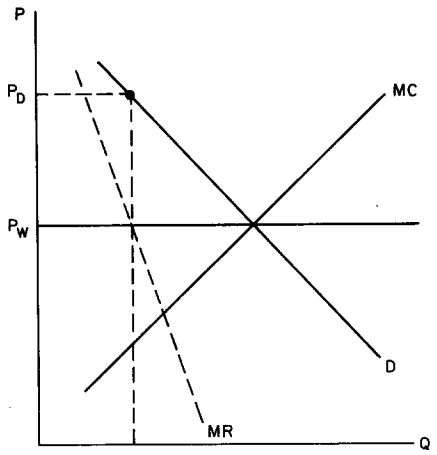

Figure 20.7

Second, the figure illustrates a case in which a price-taking domestic firm would not export – in the usual sense of the term, the domestic industry has neither a comparative advantage nor a comparative disadvantage. Yet the firm does in fact export. Clearly, we could have an industry which has at least some comparative *disadvantage*, and yet dumps in the export market. In other words, dumping can make trade run "uphill" against conventional determinants of its direction.

Third, the difference between the domestic and foreign markets remains unexplained. Why should the domestic firm be a price-setter at home, a price-taker abroad (or more generally, face more elastic demand for exports)? We would like to have a model in which this asymmetry is derived, rather than built in by assumption. In the new IO trade literature, such models have finally emerged.

4.2. Brander's model

A duopoly model of dumping was developed by Brander (1981) and elaborated on by Brander and Krugman (1983). This model goes to the opposite extreme from the asymmetrical model we just described, by postulating instead a perfectly symmetrical situation. We assume that some good is consumed in two countries, each of which has the same demand; and we assume that there is a single firm in each country, and that the two firms have identical costs. There is some positive cost of transporting the good internationally, so that in a perfect competition setting there would be no trade.

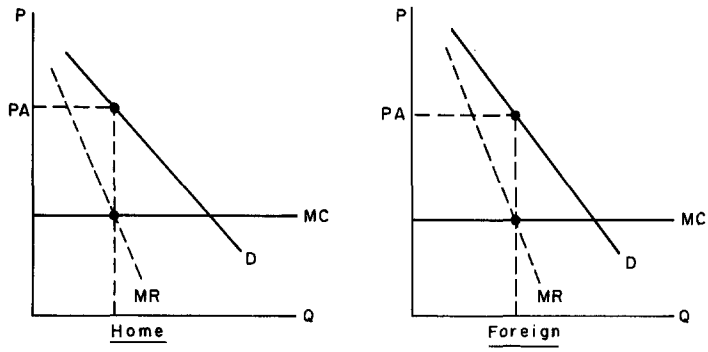

Figure 20.8

If the transport costs are not too large, however, and if the firms behave in a Cournot fashion, trade will nevertheless result. To see why, consider Figure 20.8, which illustrates what would happen in the absence of trade. We see each firm acting as a monopolist, and thus each country having a price that exceeds marginal costs. The firms do not expand their output, however, because this would depress the price on inframarginal units.

But suppose that the markup over marginal cost exceeds the transport cost between the markets. In this case each firm will have an incentive to absorb the transport cost so as to export to the other's home market. The reason is that an extra unit sold abroad, even though it yields a price net of transportation less than a unit sold domestically, does not depress the price of inframarginal sales (it depresses the price the other firm receives instead). So as long as price less transportation exceeds marginal cost, it is worth exporting.

The result is a mutual interpenetration of markets, described by Brander and Krugman as "reciprocal dumping". With Cournot behavior, equilibrium will take the following form: each firm will have a larger share of its home market than the foreign market, and will thus perceive itself as facing a higher elasticity of demand abroad than at home. The difference in perceived elasticity of demand will be just enough to induce firms to absorb transport costs. The result will therefore be a determinate volume of "cross-hauling": two-way trade in the same product. In the symmetric example considered, this pointless trade will be balanced.

From a trade theorist's point of view, this result is startling: here we have international trade occurring despite a complete absence of comparative advantage and without even any direct role for economies of scale (although an indirect role can be introduced if we support that increasing returns is the explanation of oligopoly). From an industrial organization point of view, the

result may not seem quite so outlandish, since it bears a family resemblance to the theory of basing-point pricing [Smithies (1942)]. Nonetheless, the trade-theorist's approach offers the new possibility of an explicit welfare analysis.

4.3. Reciprocal dumping and welfare

Reciprocal dumping is a totally pointless form of trade – the same good is shipped in both directions, and real resources are wasted in its transportation. Nonetheless, the trade is not necessarily harmful. International competition reduces the monopoly distortion in each market, and the pro-competitive effect can outweigh the resource waste.

The welfare effects of reciprocal dumping are illustrated in Figure 20.9. Since the countries are assumed to be symmetric, looking at only one market will do. We note two effects. First, some of the exports that are dumped in each country are a net addition to consumption. In the figure this is represented as an increase of total deliveries from an initial level z to the level $x + y$. Since the initial price P_A exceeds marginal cost c plus transportation cost t, this represents a net gain, and can be equated with the pro-competitive effect. On the other side, some of the imports displace domestic production for the domestic market. This is represented as a fall of deliveries from the domestic firm to its own market from z to x, with the quantity y both imported and exported. Since this involves a waste of resources on transportation, this constitutes a loss. From the diagram it seems impossible to tell whether the net effect is a gain or a loss.

