Chapter 7: Import Tariffs and Dumping

There are various reasons why countries use import tariffs and other types of trade policies. Nearly all countries have used these instruments in early stages of their development to foster the growth of domestic industries, in what is called *import substitution*. Such policies have been heavily criticized for protecting inefficient domestic industries from international competition. Many countries have later switched to an *export promotion* regime, under which industries are expected to meet international competition through exports, albeit with subsidies (hopefully temporary) given to exporters. The more than 140 members of the WTO have all committed to abandon such heavily regulated trade regimes, and move towards substantially freer trade. One question, then, is whether the use of import tariffs and other trade policies at early stages of the development process has any rationale at all, especially when other markets (such as for capital) might not be functioning well. While this is too big a question to deal with adequately in this chapter, we will briefly discuss the rationale for temporary tariffs in what is called "infant industry" protection.

A second question concerns the welfare cost of tariffs and quotas in situations where other markets are working well. Even under the GATT/WTO, countries are permitted to apply tariffs in a number of cases, including: (i) "escape clause" tariffs, under which countries temporarily escape from their promise to keep tariffs low, due to injury in an import-competing industry; (ii) antidumping duties, under which tariffs are applied to offset import prices that are "too low." For theoretical purposes, we can think of escape clause tariffs as *exogenously imposed* on exporting firms, and this will be our assumption in the first part of the chapter. We will examine the response of the exporters, as well as the response of import-competing firms, to such tariffs. In particular, we are interested in whether there is any "strategic" role for trade policy, whereby it gives an advantage to importing firms that leads to a welfare gain for the importing country. This possibility is associated with the work of Brander and Spencer (1984a,b). The response of firms to the tariff depends on the market structure, and we shall investigate a series of cases, concluding with an empirical investigation of these tariffs as applied to U.S. imports of compact trucks and heavyweight motorcycles (Feenstra, 1989).

Following this, we turn to a discussion of dumping. We suggest that this phenomena can be viewed as a natural attempt of imperfectly competitive firms to enter each others markets, as in the "reciprocal dumping" model of Brander (1981) and Brander and Krugman (1983). As such, it is likely to bring gains to consumers through lower prices. These gains will be offset by the use of anti-dumping duties, especially since these duties must be treated as *endogenous:* their application will depend on the prices charged by the exporting firms. Exporting firms will have an incentive to raise their prices even if there is only a threat of antidumping duties being imposed, and to raise them even further if the duties are actually imposed. For these reasons, consumer and social losses due to antidumping actions are particularly high. We review empirical work by Prusa (1991, 1992), Staiger and Wolak (1996) and Blonigen and Haynes (2002), who estimate the price and quantity effects of antidumping actions.

Tariffs under the GATT/WTO

For member countries of the WTO the use of tariffs or quotas is allowed under some circumstances. For example, Article XIX of the GATT (see Table 6.1), called the "escape clause," allows for the temporary use of protection when domestic industries are experiencing unusual import competition. In order for the articles of GATT to have legal standing in its member countries, they must be reflected in a set of trade laws within each country. In the

United States, Article XIX was incorporated into Title II, Section 201 of the Trade Act of 1974, which states in part that:

> Title II, RELIEF FROM INJURY CAUSED BY IMPORT COMPETITION
> Section 201. INVESTIGATION BY INTERNATIONAL TRADE COMMISSION
> (a) (1) A petition for eligibility for import relief for the purpose of facilitating orderly adjustment to import competition may be filed with the International Trade Commission … by an entity, including a trade association, firm, certified or recognized union, or a group of workers, which is representative of the industry…
> (b) (1) … upon the filing of a petition under subsection (a) (1), the Commission shall promptly make an investigation to determine whether an article is being imported into the United States in such increased quantities as to be a substantial cause of serious injury, or threat thereof, to the domestic industry producing an article like or directly competitive with the imported article…
> (4) For the purposes of this section, the term "substantial cause" means a cause which is important and not less than any other cause.
> Source: U.S. Public Law 93-618, Jan. 3, 1975

It can be seen that in order to qualify for tariffs protection under Section 201, several criterion need to be met, the most important of which is that imports must be a "substantial cause of serious injury, or threat thereof, to the domestic industry," where a "substantial cause" must be "not less than any other cause." This legal language is very important in practice: it means that a tariff will be granted only if rising imports are the *most important* cause of injury to the domestic industry. This criterion is difficult enough to establish that escape clause protection is used infrequently. This is shown in Table 7.1, taken from Hansen and Prusa (1995). Over the years 1980-1988, there were only 19 escape clause case files in the United States, of which

Table 7.1: Administered Protection Cases in the United States

	Escape Clause				Anti-Dumping				Countervailing Duty			
	Outcome				Outcome				Outcome			
	Negative ITC	**Affirmative ITC**	**Affirmative President**	**Total**	**Duty Levied**	**Case Rejected**	**With - drawn**	**Total**	**Duty Levied**	**Case Rejected**	**With - drawn**	**Total**
1980	1	1	1	2	4	15	10	29	3	15	5	23
1981	1	0	0	1	5	6	4	15	2	0	5	7
1982	1	2	2	3	13	29	23	65	40	54	42	136
1983	0	0	0	0	19	24	3	46	12	5	5	22
1984	4	3	1	7	8	21	44	73	19	10	15	44
1985	3	1	1	4	27	21	15	63	16	14	18	48
1986	1	0	0	1	44	20	7	71	17	6	4	27
1987	0	0	0	0	8	5	2	15	3	2	1	6
1988	1	0	0	1	19	15	0	34	3	7	2	12
All	12	7	5	19	147	156	108	411	115	113	97	325

Source: Hansen and Prusa (1995)

12 obtained a *negative* recommendation from the U.S. International Trade Commission (ITC). The remaining seven affirmative cases went to the President for a final ruling, and he gave a positive recommendation for import protection in only five cases, or less than one per year. We will investigate two of these U.S. cases in this chapter, one of which (heavyweight motorcycles) received import protection under Section 201, and the other of which (compact trucks) was denied under Section 201 but was able to get tariff protection by other means.

As an alternative to the escape clause, firms can file for import protection under the anti-dumping provision of the WTO, which is Article VI (see Table 6.1). This provision has been incorporated into Title VII of U.S. trade laws, where Section 303 deals with "countervailing duties" and Section 731 deals with "antidumping duties." Countervailing duties are applied to offset foreign subsidies that lower the price of the foreign export good in the home market. Antidumping deals with cases where it is believed that a foreign firm is selling goods in the home (i.e. importing) market at either a *lower price* than in its own market, or if there is no foreign price to observe, then at less than its *average costs* of production. The cases filed in the United States under each of these provisions are also shown in Table 7.1, and it can be seen that the number of these vastly exceeds escape clause cases.