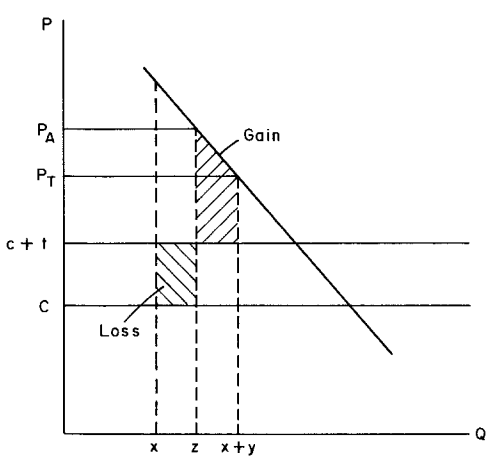

Figure 20.9

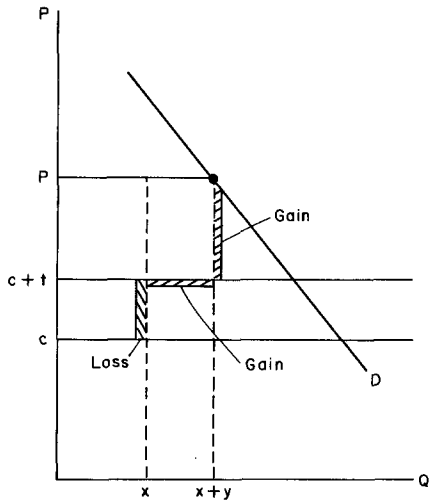

Figure 20.10

We know, however, that in one case at least there must be a gain. If transport costs are zero, cross-hauling may be pointless but it is also costless, and the pro-competitive effect yields gains. Presumably this remains true for transport costs sufficiently low.

This suggests that we examine how welfare changes as we vary transport costs. Consider the effects of a small reduction in transport costs, illustrated in Figure 20.10. There will be three effects. First, there will be a direct reduction in the cost of transporting the initial level of shipments – a clear gain. Second, there will be an increase in consumption, which will be a gain to the extent that the initial price exceeds marginal cost plus transportation cost. Third, there will be a displacement of local production by imports, which will be a loss by the change times the initial transport cost.

Can we sign the total effect? We can do so in two cases. First, suppose that transport costs are near zero. Then the last effect is negligible, and a reduction in transport is clearly beneficial.

More interestingly, suppose that initially transport costs are almost large enough to prohibit trade. Recalling our discussion above, this will be a situation where price is only slightly above marginal cost plus transport, and where the volume of trade is very small. This means that when transport costs are near the prohibitive level, the two sources of gain from a small decline in these costs become negligible, and a decline in transport costs thus reduces welfare.

Putting these results together, what we see is the relationship illustrated in Figure 20.11. If transport costs are high, but not high enough to prevent trade, trade based solely on dumping leads to losses. If they are low, trade is beneficial.

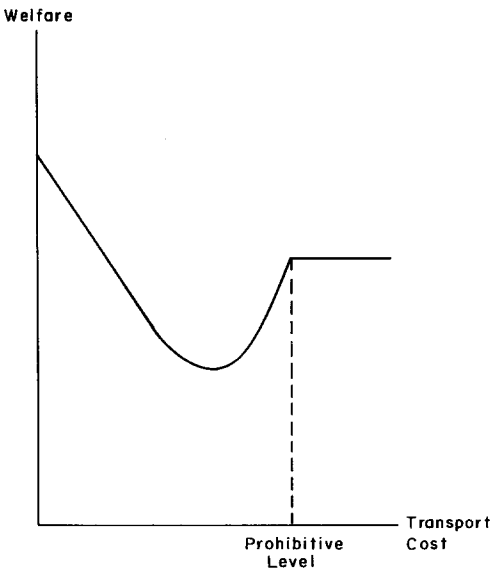

Figure 20.11

4.4. Evaluation

The new literature on dumping has so far been resolutely nonpolicy and nonempirical. Still, nothing that suggests a previously unsuspected explanation of international trade can be dismissed as without importance. Furthermore, the modelling techniques developed in the dumping literature are beginning to find at least some application. As we will see, attempts to calibrate models to actual data have so far relied on assumptions that bear a clear family resemblance to those introduced by Brander, and Brander and Krugman.

5. Strategic trade policy

One of the most controversial ideas of the new IO/trade literature has been the suggestion that government intervention can raise national welfare by shifting oligopoly rents from foreign to domestic firms. The starting point of this debate was several papers by Brander and Spencer (1983, 1985), who showed that in principle government policies such as export subsidies can serve the same purpose as, for example, investment in excess capacity in the IO literature on entry deterrence. That is, government policies can serve the "strategic" purpose of altering the subsequent incentives of firms, acting as a deterrent to foreign

competitors. The "strategic" analysis seems to offer a possible rationale for trade policies, such as export subsidies, that have been almost universally condemned by international economists in the past.

The Brander–Spencer analysis, coming at a time of heated debate over U.S. international competitiveness, appears dangerously topical, and other economists have been quick to challenge the robustness of their results. The critiques are themselves of considerable analytic interest. In this survey I consider four important lines of research suggested by the critique of Brander–Spencer strategic trade policy. First is the dependence of trade policy recommendations on the nature of competition between firms, analyzed by Eaton and Grossman (1986). Second is the general equilibrium issue raised by the fact that industries must compete for resources within a country, analyzed by Dixit and Grossman (1984). Third is the question of entry, studied by Horstmann and Markusen (1986) and Dixit (forthcoming b). Finally is the question of who is behaving strategically with respect to whom, analyzed by Dixit and Kyle (1985).

5.1. The Brander–Spencer analysis

As is often the case in the IO/trade literature, the initial insight in strategic trade policy was obtained by subtraction rather than addition: by simplifying a trade issue to a form where a familiar model of imperfect competition can be easily applied.

Consider an industry in which there are only two firms, each in one country. The clever simplification that Spencer and Brander suggest is to assume that neither country has any domestic demand for the industry's products. Instead, both countries export to a third market. Also, distortions other than the presence of monopoly power in this industry are ruled out – i.e. the marginal cost of each firm is also the social cost of the resources it uses. The result is that for each country national welfare can be identified with the profits earned by its firm.

Since the firms are themselves attempting to maximize profits, one might imagine that there is no case for government intervention. However, this is not necessarily the case. To see why, we assume for now that the two firms compete in Cournot fashion, and illustrate their competition with Figure 20.12.

Each firm's reaction function will, for reasonable restrictions on cost and demand, slope down, and the Home firm's reaction function will be steeper than its competitor's. Point N is the Nash equilibrium. Drawn through point N is one of the Home firm's iso-profit curves. Given that the reaction function is constructed by maximizing Home's profits at each level of Foreign output, the iso-profit curve is flat at point N.

Now it is apparent that the Home firm could do better than at point N if it could only somehow commit itself to produce more than its Cournot output.

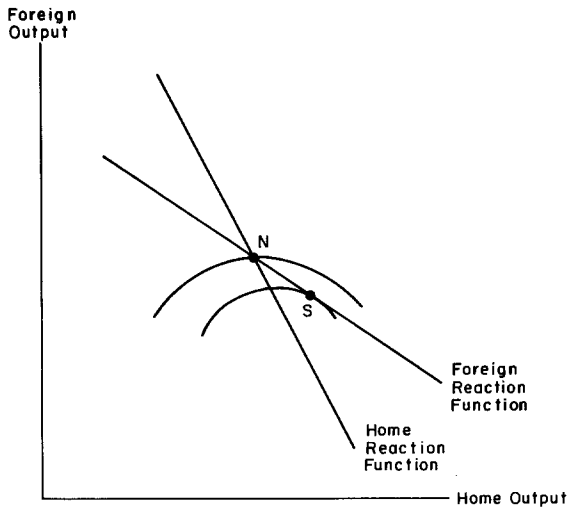

Figure 20.12

Indeed, if the Home firm could pre-commit itself to any level of output, while knowing that the Foreign firm would revise its own plans optimally, the outcome could be driven to the Stackleberg point *S*. The problem is that there is no good reason to assign the leadership role to either firm. If no way to establish a commitment exists, the Nash outcome is what will emerge.

What Spencer and Brander pointed out was that a government policy could serve the purpose of making a commitment credible. Suppose that the Home government establishes an export subsidy for this industry. This subsidy will shift the Home reaction function to the right, and thus the outcome will shift southeast along the Foreign reaction function. Because the subsidy has the deterrent effect of reducing Foreign exports, the profits of the Home firm will rise by *more* than the amount of the subsidy. Thus Home national income will rise. The optimal export subsidy is of course one that shifts the reaction function out just enough to achieve the Stackleberg point *S*.

It is possible to elaborate considerably on this basic model. Most notably, we can imagine a multi-stage competitive process, in which firms themselves attempt to establish commitments through investment in capital or R&D. In these models, considered in Brander and Spencer (1983), optimal policies typically involve subsidies to investment as well as exports. The basic point remains the same, however. Government policy "works" in these models for the same reason that investing in excess capacity works in entry deterrence models, because it alters the subsequent game in a way that benefits the domestic firm.

5.2. *The nature of competition*

Eaton and Grossman (1986) have argued forcefully that the argument for strategic trade policy is of limited use, because the particular policy recommendation depends critically on details of the model. In particular, they show that the Brander–Spencer case for export subsidies depends on the assumption of Cournot competition. With other assumptions, the result may go away or even be reversed.

To see this, suppose instead that we have Bertrand competition, with firms taking each others' prices as given. (As in our discussion of import quotas above, we must assume the two firms are producing differentiated products if the model is not to collapse to perfect competition.) Then the reaction function diagram must be drawn in price space.

Figure 20.13 shows the essentials. Each firm's best responses describe a reaction function that is upward sloping. With reasonable restrictions, Home's curve is steeper than Foreign's. The Nash equilibrium is at N, and the Home iso-profit curve passing through N is flat at that point.

The crucial point is that now Home can increase its profits only by moving northeast along the Foreign reaction function. That is, it must persuade Foreign to charge a *higher* price than at the Nash equilibrium. To do this, it must commit to a higher price than will ex post be optimal. To achieve this, what the government must do is impose, not an export subsidy, but an export *tax*!

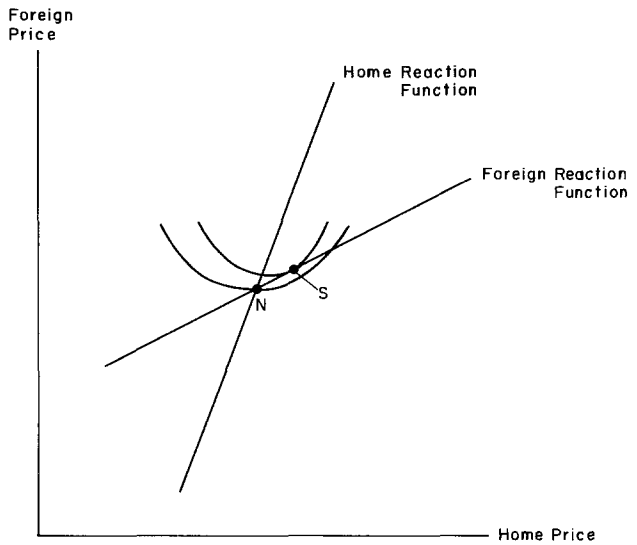

Figure 20.13

So what Eaton and Grossman show is that replacing the Cournot with a Bertrand assumption reverses the policy recommendation. Given the shakiness of any characterization of oligopoly behavior, this is not reassuring.

Eaton and Grossman go further by embedding both Cournot and Bertrand in a general conjectural variations formulation. The result is of course that anything can happen. One case that these authors emphasize is that of "rational" conjectures, where the conjectures actually match the slope of the reaction functions (a case that I do not find particularly interesting, given the problems of the conjectural variation approach in general). In this case, not too surprisingly, free trade turns out to be the optimal policy.

5.3. Competition for resources

Dixit and Grossman (1984) offer a further critique of the case for strategic trade policy based on the partial equilibrium character of the models. Their point may be made as follows: an export subsidy works in the Brander–Spencer model essentially by lowering the marginal cost faced by the domestic exporter. Foreign firms, seeing this reduced marginal cost, are deterred from exporting as much as they otherwise would have, and this is what leads to a shifting of profits. But in general equilibrium, an export industry can expand only by bidding resources away from other domestic industries. An export subsidy, while it lowers marginal cost in the targeted industry, will therefore raise marginal cost in other sectors. Thus, in industries that are not targeted the effect will be the reverse of deterrence.

Dixit and Grossman construct a particular tractable example where a group of industries must compete for a single common factor, "scientists". An export subsidy to one of these sectors necessarily forces a contraction in all the others. As we might expect, such a subsidy raises national income only if the deterrent effect on foreign competition is higher in the subsidized sector than in the sectors that are crowded out. As the authors show, to evaluate the desirability of a subsidy now requires detailed knowledge not only of the industry in question but of all the industries with which it competes for resources. Their conclusion is that the likelihood that sufficient information will be available is small.