Over 1980-1988, there were more than 400 antidumping cases files in the U.S., and of these, about 150 were rejected and another 150 had duties levied. In order to have duties applies, a case must first go to the Department of Commerce (DOC), which rules on whether imports have occurred as "less than fair value," i.e. below the price or average costs in its own market. These rulings were positive in 94% of cases during this period (Hansen and Prusa, 1995, p. 300). The case is then brought before the ITC, which must rule on whether imports have caused "material injury" to the domestic industry (defined as "harm that is not inconsequential, immaterial, or unimportant"). This criterion is much easier to meet than the "substantial cause of serious injury" provision of Section 201, and as a result, the ITC more frequently rules in favor of antidumping duties. Furthermore, the application of duties does not require the additional approval of the President. These legal factors explain the much greater use of antidumping than the escape clause in the United States, and it is also becoming more commonly used in other countries, as described by Prusa (2001).

There is a surprising third category of antidumping cases shown in Table 7.1: of the roughly 400 cases in the U.S. over this period, about 100 or one-quarter of these were *withdrawn* prior to a ruling by the ITC. What are we to make of these cases? Prusa (1991, 1992) describes how U.S. antidumping law actually permits the U.S. firms to withdraw its case, and then acting through an intermediary at the DOC, agree with the foreign firm on the level of prices and market shares! This type of communication between two American firms would be illegal under U.S. anti-trust law, of course, but is exempted from prosecution in anti-dumping cases under the so-called Noerr-Pennington doctrine. As we would expect, these withdrawn cases result in a significant increase in market prices, with losses for consumers, as will be discussed at the end of the chapter.

Social Welfare

In the previous chapter we were careful to allow for heterogeneous consumers, and considered systems of lump-sum transfers or commodity taxes and subsidies such that everyone could be better off (Pareto gains from trade). It will now be convenient to adopt a simpler measure of overall social welfare, without worrying about whether every individual is better off or not. To construct this we need to have a method to "add up" the utilities of consumers. This will be achieved by assuming that every individual has a quasi-linear utility function, given by

$c_0^h + U^h(c^h)$, where c_0^h is the consumption of a numeraire good, and c^h is the consumption vector of all other goods for consumer h=1,…,H, with U^h increasing and strictly concave. Each consumer maximizes utility subject to the budget constraint $c_0^h + p'c^h \le I^h$.

Let $c^h = d^h(p)$ denote the optimal vector of consumption for each individual, with remaining income spent on the numeraire good, $c_0^h = I^h - p'd^h(p)$. Then we can define social welfare as the sum of individual utilities,

$$W(p,I) \equiv \sum_{h=1}^{H} I^h - p'd^h(p) + U^h[d^h(p)] \ , \qquad (7.1)$$

where total income is $I = \sum_{h=1}^{H} I^h$. Notice that the sum over individuals of the last two terms on the right of (7.1) gives consumer surplus. By the envelope theorem, the derivative of (7.1) is the negative of total consumption, $\partial W / \partial p = \sum_{h=1}^{H} - d^h(p) \equiv -d(p)$. Thus, we can use the social welfare function just like an indirect utility function for the economy as a whole.

Let us further simplify the analysis by supposing that there is only a *single import good* subject to a tariff. Holding the prices of all other goods fixed, we will therefore treat p as a *scalar,* denoting the price of that good in the importing country. Its world price is denoted by the scalar p*, and the difference between these is the *specific* import tariff t, so p = p* + t. We suppose that the numeraire good is also traded, at a fixed world price of unity. Labor is assumed to be the only factor of production, and each unit of the numeraire good requires one unit of labor. It follows that wages in the economy are also unity, so that total income equals the fixed labor supply of L. These assumptions allow the economy to mimic a partial-equilibrium setting, where wages are fixed and trade is balanced through flows of the numeraire good.

Output of the good in question is denoted by the scalar y, which may be produced by competitive or imperfectly competitive firms. We suppose that the industry costs of producing the good are denoted by C(y), with marginal costs $C'(y)$.[1] Imports are denoted by the scalar m = d(p) – y, where $d'(p) < 0$ from the assumption that U^h is strictly concave for all h. We assume that revenue raised from the tariff, tm, is redistributed back to consumers, who are also each entitled to profits from the import-competing industry, which are py – C(y). It follows that social welfare is written as,

$$W[p, L + tm + py - C(y)] \equiv W(t). \tag{7.2}$$

This general expression for social welfare holds under perfect or imperfect competition. In the former case, it is common to refer to profits [py – C(y)] as producer surplus, i.e. the return to fixed factors of production in the industry. In the latter case, we denote profits of the domestic industry by π = py – C(y), and will need to specify how these depend on actions of foreign firms. We will be considering three cases: (i) perfect competition in the home and foreign industries; (ii) foreign monopoly, with no domestic import-competing firms; (iii) duopoly, with one home firm and one foreign firm engaged in either Cournot or Bertrand competition. A fourth case of monopolistic competition is discussed by Helpman (1990), and is not covered here. We begin with perfect competition, where we distinguish a *small importing country*, meaning that the world price p* is fixed even as the tariff varies, and a *large country*, whose tariff affects the foreign price p*.

[1] Under perfect competition C(y) denotes industry costs, and under monopoly it denotes the firm's costs. Under oligopoly with a homogeneous product, we should replace C(y) with NC(y), where N is the number of firms and C(y) is the costs of each. Similarly, we replace sales py in (7.2) by Npy. With free entry and zero profits, we can simply omit the profit term in (7.2) and this amended welfare function still applies. The welfare function with a differentiated import and domestic product will be described later in the chapter.

In each case, we are interested in how social welfare in (7.2) varies with the tariff. To determine this, let us first derive a general expression for the change in welfare. Treating the price p and output y as depending on the tariff, we can totally differentiate (7.2) to obtain:

$$\frac{dW}{dt} = -d(p)\frac{dp}{dt} + m + \left(t\frac{dm}{dp} + y\right)\frac{dp}{dt} + [p - C'(y)]\frac{dy}{dt}$$

$$= m\left(1 - \frac{dp}{dt}\right) + t\frac{dm}{dp}\frac{dp}{dt} + [p - C'(y)]\frac{dy}{dt} \qquad (7.3)$$

$$= t\frac{dm}{dp}\frac{dp}{dt} - m\frac{dp^*}{dt} + [p - C'(y)]\frac{dy}{dt}\ .$$

The second line of (7.3) follows by noting that y – d(p) = m and combining terms, while the third line follows because p = p* + t, so that [1-(dp/dt)] = –dp*/dt.

We will be discussing each of the terms on the last line of (7.3) throughout this chapter, but note here the similarity between these terms and those derived in the previous chapter. The first term on the last line of (7.3) can be interpreted as the efficiency cost of the tariff, much like the term $t^{1\prime}(m^1 - m^0)$ in chapter 6; the second term is the effect of the tariff on the foreign price p*, or the terms of trade effect, like $(p^{*0} - p^{*1})' m^0$ in chapter 6; and the third term reflects the change in industry output times the price-cost margin, like $(p - \tilde{p})'(y - y^a)$ in chapter 6. This third term reflects the fact that with imperfect competition there is a gap between the price or consumer valuation of a product, and the marginal costs to firms. This distortion due to monopolistic pricing creates an efficiency loss, and any increase in domestic output will therefore offset that loss and serve to raise welfare.