5.4. Entry

The strategic trade policy argument hinges on the presence of supernormal profits over which countries can compete. Yet one might expect that the possibility of entry will limit and perhaps eliminate these profits. If so, then even in oligopolistic industries the bone of contention may be too small to matter.

Horstmann and Markusen (1986) have analyzed the Brander–Spencer argument when there is free entry by firms. The number of firms in equilibrium is limited by fixed costs, but they abstract from the integer problem. The result of allowing entry is to restore the orthodox argument against export subsidy, in a strong form: *all* of a subsidy is absorbed either by reduced scale or worsened terms of trade, and thus constitutes a loss from the point of view of the subsidizing country.

Dixit (forthcoming b) is concerned with a more dynamic version of the same problem. He notes that in industries characterized by technological uncertainty, there will be winners and losers. The winners – who will actually make up the industry – will appear to earn supernormal profits, but this will not really indicate the presence of excess returns. Ex ante, an investment, say in R&D, may be either a winner or a loser, so that the costs of those who did not make it should also be counted. Dixit develops a technology race model of international competition in a single industry, and shows that in such an industry high profits among the winners of the race do not offer the possibility of successful strategic trade policy.

5.5. A larger game?

The Brander–Spencer analysis assumes that the government in effect can commit itself to a trade policy before firms make their decisions. They also leave aside the possible reactions of foreign governments. Yet a realistic analysis would surely recognize that firms also make strategic moves designed to affect government decisions, and that governments must contend with the possibility of foreign reactions. Many of the ramifications of these larger games have been explored by Dixit and Kyle (1985).

To see what difference this extension makes, consider two cases. First, suppose that there is a firm that faces the following situation: it can commit itself to produce by making an irreversible investment. Once this cost is sunk, it will be socially optimal to provide the Brander–Spencer export subsidy, and with this subsidy the firm will find that its entry was justified. From a social point of view, however, it would have been preferable for the firm not to have entered at all.

In this case, what is clear is that if the firm can move first, the government will find itself obliged to provide the subsidy. Yet it would have been better off if it could have committed itself not to provide the subsidy, and thus deterred the undesirable entry. The possibility of an export subsidy, though it raises welfare *given* entry, in the end is counterproductive. The government would have been better off if it had never heard of Brander and Spencer, or had a constitutional prohibition against listening to them.

Alternatively, consider the case of two countries, both able to pursue Brander–Spencer policies. It is certainly possible that both countries may be worse off as the result of a subsidy war, yet they will find themselves trapped in a prisoner's dilemma.

The point of the extended game analysis, then, is that even though interventionist policies may be shown to be locally desirable, it may still be in the country's interest that the use of such policies be ruled out.

5.6. Evaluation

Strategic trade policy is without doubt a clever insight. From the beginning, however, it has been clear that the attention received by that insight has been driven by forces beyond the idea's intellectual importance. The simple fact is that there is a huge external market for challenges to the orthodoxy of free trade. Any intellectually respectable case for interventionist trade policies, however honestly proposed – and the honesty of Brander and Spencer is not in question – will quickly find support for the wrong reasons. At the same time, the profession of international economics has a well-developed immune system designed precisely to cope with these outside pressures. This immune system takes the form of an immediate intensely critical scrutiny of any idea that seems to favor protectionism. So Brander–Spencer attracted both more attention and more critical review than would normally have been the case.

That said, *does* the marriage of trade and IO offer an important new case for protectionism? To answer this we must go beyond the Brander–Spencer analysis of export competition to consider a wider range of models.

6. A new case for protection?

To the extent that the IO/trade linkage offers any new comfort to protectionists, it takes the form of four not wholly distinct arguments. First is the possibility that trade policy can be used to extract rent from foreign monopolists. Second is the potential for shifting rent from foreign to domestic firms. Third is the possible use of protectionist policies as a way to get firms further down their average cost curves. Last is the use of protection to promote additional entry, where this is desirable.

6.1. Extracting rent from foreigners

The possibility of using a tariff to extract gains from a foreign monopolist has been emphasized in two papers by Brander and Spencer (1981, 1984). In its

simplest version, their analysis considers a foreign monopolist selling to the domestic market without any domestic competition. They point out that under a variety of circumstances a tariff will be partly absorbed by the foreign firm rather than passed on to domestic consumers. For example, suppose that demand is linear and that a specific tariff is imposed: then only half of the tariff will be passed on in prices, with the rest coming out of the firm's markup.

This observation suggests a terms-of-trade justification for tariffs similar to the traditional optimum tariff argument. The difference is that there is no requirement that the tariff-imposing country be large relative to world markets. As long as the foreign seller is charging a price above marginal cost, and as long as it is able to discriminate between the domestic market and other markets, it will be possible for a tariff to lower prices.

In one extension of their analysis, Brander and Spencer go on to consider the case where the foreign firm is attempting to deter entry by a potential domestic competitor. They follow an early Dixit model in which the incumbent firm does this by setting a limit output high enough that if it were to be maintained post-entry this entry would be unprofitable. (In Dixit's model the potential entrant is assumed to believe that the incumbent firm will maintain its pre-entry output, even though it would not be profit-maximizing to carry out this threat ex post. Such ad hoc entry deterrence models are now unfashionable, but this paper was written before Dixit acquired enlightenment and became (subgame) perfect.) The result in this case is that any tariff low enough that the limit pricing strategy is maintained will be wholly absorbed by the foreign firm.

6.2. Rent-shifting

Clearly, a tariff can give domestic firms a strategic advantage in the domestic market, in the same way that export subsidies can give them an advantage in foreign markets. Welfare assessment of strategic tariff policy is however complicated by the need to worry about domestic consumers. What Brander and Spencer (1984) point out, however, is that rent-shifting will generally reinforce rent extraction. That is, if in the absence of domestic competitors a tariff would be partly absorbed by foreign firms, the presence of domestic competitors will reinforce the case for a tariff.

6.3. Reducing marginal cost

In Krugman (1984a) it is pointed out that protection of the domestic market can serve as a form of export promotion. The model is a variant of Brander and Krugman (1983), where two firms interpenetrate each others' home markets

through reciprocal dumping. Instead of constant marginal cost, however, each firm has downward-sloping marginal cost. Suppose now that one firm receives protection in its Home market. The immediate result will be that it sells more and the other firm less. This will reduce the Home firm's marginal cost, while raising its competitor's cost; this will in turn have the indirect effect of increasing the Home firm's sales in the unprotected foreign market. In the end, "import protection is export promotion": protection of the Home market actually leads to a rise in exports. The same results obtain when the economies of scale are dynamic rather than static, arising for example from R&D or a learning curve.

Is this policy desirable from the point of view of the protecting country? We can surmise that it might be, because it is in effect a strategic export policy of the kind with which we are now familiar. A numerical example in Krugman (1984b) shows at least that such a policy could be worth carrying out – if there is no retaliation.

6.4. Promoting entry

Venables (1985a) considers another variant of the Brander–Krugman model in which marginal cost is constant, but there are fixed costs. This time, however, he allows free entry and waives integer constraints on the number of firms. He now asks what the effects of a small tariff imposed by one country would be.

It is immediately apparent that such a tariff would raise the profitability of domestic firms and lower the profitability of foreign, leading to entry on one side and exit on the other. This makes the Home market more competitive, and the Foreign market less competitive. What Venables is able to show, surprisingly, is that for a small tariff this indirect effect on competition has a stronger effect on prices than the direct effect of the tariff itself. The price of the protected good will *fall* in the country that imposes the tariff, while rising in the rest of the world!

To understand this result, first note the first-order condition for a firm's deliveries to each market:

$$p + x(\mathrm{d}p/\mathrm{d}x) = c,$$

where x is the firm's deliveries to the market and c is the marginal cost. In a Cournot model $\mathrm{d}p/\mathrm{d}x$ as perceived by the firm will be the slope of the market demand curve, and thus will itself be a function of the market price p. Thus, x will be a function of p, as will the revenues earned by the firm in that market.

Since everything is a function of p, we can write the zero-profit condition that must hold with free entry as a function of p and of p^*, the price in the foreign market. In Figure 20.14, the schedule HH represents the combinations of P and P^* consistent with zero profits for a representative firm producing in Home, FF

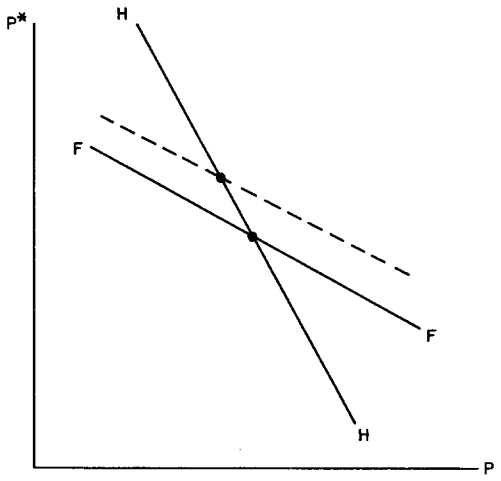

Figure 20.14

the zero-profit locus for a firm producing in Foreign. In the presence of transport costs it will ordinarily be true that *HH* is steeper than *FF*, i.e. Home firms are relatively more affected by the Home price than Foreign firms. A free entry equilibrium will occur when both zero-profit conditions are satisfied.

Now suppose that a tariff is imposed by Home. The zero-profit locus for Home firms will not be affected, but Foreign firms will face increased costs on shipment to Home. They will have to receive a higher price in at least one market to make up for this, so *FF* shifts out. We now see Venables' result: the price in Home must actually fall, while that in Foreign rises.

The welfare calculation is now straightforward. Profits are not an issue, because of free entry. Consumers are better off in the protecting country. And there is additional government revenue as well.

6.5. Evaluation

The new literature on IO and trade certainly calls into question the traditional presumption that free trade is optimal. Whether it is a practical guide to productive protectionism is another matter. The models described here are all quite special cases; small variations in assumptions can no doubt reverse the conclusions, as was the case in the Brander–Spencer model of export competition.

It may be questioned whether our understanding of how imperfectly competitive industries actually behave will ever be good enough for us to make policy

prescriptions with confidence. What is certain is that purely theoretical analyses will not be enough. Until very recently, there was essentially no quantification of the new ideas in trade theory. In the last two years, however, there have been a handful of preliminary attempts to put numbers into the models. I conclude the chapter with a discussion of these efforts.

7. Quantification

Efforts to quantify the new theoretical models have been of three kinds. First have been econometric studies of some of the aggregate predictions of the intraindustry trade model described in Section 2 of this chapter. Second, and most recent, have been efforts to "calibrate" theoretical models to fit the facts of particular industries. Finally, and most ambitiously, Harris and Cox have attempted to introduce industrial organization considerations into a general equilibrium model of the Canadian economy.

7.1. Testing the intraindustry trade model

The empirical analysis of intraindustry trade, in such studies as that by Grubel and Lloyd (1975), long predates the monopolistic competition theory described in this survey. Without a theoretical base, however, discussion of intraindustry trade often seemed confused. Only once formal models became available was it possible for empirical workers to concentrate on propositions derived from these models.

Two studies focus on the most direct proposition, that the proportion of intraindustry as opposed to interindustry trade should be positively correlated with the degree of similarity between countries' capital–labor ratios. Loertscher and Wolter (1980) use differences in per capita income as a proxy for differences in resource endowments, and confirm the correlation using a cross-section for a single year. Helpman (1985) uses a more extended data set to confirm the proposition over a number of years; he also shows that as the industrial countries became more similar over time the relative importance of intraindustry trade grew, just as the model would suggest.

Havrylyshyn and Civan (1984) study a proposition that is less clearly implied by the model, but in the same spirit: namely, that intraindustry trade is likely to be more prevalent in the trade between advanced countries than in trade among LDCs, on the presumption that advanced countries produce more differentiated products. They find that this is, indeed, the case.