Perfect Competition, Small Country

Holding p* fixed, we already argued in the previous chapter that “free trade is better than restricted trade for a small country.” In other words, the optimal tariff is zero. We now provide a more direct demonstration of this result, and also show how the welfare loss due to a tariff can be measured. Under perfect competition profits are maximized when $p = C'(y)$, so the final term in (7.3) is zero. When world prices are fixed and domestic prices given by p = p* + t, then dp*/dt = 0 and dp/dt = 1. Using these various relations in (7.3), we readily obtain:

$$\frac{dW}{dt} = t\frac{dm}{dp} \ . \tag{7.4}$$

Evaluating this expression at a zero tariff, we have:

$$\left.\frac{dW}{dt}\right|_{t=0} = 0 \, . \qquad (7.4')$$

This proves that social welfare has a critical point at a zero tariff, but we still need to determine whether this is a maximum or not. Differentiating (7.4) and evaluating at t = 0,

$$\left.\frac{d^2W}{dt^2}\right|_{t=0} = \frac{dm}{dp} < 0 \, , \tag{7.5}$$

where this sign is obtained because $dm/dp = d'(p) - (1/C'')$, with $d'(p) < 0$ from concavity of the utility functions and $C'' > 0$ from the second-order condition for profit maximization. This proves that the critical point at t = 0 is a local *maximum*, and in fact, it is also a global maximum since with $dm/dp < 0$ then t = 0 is the *only* tariff at which (7.4) equals zero. Therefore, the *optimal tariff for a small country is zero.*

It is relatively easy to obtain an expression for the loss in welfare from applying a tariff. To do so, let us take a second-order Taylor series approximation of welfare, around the free trade point,

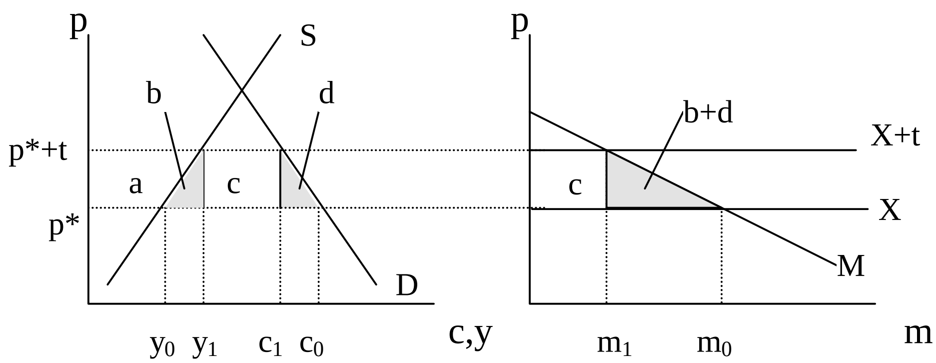
$$W(t) \approx W(0) + t\left.\frac{dW}{dt}\right|_{t=0} + \tfrac{1}{2}t^2\left.\frac{d^2W}{dt^2}\right|_{t=0}. \tag{7.6}$$

Evaluating this using (7.4') and (7.5), we see that,

$$W(t) - W(0) \approx \tfrac{1}{2}t^2\left.\frac{d^2W}{dt^2}\right|_{t=0} = \tfrac{1}{2}t^2\frac{dm}{dp} = \tfrac{1}{2}\Delta p \Delta m < 0 . \tag{7.7}$$

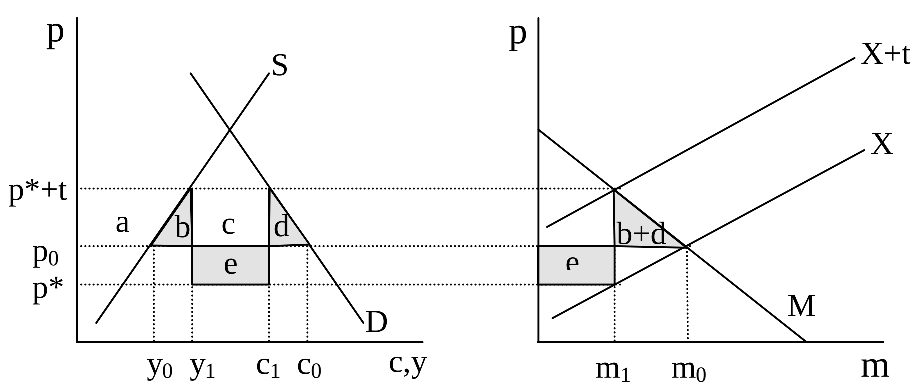
The final expression in (7.7) is negative since the tariff reduces imports, so the welfare loss equals one-half times the increase in price times the change in imports. This loss is illustrated in Figure 7.1. In panel (a) we show the domestic demand curve D and supply curve S, together with the constant world price p*. Under free trade, domestic demand is at c_0 and supply at y_0, so imports are $m_0 = c_0 - y_0$. This is shown in panel (b), which graphs the import demand curve M = D – S. We can think of the fixed world price p* as establishing a horizontal export supply curve X, which intersects M at the equilibrium imports m_0.

With the import tariff of t, the export supply curve shifts up to X + t in panel (b), leading to the equilibrium domestic price of p = p* + t. Thus, the domestic price increases by the full amount of the tariff. In panel (a), this leads to reduced demand of c_1 and increased supply of y_1. The change in welfare in Figure 7.1(a) can be decomposed as: –(a+b+c+d) consumer surplus loss + (a) producer surplus gain + (c) tariff revenue = –(b+d), which is always negative. Area (b+d) is the deadweight loss of the tariff, and also shown as the triangle under the import demand curve in panel (b). The area (d) is interpreted as the consumer surplus loss for those units no



(a) Domestic market (b) Import market

Figure 7.1: Small Country



(a) Domestic market (b) Import market

Figure 7.2: Large Country

longer purchased (i.e. c_0–c_1), while the area (b) is interpreted as the increase in marginal costs (along the supply curve) for the extra units produced (i.e. y_1–y_0).

So we see that the deadweight loss of the tariff can be measured by a triangle under the import demand curve. Since both the height and the base of the triangle depend on the tariff, the area of the triangle itself is of the second-order of smalls for a small tariff, i.e. the deadweight loss in (7.7) depends on the *square* of the tariff. Notice that we can re-write (7.7) to measure the deadweight loss as a fraction of import expenditure:

$$\frac{W(t)-W(0)}{pm} \approx \frac{1}{2}\left(\frac{t}{p}\right)^2\left(\frac{dm}{dp}\frac{p}{m}\right). \tag{7.7'}$$

For example, with a 10% tariff and an import demand elasticity of 2, the deadweight loss relative to import expenditure will be 1%. As is typical for triangle calculations, we see that the deadweight loss is quite small for moderate tariffs. This fact has led many researchers to conclude that a formula like (7.7') does not capture the inefficiencies present in import substitution regimes. We will be investigating some reasons why the deadweight loss of trade restrictions may well be greater than (7.7'). This can occur if foreign firms anticipate the tariffs, as with antidumping duties (discussed later in this chapter), or if quotas are used instead of tariffs (discussed in the next chapter), or due to the effect of tariffs on decreasing the *variety* of import products available. This latter effect has been emphasized by Feenstra (1992) and Romer (1994). Both authors provide simple formulas to compute welfare losses due to a reduction in import varieties, and these are much greater than (7.7'). In addition, Feenstra (1988b) and Klenow and Rodrígruez-Clare (1997) provide estimates of the welfare *gain* due to new import varieties, which can be substantial.

Perfect Competition, Large country

For a large country, we suppose that the world price of imports depends on the tariff chosen, which is written as p*(t). Generally, we define the *terms of trade* as the price of a country's exports divided by the price of its imports, so that a fall in the import price p* is an *improvement* in the terms of trade. We will argue a tariff leads to such an improvement in the terms of trade under perfect competition, as we assume in this section. In the next section we will examine the sign of this derivative under foreign monopoly.

The domestic price of the import good is p = p* + t, so now $dp^*/dt \neq 0$ and $dp/dt \neq 1$. We still have $p = C'(y)$ under perfect competition, so (7.3) becomes,

$$\frac{dW}{dt} = t\frac{dm}{dp}\frac{dp}{dt} - m\frac{dp^*}{dt}. \qquad (7.8)$$

The first term is interpreted as the marginal deadweight loss from the tariff; and the second term is the terms of trade effect of the tariff, i.e. the reduction in the price of p* times the amount of imports. The sign of dp*/dt can be determined from Figure 7.2. In panel (a), we show the domestic demand curve D and supply curve S, which lead to the import demand curve M=D-S in panel (b). Also shown is the foreign supply curve X, which we assume is upward sloping. The initial equilibrium foreign and domestic price is $p_0^* = p_0$. The tariff shift up the export supply curve to X + t, which intersects import demand at the new domestic price p = p* + t. It is clear from the diagram that the increase in the domestic price from p_0 to p* + t is *less than* the amount of the tariff t, which implies that the new foreign price p* is less than its initial value p_0^*. This is a terms of trade gain for the importing country.

Using the result that dp*/dt < 0, we obtain from (7.8),

$$\left.\frac{dW}{dt}\right|_{t=0} = -m\frac{dp^*}{dt} > 0, \tag{7.9}$$

so that a small tariff will necessarily raise welfare. The change in welfare in Figure 7.2 is: –(a+b+c+d) consumer surplus loss + (a) producer surplus gain + (c+e) tariff revenue = e – (b+d). The area e equals the drop in the price p* times the import quantity $m_1 = c_1 - y_1$, which is a precise measure of the terms of trade gain. The deadweight loss triangle (b+d) is still measured by (7.7), and depends on the square of the tariff, so it is of the second-order of smalls. This does not apply to the terms of trade gain e, however, which depends on t rather than t^2. For these reasons, the net welfare gain e – (b+d) is positive for tariffs sufficiently small, while it is negative for large tariffs.

The *optimal tariff t** is computed where (7.8) equals zero:

$$\frac{dW}{dt} = 0 \quad \Rightarrow \quad \frac{t^*}{p^*} = \left(\frac{dp^*}{dt}\frac{m}{p^*}\right) \Big/ \left(\frac{dm}{dp}\frac{dp}{dt}\right) . \tag{7.10}$$

To interpret this expression, we simplify it in two different ways:

(1) Since domestic imports equal foreign exports, then $m = x \;\Rightarrow\; \frac{dm}{dp}\frac{dp}{dt} = \frac{dx}{dt}$.

Substituting this into (7.10) we obtain,

$$\frac{t^*}{p^*} = \left(\frac{dp^*}{dt}\frac{x}{p^*}\right) \Big/ \left(\frac{dx}{dt}\right) = 1 \Big/ \left(\frac{dx}{dp^*}\frac{p^*}{x}\right), \tag{7.11}$$

where the second term is obtained because $\left(\frac{dx}{dt}\Big/\frac{dp^*}{dt}\right) = \frac{dx}{dp^*}$, which is the slope of the foreign export supply curve. Thus, (7.11) states that the *optimal percentage tariff*, t*/p*, equals the *inverse of the elasticity of foreign export supply*.

This is a good formula for comparing the case of a small country, where the elasticity of foreign export supply is infinite and so the optimal tariff is zero, to the large country where the elasticity of foreign export supply is finite and positive, and so is the optimal tariff. Beyond this, however, the formula is not very helpful because there is little that we know empirically about the elasticity of foreign export supply: how "large" does an importing country have to be before it is reasonable to treat the elasticity of foreign export supply as less than infinite? There is no good answer to this question. We therefore turn to a second interpretation of the optimal tariff.

(2) An alternative way of writing (7.10) is to just rearrange terms, obtaining:

$$\frac{t^*}{p} = \left(\frac{dm}{dp}\frac{p}{m}\right)^{-1}\left(\frac{dp^*}{dt}\Big/\frac{dp}{dt}\right) \quad . \tag{7.12}$$

Now the optimal tariff equals the *inverse of the elasticity of import demand supply*, times the ratio of the change in the relative *foreign* and *domestic* price of imports. Since the import demand elasticity is negative, and presuming that dp/dt > 0 (which we will confirm below), then the optimal tariff is positive provided that dp*/dt < 0.

Think about the foreign price p* as being chosen strategically by exporting firms. When these firms are faced with a tariff, how will they adjust the *net of tariff* price p* that they receive? Will they absorb part of the tariff, meaning that dp*/dt < 0 and dp/dt < 1, in an attempt to moderate the increase in the import price p = p* + t? This may well be a profit-maximizing strategy. Generally, we will refer to the magnitude of the derivative dp/dt as the "pass-through" of the tariff: if domestic prices rise by less than the tariff, so that dp/dt < 1, this means that foreign exporters have absorbed part of the tariff, dp*/dt < 0, which is a terms of trade gain. The smaller the pass-through of the tariff, the larger the optimal tariff from (7.12). The nice feature of this formula is that it puts the emphasis on the pricing decisions made by foreign exporters, which is entirely appropriate. We analyze this decision of foreign firms next.

Foreign Monopoly

We turn now to the case of a single foreign exporter, selling into the home market. The idea that this firm does not have any competitors in the home market is not very realistic: tariffs are designed to protect domestic firms, and if there are none, we would not expect a tariff! So the assumption of a foreign monopolist should be thought of as a simplification. Our analysis of this case follows Brander and Spencer (1984a,b).