These regression studies suffer from a common problem of lack of congruence between the data and the concepts in the theoretical model. In the theory, an

"industry" is a group of products produced with similar factor intensities, so that trade within an industry cannot be explained by conventional comparative advantage. Whether this concept of an industry has anything to do with a three-digit Standard International Trade Classification category – the unit to which the analysis is in each case applied – is anybody's guess. What is clear is that the data does not provide a very good correspondence to the theoretical concept.

7.2. Calibrated models

The newest development in the IO/trade field is the attempt to quantify models by calibrating them to data from actual industries. This style of analysis seems likely to grow, and needs a name; for now we may call these studies Industrial Policy Exercises Calibrated to Actual Cases (IPECACs).

The pioneering work here is Dixit's (forthcoming a) model of the auto industry. The U.S. auto market is represented as a noncooperative oligopoly, with foreign autos differentiated from domestic. Demand functions are derived from other published studies; constant terms and cost parameters are derived from actual industry data. In order to make the model fit, Dixit is also obliged to adopt a conjectural variations approach, with the conjectures derived in the process of calibrating the model.

Once the model is calibrated, it is possible to perform policy experiments on it. In particular, Dixit calculates the optimal trade policy when a tariff is the only available instrument, and the optimal trade-cum-industrial policy when a production subsidy is also available. He finds that a modest tariff is in fact justified, for the reasons we described above. The gains from this optimal tariff are however fairly small. When a production subsidy is allowed, the additional role for a tariff is greatly reduced, with the gains from adding tariffs as an instrument extremely small.

A model similar in spirit but quite different in detail is Baldwin and Krugman (forthcoming), which studies the competition in 16K Random Access Memories. The model is a variant of Krugman (1984a), with strong learning-by-doing providing the increasing returns. As in the Dixit analysis, the model's parameters are partly drawn from other published studies, partly estimated by calibrating the model to actual data. Also, as in Dixit's study, it proves necessary to adopt a conjectural variations approach in order to match the observed industry structure.

In the Baldwin–Krugman analysis, the policy experiment is a historical counterfactual. How would the competition in 16K RAMs have been different if the Japanese market, which appears to have been de facto closed to imports, had been open? The model yields a striking result: instead of being substantial net

exporters, the Japanese firms would not even have been able to compete in their own home market. Thus, import protection was export promotion with a vengeance.

The welfare implications of this counterfactual can also be computed. According to the model, Japanese market closure, although it successfully promoted exports, did not benefit Japan. Because Japanese firms appear to have had inherently higher costs than their U.S. rivals, market closure was a costly policy that hurt both the United States and Japan.

At the time of writing, the only other IPECAC is a study by Venables and Smith (1986). They apply methods that combine those of the Dixit and Baldwin–Krugman papers, as well as an interesting formulation of multi-model competition, to study the U.K. refrigerator and footwear industries. The results are also reminiscent to some degree of both other studies: modest tariffs are welfare-improving, and protection has strong export-promoting effects.

The calibrated trade models are all at this point rather awkward constructs. They rely on ad hoc assumptions to close gaps in the data, and they rely to an uncomfortable degree on conjectural variations – an approach that each of the papers denounces even as it is adopted. To some extent the results of this literature so far might best be regarded as numerical examples informed by the data rather than as studies that are seriously meant to capture the behavior of particular industries. Nonetheless, the confrontation with data does lend a new sense of realism and empirical discipline to the IO/trade literature.

7.3. General equilibrium

The most ambitious attempt to apply industrial organization to trade policy analysis is the attempt by Harris and Cox to develop a general equilibrium model of Canada with increasing returns and imperfect competition built in. This effort, reported in Harris (1984) and Harris and Cox (1984), stands somewhat apart from much of the other literature reviewed here. Although some elements of the monopolistic competition model are present, the key to the results is the adoption of the Eastman–Stykolt pricing assumption, that firms are able to collude well enough to raise the domestic price to the foreign price plus tariff.

Given this assumption, it is naturally true that Canadian import-competing industries are found to have excessive entry and inefficiently small scale. The authors also offer a fairly complex analysis of pricing and entry in export markets, which leads them to believe that inefficient scale in Canadian export industries results from U.S. protection. Combining these effects, the authors find that the costs to Canada from its partial isolation from the U.S. market are several times higher than those estimated using conventional computable general

equilibrium models. Thus, the Harris–Cox analysis makes a strong case for free trade between the United States and Canada.

The Harris–Cox study has not yet been followed by a body of work that would enable us to evaluate the robustness of its conclusion. It is unclear, in particular, how much the assumption of collusion-cum-free entry is driving the results; would a noncooperative market structure still imply comparably large costs from protection? It is a fairly safe bet, however, that over the next few years workers in this area will attempt to fill in the space between Harris–Cox and the calibrated models, building more or less general equilibrium models that also have some detailing of the process of competition in individual industries.

7.4. Evaluation

The attempts at quantification described here are obviously primitive and preliminary. However, the same could be said of attempts to apply industrial organization theory to purely domestic issues. The problem is that the sophistication of our models in general seems to have outrun our ability to match them up with data or evidence. The first efforts in this direction in international IO are therefore welcome. One might hope that this effort will be aided by an interchange with conventional IO research that poses similar issues, such as the analysis of the effects of mergers.

8. Concluding comments

The rapid growth in the application of industrial organization concepts to international trade seems to be remaking trade theory in IO's image. Traditional trade theory was, by the late 1970s, a powerful monolithic structure in which all issues were analyzed using variants of a single model. The new literature has successfully broken the grip of that single approach. Increasingly, international economics, like industrial organization, is becoming a field where many models are taught and research is an eclectic mix of approaches.

This transformation of the subject has been extremely valuable in several ways. First of all, the fundamental insight is right – markets are often not perfectly competitive, and returns to scale are often not constant. Beyond this, the new approaches have brought excitement and creativity to an area that had begun to lose some of its intellectual drive.

At this point, however, the central problem of international trade is how to go beyond the proliferation of models to some kind of new synthesis. Probably, trade theory will never be as unified as it was a decade ago, but it would be desirable to see empirical work begin to narrow the range of things that we regard as plausible outcomes.

Appendix: Some basic models

Applications of industrial organization to international trade so far rely on fairly simple models, so that it is still possible to describe most research in this field verbally and graphically. For completeness, however, this Appendix offers formal presentations of simple versions of the two "workhorse" models of the new field: the monopolistic competition model of international trade resulting from economies of scale, and the homogeneous-product duopoly model.