Let x denote the sales of the exporting firm into the home market, which equals home consumption, so x = d(p). We will invert this expression and work with the inverse demand curve, p = p(x), with $p' < 0$. The price received by the foreign exporter is p* = p(x) – t, so that foreign profits are:

$$\pi^*(x) = x[p(x) - t] - C^*(x), \tag{7.13}$$

where C*(x) are foreign costs. Maximizing this over the choice of x, the first order condition is,

$$\pi^{*\prime}(x) = p(x) + xp'(x) - [C^{*\prime}(x) + t] = 0. \tag{7.14}$$

The term $p(x) + xp'(x)$ is just marginal revenue, while $C^{*\prime}(x) + t$ is marginal costs inclusive of the tariff, and these are equalized to maximize profits.

Totally differentiating (7.14) we obtain $\pi^{*\prime\prime}(x)dx - dt = 0$, so that,

$$\frac{dx}{dt} = \frac{1}{\pi^{*''}(x)} < 0 \quad , \tag{7.15}$$

where the sign is obtained from the second-order condition for profit maximization. It follows that the change in the import price is,

$$\frac{dp}{dt} = p'(x)\frac{dx}{dt} = \frac{p'(x)}{\pi^{*''}(x)} > 0 \; . \tag{7.16}$$

Not surprisingly, the tariff inclusive price $p = p^* + t$ rises. We are interested in whether it rises *less than* the amount of the tariff, i.e. whether the pass-through of the tariff is less than complete. Notice that with $p = p^* + t$, then $dp/dt < 1$ if and only if $dp^*/dt < 0$. Thus, "partial pass-through" of the tariff to domestic prices is equivalent to having the foreign firm absorb part of the tariff, which is a terms of trade gain.

Noting that the numerator and denominator of (7.16) are both negative, then $dp/dt < 1$ if and only if,

$$p'(x) > \pi^{*''}(x) = 2p'(x) + xp''(x) - C^{*''}(x) \, . \tag{7.17}$$

The left side of (7.17) is the slope of the inverse demand curve, while the right side is interpreted as the slope of the marginal revenue curve, $[2p'(x) + xp''(x)]$, less the slope of marginal costs. Suppose that marginal costs are constant, $C^{*''} = 0$. Then (7.17) will hold if and only if,

$$p'(x) + xp''(x) < 0 \, , \tag{7.17'}$$

which guarantees that marginal revenue is steeper than demand. This condition will hold for linear or concave demand curves, or for any demand curve that is not "too convex."

To illustrate these results, in Figure 7.3 we show the initial equilibrium with the domestic and foreign price of p_0. With the increase in the marginal costs due to the tariff t, the import price rises to p_1. Provided that the marginal revenue is *steeper* than demand, we see this increase in price is less than t, so that the *foreign* price received by the exporters falls, $p_1 - t < p_0$. In that case, $dp^*/dt < 0$ and then the optimal tariff from (7.8) is positive. The change in welfare is shown in Figure 7.3 by –(c+d) consumer surplus loss + (c+e) revenue gain = (e–d), which is positive if the tariff is sufficiently small.

If marginal revenue is *flatter* than demand, however, then $dp^*/dt > 0$ and the optimal policy is an *import subsidy*. We regard this as a relatively unusual case, but it is certainly possible. For example, if the elasticity of demand is constant, then since marginal revenue is $mr(x) = p(x)[1-(1/\eta)]$, so we have that $-mr'(x) = -p'(x)[1-(1/\eta)] < -p'(x)$, and it follows that marginal revenue is flatter than demand.

We next check whether an *ad valorem* tariff τ leads to similar results. The net of tariff price received by the foreign exporters is now $p^* = p(x)/(1+\tau)$, so that profits are:

$$\pi^*(x) = \frac{xp(x)}{(1+t)} - C^*(x). \tag{7.18}$$

Maximizing this over the choice of x, the first order condition is $p + xp' = (1+\tau)C^{*\prime}$, which can be written as,

$$p(x)\left(1 - \frac{1}{\eta}\right) = (1+\tau)C^{*\prime}(x), \tag{7.19}$$

using the elasticity $\eta(x) = (dx/dp)(p/x) = p/xp'(x)$.

It is straightforward to show that $dx/d\tau < 0$ and $dp/d\tau > 0$, as with the specific tariff. To

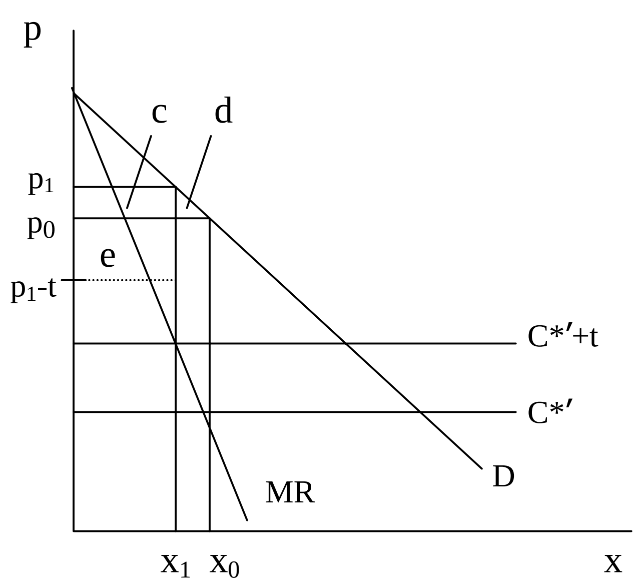


Figure 7.3

determine the change in the foreign price p*, rewrite (7.19) as,

$$p^* = \frac{p(x)}{(1+\tau)} = \left(\frac{\eta}{\eta-1}\right)C^{*\prime}(x) \quad . \tag{7.19'}$$

Consider the case where the exporter's marginal costs $C^{*\prime}(x)$ are constant. Then differentiating (7.19'), we obtain,

$$\frac{dp^*}{d\tau} = \left[\frac{\eta'}{\eta-1} - \frac{\eta\eta'}{(\eta-1)^2}\right]\frac{dx}{d\tau}C^{*\prime} = -\frac{\eta'(x)}{(\eta-1)^2}\frac{dx}{d\tau}C^{*\prime} \quad . \tag{7.20}$$

Using the fact that $dx/d\tau < 0$, we see that $dp^*/d\tau < 0$ when $\eta'(x) < 0$, meaning that the elasticity of demand *increases* as consumption of the importable falls. In that case the tariff leads to a fall in the price-cost margin set by the foreign exporter, so that p* falls, which is a terms of trade gains for the importer. Thus, we summarize our results with:

Theorem (Brander and Spencer, 1984a,b)

When the home country imports from a foreign monopolist with constant marginal costs, then:

(a) a small specific tariff raises home welfare if marginal revenue is steeper than demand;

(b) a small *ad valorem* tariff raises home welfare if the elasticity of demand increases as consumption of the importable falls. In both cases, the optimal tariff is positive.

Notice that the condition the $\eta'(x) < 0$ in part (b) is identical to the assumption on the elasticity of demand used by Krugman (1979), as discussed at the beginning of chapter 5. This case applies for linear or concave demand curves, and more generally, any curve that is "less convex" than a constant-elasticity demand curve.

Cournot Duopoly

Let us now introduce a domestic firm that is competing with the foreign firm in the domestic market. We will have to specify the strategic variables chosen by the firms, and will assume Cournot competition in quantities in this section, and Bertrand competition in prices in the next. To avoid covering too many cases, we will focus on *specific* tariff with Cournot competition, and the *ad valorem* tariff with Bertrand competition. To preview our results in this section, we confirm the finding of Helpman and Krugman (1989, section 6.1) that a positive tariff is very likely to be the optimal policy under Cournot duopoly.

We let x denote the sales of the foreign exporter in the domestic market, and y denote the sales of the home firm, so total consumption is z = x + y. As before, we invert the demand curve z = d(p) to obtain inverse demand p = p(z), with $p' < 0$. Profits of the foreign and home firms are then,

$$\pi^* = x[p(z) - t] - C^*(x), \tag{7.21a}$$

$$\pi = yp(z) - C(y), \tag{7.21b}$$

Maximizing these over the choice of x and y, respectively, the first order conditions are:

$$\pi^*_x = p(z) + xp'(z) - [C^{*\prime}(x) + t] = 0. \tag{7.22a}$$

$$\pi_y = p(z) + yp'(z) - C'(y) = 0. \tag{7.22b}$$

The second-order conditions are $\pi^*_{xx} = 2p' + xp'' - C^{*\prime\prime} < 0$ and $\pi_{yy} = 2p' + yp'' - C'' < 0$. In addition, we assume that the stability condition $\pi^*_{xx}\pi_{yy} - \pi^*_{xy}\pi_{yx} > 0$ holds.

Using (7.22a), we can solve for foreign exports x as a function of domestic sales y, written as the reaction curve x =r*(y, t). From (7.22b), we can also solve for domestic output y as a function of foreign sales x, written as a reaction curve y = r(x). These reaction curves are graphed as R*R* and RR in Figure 7.4, and their intersection determines the Cournot equilibrium denoted by point C. The typical property of these reaction curves is that they are both downward sloping. For stability, the home reaction curve RR needs to cut the foreign reaction curve R*R* from above, as illustrated.[2] Notice that the iso-profit curves of π have higher profits in the downwards direction (i.e. for reduced x), and similarly the iso-profit curve π^* have higher foreign profits in the leftward direction (for reduced y), as illustrated.

With the tariff, the foreign firm will reduce the amount it wishes to export (from (7.22b), $dx/dt = 1/\pi^*_{xx} < 0$), and its reaction curve shifts down to $R'R'$, as shown in Figure 7.5. The equilibrium therefore shifts from point C to point D, involving reduced sales of export sales x but increased domestic sales y, together with increased home profits. To determine the effect on the domestic prices we need to calculate the impact on *total sales* z = x + y, and then on p(z). To determine this, it is convenient to sum the first-order conditions, obtaining,

$$2p(z) + zp'(z) = C'(y) + [C^{*\prime}(x) + t]. \tag{7.23}$$

Suppose that domestic and foreign marginal costs are *both constant*. Then we can totally differentiate (7.23) to obtain:

$$\frac{dz}{dt} = \frac{1}{[3p'(z) + zp''(z)]} \quad , \tag{7.24a}$$

and,

$$\frac{dp}{dt} = \frac{p'(z)}{[3p'(z) + zp''(z)]}. \tag{7.24b}$$

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[2] In problem 7.2, you are asked to derive these properties of the reaction curves.

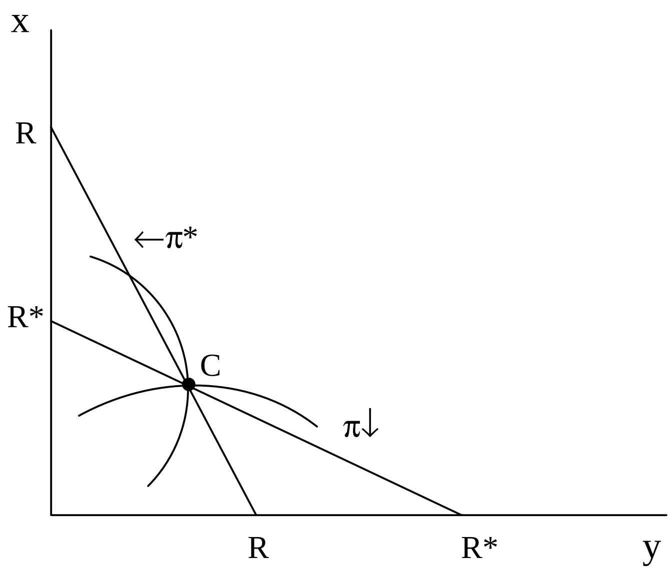

Figure 7.4

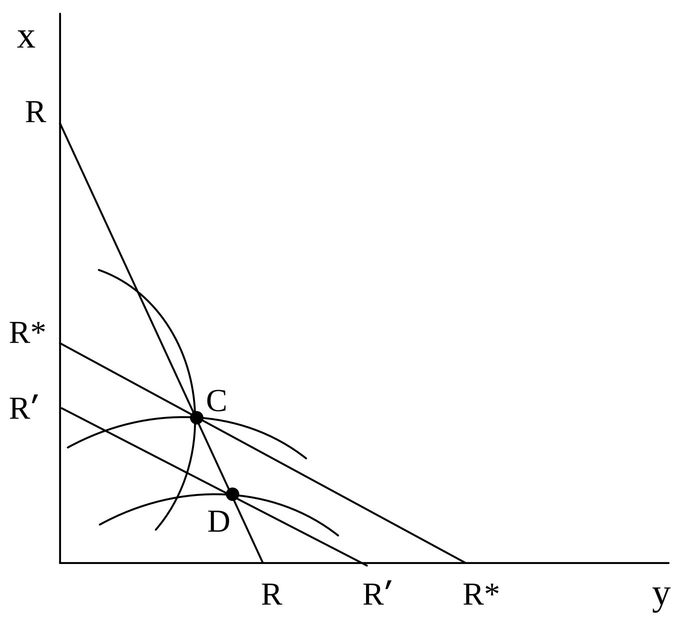

Figure 7.5

From (7.24a) we see that imports fall due to the tariff if $3p'(z) + zp''(z) < 0$. In that case the numerator and denominator of (7.24b) are both negative, so that dp/dt < 1 if,

$$p'(z) > 3p'(z) + zp''(z) \quad \Leftrightarrow \quad 2p'(z) + zp''(z) < 0. \tag{7.25}$$

The condition on the right of (7.25) states that marginal revenue for the market as a whole, which is $p(z) + zp'(z)$, *slopes down*. This is a significantly weaker condition than (7.17'), which involved a comparison of the slopes of marginal revenue and demand; now, we only need to check the slope of marginal revenue, and most demand curves will satisfy (7.25). This includes the constant elasticity curve, for which $mr'(z) = p'(z)[1-(1/\eta)] < 0$. When (7.25) is satisfied, then dz/dt < 0 in (7.24) and dp/dt < 1 in (7.24a), so there is a beneficial terms of trade impact (dp*/dt < 0) for the importing country.