A.1. Monopolistic competition

The simplest version of the monopolistic competition model of trade is one in which there is only one factor of production and countries have identical technologies, so that economies of scale are the only reason for trade. We further assume that product differentiation takes the Spence–Dixit–Stiglitz form in which each individual has a taste for variety, rather than letting the demand for variety arise from differences between consumers. The model can be further simplified by assuming particular forms for both production and utility functions. The result is a "rock-bottom" model which reveals the essentials of the approach in the simplest possible form.

Let us assume, then, that there is a very large number of potential products N (it would be more rigorous to assume a continuum of products, but this would complicate the exposition with no gain in insight). These products enter symmetrically into the utility of all consumers, with the utility function taking the specific convenient form:

$$U = \sum_{i=1}^{N} c_i^{\theta}, \quad 0 < \theta < 1, \tag{1}$$

where c_i is an individual's consumption of good i, and θ measures the degree of substitution between varieties; note that (1) can be monotonically transformed into a CES function with elasticity of substitution $1/(1 - \theta)$.

There is only one factor of production, labor. Not all goods will in general be produced. For any good that is produced the labor employed is:

$$l_i = \alpha + \beta x_i, \quad \alpha, \beta > 0, \tag{2}$$

where x_i is output of good i. The presence of the fixed cost α introduces economies of scale into the model. As we will see, it is this fixed cost that limits the number of varieties that any one country actually produces, and therefore leads to both trade and gains from trade.

Let L be an economy's total labor force. Then full employment requires that

$$L = \sum_{i=1}^{n} (\alpha + \beta x_i), \tag{3}$$

where n is the number of goods actually produced.

A.1.1. A closed economy

First we consider equilibrium in a single economy that does not trade with the rest of the world. Each consumer will maximize welfare subject to his budget constraint; the first-order conditions from that maximization problem will take the form:

$$\theta c_i^{\theta-1} = \lambda p_i, \tag{4}$$

where λ is the marginal utility of income. This may be rewritten in the form:

$$c_i = \left[(\lambda/\theta) p_i\right]^{-1/(1-\theta)}. \tag{4'}$$

If the number of available products is sufficiently large, the marginal utility of income of each will be negligibly affected by changes in its price, so that the demand for each good will have a constant elasticity $1/(1-\theta)$.

Next we turn to the problem of firms. We begin by noting that as long as there are more potential varieties than are actually produced, there will be no reason for more than one firm to produce any given variety; since the varieties are symmetrical, a firm will always prefer to switch to a different variety rather than compete with another firm head to head. Thus, each good will be produced by a monopolist. Since the monopolist faces demand with an elasticity $1/(1-\theta)$, her optimal price is:

$$p = (\beta/\theta) w, \tag{5}$$

where w is the wage rate. Notice that there is no subscript. Given the symmetry assumed among the goods, they will all have the same price p. We can choose labor as the numeraire and write the price equation as:

$$p/w = \beta/\theta. \tag{5'}$$

Next we introduce the possibility of entry and exit. If firms are free to enter and exit, and we ignore integer constraints, then profits will be driven to zero. But the profits of a representative firm are:

$$\pi = (p - \beta w) x - \alpha w$$

or

$$\pi/w = p/w - \beta x - \alpha = 0. \tag{6}$$

This implies that the output of a representative firm is:

$$x = \alpha\theta/[\beta(1-\theta)]. \tag{7}$$

Using the full-employment condition we can then conclude that the number of firms, which is also the number of goods actually produced, is:

$$n = L/[\alpha + \beta x] = L(1-\theta)/\alpha. \tag{8}$$

Note that it is the fixed cost α that limits the number of goods produced. If there were no fixed cost, or the fixed cost were very small, the product space would become saturated and our assumption that each good is produced by a single firm would break down.

Also note that while we can determine the *number* of goods n that is produced, we cannot determine *which* n goods are produced. This indeterminacy cannot be eliminated without spoiling the simplicity of the model. It arises precisely because of the assumed symmetry of the goods, which in turn is what allows us to find a zero-profit equilibrium.

Finally, we can determine the utility of a representative household. Let us assume that each household owns one unit of labor. Then it has an income w, which it will divide equally among all available products. Utility is therefore:

$$U = n(w/np)^{\theta} = (w/p)^{\theta} n^{1-\theta} = (\theta/\beta)^{\theta} n^{1-\theta}. \tag{9}$$

Welfare is therefore increasing in the number of goods available.

A.1.2. A trading world

Now consider a world of two countries: Home, with a labor force L, and Foreign, with a labor force L^*. In the absence of trade each of these countries would be described by the analysis just developed. Suppose, however, that the countries are able to trade with each other at zero cost. Then wages will be equalized, and the countries will in effect constitute a single larger economy with a labor force $L + L^*$. Home will produce $n = L\alpha/(1-\theta)$ goods, Foreign $n^* = L^*\alpha/(1-\theta)$ goods. Since firms will still never compete over a market, these will be different goods – i.e. each good that is produced will be produced in only one country. Thus, the countries will be specialized in producing different ranges of goods, and will trade with each other.

There are three important points to note about this trade. First, since it is indeterminate who produces what, the pattern of trade is indeterminate. We know that the countries specialize, but not in what. This indeterminacy is at first disturbing, but it is characteristic of models with increasing returns.

Second, while the pattern of trade is indeterminate, the volume of trade is fully determined. Each household will spend the same share of income on each good, and each household will spend a share $n/(n + n^*)$ on Home-produced goods, $n^*/(n + n^*)$ on Foreign goods. The total income of Home is wL, the total income of Foreign wL^*. Thus, the value of Home's imports from Foreign is $wLL^*/(L + L^*)$, which is also the value of Foreign's imports from Home. Trade is balanced, as it must be in a model with no saving.

Finally, trade is mutually beneficial. In the absence of trade Home households would have had only n products available; as a result of trade the number available increases to $(n + n^*)$. Letting U_A be welfare in the absence of trade and U_T be welfare with trade, we have:

$$U_T/U_A = [(n + n^*)/n]^{1-\theta} > 1. \tag{10}$$

Foreign households similarly gain. Note that the gain from trade is larger, the smaller is θ, i.e. the greater the gains from variety.