Checking social welfare, we again use the general change in social welfare in (7.3), rewritten here using foreign exports (x) rather than home imports (m):

$$\frac{dW}{dt} = t\frac{dx}{dt} - x\frac{dp^*}{dt} + [p - C'(y)]\frac{dy}{dt}, \tag{7.3'}$$

where the final term reflects the change in domestic output from equilibrium point C to point D. The first term on the right of (7.3) vanishes for small tariffs, and the second term is positive when (7.25) holds, so that a positive tariff improves the terms of trade. For the third term, in the typical case where both reaction curves are downward sloping, with the home curve cutting the foreign curve from above as shown in Figure 7.5, then we will have dy/dt > 0: the tariff will lead to an increase in domestic output, which brings an additional terms of trade gain. In this case, the optimal tariff is unambiguously positive.

However, the typical pattern of the reaction curves shown in Figure 7.5 need not hold, and it is possible that the home curve slope upwards instead, in which case dy/dt < 0, so the tariff *reduces* home output. This will tend to offset the terms of trade gains due to the tariff. With constant marginal costs, it can be shown that this case is avoided, so that dy/dt > 0, provided that $p'(z) + yp''(z) < 0$.[3] This condition states that "perceived" marginal revenue for the foreign firm, $p(z) + yp'(z)$, is steeper than the demand curve p(z), and is somewhat weaker than (7.17').

Combined with our finding that dp/dt < 1 when (7.25) holds, so that dp*/dt < 0, we therefore have two distinct reasons why a tariff will raise social welfare: the terms of trade effect; and the efficiency effect, whereby the tariff moves the home firm to a higher level of output at point D and offsets the distortion between price and marginal cost.

The idea that imperfect competition might justify the "strategic" use of trade policy was an area of very active research during the 1980s. In the tariff case we are discussing, it is tempting to refer to the last term in (7.3) as a "profit shifting" motive for the use of tariffs, suggesting that a "strategic" use of tariffs is to shift profits towards the home firm. But this terminology must be interpreted with caution. There is no direct relation between the sign of the last term in (7.3) and the change in profits for the domestic firm. In the case we are considering, profits of the home firms *always* rise from point C to point D due to the tariff, but nevertheless, the last term in (7.3) can be positive or negative.[4]

In addition, Horstmann and Markusen (1986) argue the "profit shifting" motive for the tariff disappears if there is *free entry* into the domestic industry with Cournot competition. That is, suppose we allow free entry of home firms. Then the tariff, which would cause an incipient

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[3] You are asked to prove this in problem 7.3.
[4] See problem 7.3.

rise in profits, leads to the entry of domestic firms until profits are returned to zero. Domestic welfare is written in this case as, $W[p, L + tm + N(py - C(y))]$, where N is the number of domestic firms, but with profits equal to zero this becomes W(p,L + tm). Differentiating this with respect to the tariff t, we obtain the total change in utility:

$$\frac{dW}{dt} = -d(p)\frac{dp}{dt} + m + t\frac{dm}{dp}\frac{dp}{dt} . \qquad (7.26)$$

This very simple expression is the alternative to (7.3) when profits are identically zero. For small tariffs, the final term vanishes, so the change in welfare depends on a comparison of the first two terms. It is immediate that welfare of the importing country increases for a small tariff if and only if $dp/dt < m/d(p)$. The interpretation of this condition is that the pass-through of the tariff to domestic prices must be *less than* the import share m/d(p). Thus, having a terms of trade gain due to the tariff (meaning that $dp/dt < 1$) is no longer sufficient to obtain a welfare improvement; instead, we must have $dp/dt < m/d(p)$. We will be reviewing estimates of the pass-through later in the chapter, and it is not unusual to find that 50 – 75% of a tariff is reflected in the import price. Under Cournot competition and free entry, this would be welfare improving (due to tariff revenue raised) only in an industry where the import share *exceeds* this magnitude.

Bertrand Duopoly

We turn next to the case of Bertrand competition between the home and foreign firm, where they are choosing prices as strategic variables. If the domestic and imported good are perfect substitutes, as we assumed in the previous section, then Bertrand competition leads to marginal cost pricing. To avoid this case, we will suppose that the domestic and import good are *imperfect substitutes*, with the price of the import good denoted by p and the domestic good by q.

Let us momentarily depart from our assumption at the beginning of this chapter that there is an additively separable numeraire good that absorbs all income effects, and instead model demand for the domestic good as y = d(p,q,I), and demand for the imported good as x = d*(p,q,I), where I is the expenditure on both of these goods. We will treat this expenditure as constant, though this is a strong assumption and will be weakened below. Both these demand functions should be homogeneous of degree zero in prices and expenditure I.

With an *ad valorem* tariff of τ on imports, their domestic price is p=p*(1+τ). So profits of the foreign and home firms are:

$$\pi^* = \frac{pd^*(p,q,I)}{(1+\tau)} - C^*[d^*(p,q,I)]. \tag{7.27a}$$

$$\pi = qd(p,q,I) - C[d(p,q,I)], \tag{7.27b}$$

Maximizing these over the choice of p and q, respectively, treating total expenditure I as fixed, the first-order conditions $\pi_p^* = \pi_q = 0$ can be simplified as:

$$p\left(1 - \frac{1}{\eta^*}\right) = (1+\tau)C^{*\prime}[d^*(p,q,I)], \tag{7.28a}$$

$$q\left(1 - \frac{1}{\eta}\right) = C'[d(p,q,I)], \tag{7.28b}$$

where $\eta^* \equiv -(\partial d^*(p,q,I)/\partial p)(p/d^*)$ and $\eta \equiv -(\partial d(p,q,I)/\partial q)(q/d)$ are the (positive) elasticities of import and domestic demand, respectively. The second-order conditions are $\pi_{pp}^* < 0$ and $\pi_{qq} < 0$, and for stability we require that $\pi_{qq}\pi_{pp}^* - \pi_{qp}\pi_{pq}^* > 0$.