A.2. Homogeneous-product duopoly

The other most widely used model in applications of industrial organization to international economics is the simple model of homogeneous product duopoly. This model can be used to demonstrate the pro-competitive effect of trade; the motivations behind dumping; the potential for strategic trade policy; and the possibility that protection promotes exports. I present here a simple linear version, then indicate how it can be extended.

Suppose that there are two countries, Home and Foreign, that both demand some product. For simplicity they will be assumed to have identical, linear demand curves, which we write in inverse form as:

$$p = A - Bz, \tag{11}$$

$$p^* = A - Bz^*, \tag{12}$$

where z, z^* are total deliveries to the Home and Foreign markets, respectively.

Each of the countries is also the base of a single firm producing the good. Each firm can deliver to either country; we let x be the Home firm's deliveries to its own market, x^* its deliveries to the Foreign market. Then its costs will depend

on its shipments:

$$C = F + cx + (c + t)x^*, \tag{13}$$

where marginal cost is for the moment assumed constant, and t may be interpreted as transport cost. Also, let y be the Foreign firm's deliveries to the Home market and y^* its deliveries to its own market; if the firms have identical costs we then have:

$$C^* = F + cy^* + (c + t)y. \tag{14}$$

In the absence of trade each firm would be a monopolist, and we would have $z = x$, $z^* = y^*$. In that case it is straightforward to see that the price in each market would be:

$$p = c + (A - c)/2. \tag{15}$$

If the markup $(A - c)/2$ exceeds the transport cost t, however, each firm will have an incentive to ship into the other firm's market, since it will be able to sell goods there at above its marginal cost of delivery. Thus, we need to analyze an equilibrium in which each firm may ship to both markets, and therefore

$$z = x + y, \tag{16}$$

$$z^* = x^* + y^*. \tag{17}$$

Each firm must choose its levels of shipments to each market based on its beliefs about the other firm's actions. The simplest assumption is that each firm takes the other firm's deliveries to *each* market as given – the Home firm maximizes profits taking y and y^* as given, and vice versa. Then the model breaks into two separate Cournot games in the two markets. Since these games are symmetric, it is sufficient to examine only what happens in the Home market. The Home firm's reaction function is:

$$x = (A - c)/2B - y/2, \tag{18}$$

while the Foreign firm's reaction function is:

$$y = (A - c - t)/2B - x/2. \tag{19}$$

These reaction functions are shown in Figure 20.15. Note that there is a positive intersection if and only if $(A - c)/2 > t$ – that is, if the monopoly markup in the absence of trade would have exceeded the transport cost.

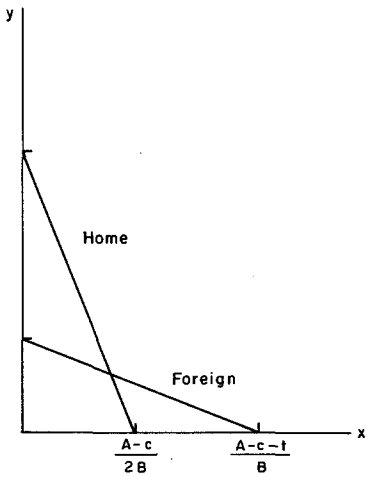

Figure 20.15

If there is a positive intersection, there will be trade. That is, the Foreign firm will have positive sales in the Home market. Given the symmetry of the markets, furthermore, this will be two-way trade in the same product: the Home firm will ship the same product to the Foreign market.

A.2.1. Interpretation and effects of trade

We have described this trade as "reciprocal dumping". In what sense is this dumping? The point is that the price that each firm receives on its export sales is the same that it receives on domestic sales, and therefore does not compensate for transport cost. Equivalently, we can observe that if the firm simply sold all its output at a fixed price at the factory gate, private shippers would not find it profitable to export. It is only because the firm is willing to absorb the transport cost, receiving a lower net price on export sales than on domestic sales, that trade takes place.

Why are firms willing to do this? *Price* net of transport cost is lower on export sales than on domestic sales. In equilibrium, however, each firm will have a smaller share of its export market than of its domestic market, and will therefore perceive itself as facing a higher elasticity of demand abroad than at home. This is what makes the marginal revenue on export sales equal that on domestic sales, despite the lower net price.

What are the effects of this seemingly pointless trade? First, it unambiguously lowers the price in both markets, and hence raises consumer surplus. This

pro-competitive effect is strongest in the case of zero transport costs, in which the markup over marginal cost falls from $(A - c)/2$ to $(A - c)/4$ as a result of trade.

Second, trade leads to a waste of resources in seemingly pointless cross-hauling of an identical product – except in the case where transport costs are zero.

Finally, trade leads to a fall in profits both because the price falls and because firms incur transport expenses.

The net welfare effect is ambiguous, except in the case of zero transport cost. The pro-competitive effect reduces the monopoly distortion, but against this must be set the waste of resources in transportation. For this linear model it is possible to show that trade leads to gains if t is close to zero, but to losses if t is close to $(A - c)/2$, the monopoly markup in the absence of trade.

A.2.2. Extensions

One extension is to add government policy to the model, in the form of a tax on imports, a subsidy on exports, etc. The simplest Brander–Spencer model takes this basic framework but assumes that instead of selling to each other both countries sell to a third market. This means that each country's welfare can be identified with the profits earned from these exports. It is then straightforward to show that an export subsidy will raise profits at the expense of the other country.

A second extension is to vary the linear cost function. Specifically, assume that each firm's costs take the form:

$$C = C(x + x^*) + tx^*, \tag{20}$$

with $C'' < 0$, declining marginal costs. This now introduces an interdependence between the two markets: the more the Home firms sells in one market, the lower its marginal costs of shipment to the other market. In this case protection of the domestic market has the effect of increasing exports. A tariff or import quota increases the protected firm's sales in its domestic market, while lowering the sales of its rival. This in turn lowers the marginal cost of the protected firm, raises the marginal cost of the other firm, and thus leads to a rise in sales abroad as well as at home.

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