Given the domestic price q, income I and the tariff, we can use (7.28a) to solve for the tariff-inclusive import price p, obtaining the reaction curve $p = r^*(q, \tau)$. In addition, given the tariff-inclusive import price p and income I, we can use (7.28b) to solve for the domestic price q, obtaining the reaction curve $q = r(p)$. The intersection of these determines the Bertrand equilibrium, at point B in Figure 7.6. The iso-profit curves of π have higher profits in the rightward direction (i.e. for higher p), and similarly the iso-profit curve π^* have higher foreign profits in the upward direction (for higher q), as illustrated. To derive the properties of the reaction curves, it is helpful to simplify the elasticities of demand. If the demand functions d and d* have income elasticities of unity, then it turns out that a change in income I does not affect the elasticities at all, nor the reaction curves. It follows that the elasticities can be written as functions of the *price ratio* of p and q, or $\eta^*(p/q)$ and $\eta(q/p)$.[5]

The assumption that we used earlier to ensure that the *ad valorem* tariff led to a fall in the import price p*, or a terms of trade gain, was that the elasticity of demand was decreasing in *quantity*. Since we are now thinking of the elasticities as function of relative prices, the analogous assumption would be $\eta^{*\prime}(p/q) > 0$ and $\eta'(q/p) > 0$; that is, elasticities increase as the *relative price* of that good rises. Treating foreign and domestic marginal costs as constant in (7.29), this assumption will ensure that both reaction curves $p = r^*(q, \tau)$ and $q = r(p)$ slope upwards, as shown in Figure 7.6. As the relative price of the competing good rises, the elasticity falls, and each firm will charge a higher price for their own good. Furthermore, there is a *dampened* response of each price to that of the competing good, so that $\frac{dp}{dq}\frac{q}{p} = r_q^*(q,\tau)\frac{q}{p} < 1$,

[5] See problem 7.4 to prove these properties of the elasticities.

and $\frac{dq}{dp}\frac{p}{q} = r_p(p)\frac{p}{q} < 1.$[6]

Suppose that the *ad valorem* tariff τ increases. From the second-order conditions for profit maximization, we will have an increase in the tariff-inclusive import price p, from (7.30a). In Figure 7.7, the foreign reaction curve shifts rightward to R′R′. This leads to an induced increase in the domestic price q, and a further increase in the import price p, until the new equilibrium is reached at point D. We are interested in whether the percentage increase in p is *less than* the amount of the tariff, that is, $(dp/d\tau)(1+\tau)/p < 1$, which will ensure that $dp^*/d\tau < 0$ so that there is a terms of trade gain.[7] It turns out that the assumptions we have already made, that $\eta^{*\prime}(p/q) > 0$ and $\eta'(q/p) > 0$, are enough to guarantee this outcome. These conditions are analogous to what we used above to ensure that the *ad valorem* tariff on a foreign monopolist led to a fall in the import price p*, or a terms of trade gain. Thus, whether there is a single foreign firm, or a duopoly in the import market, the key condition to ensure a terms of trade gain is that the elasticity of demand is increasing in price or decreasing in quantity. This condition holds for any demand curve that is "less convex" than a constant-elasticity demand curve.

To demonstrate the effect of the tariff on p*, write the import price *net* of the tariff as $p^* = p/(1+\tau)$. From (7.28a) this equals,

$$p^*\left(1 - \frac{1}{\eta^*}\right) = C^{*\prime}. \tag{7.29}$$

Totally differentiate this holding marginal cost constant, to obtain:

[6] In problem 7.5 you are asked to demonstrate these properties of the reaction curves.

[7] Notice that with $p=p^*(1+\tau)$, then $dp/d\tau = p^* + (1+\tau)dp^*/d\tau$, so $(dp/d\tau)(1+\tau)/p = 1 + (dp^*/d\tau)(1+\tau)/p^*$. Therefore, if $(dp/d\tau)(1+\tau)/p < 1$ then $dp^*/d\tau < 0$.

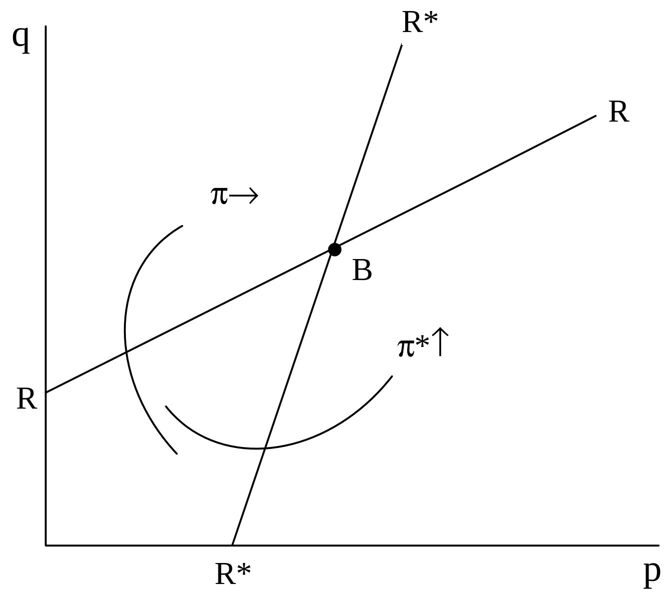

Figure 7.6

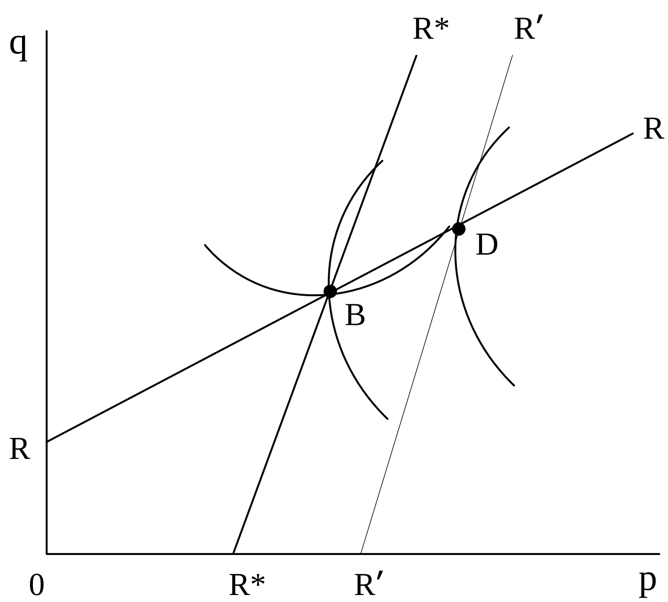

Figure 7.7

$$\frac{dp^*}{d\tau}\left(1-\frac{1}{\eta^*}\right)+\left(\frac{\eta^{*\prime}}{\eta^{*2}}\right)\frac{d(p/q)}{d\tau}=0 \Rightarrow \frac{dp^*}{d\tau}=-\left[\frac{\eta^{*\prime}}{\eta^*(\eta^*-1)}\right]\frac{d(p/q)}{d\tau} . \qquad (7.30)$$

Since we have assumed that $\eta^{*\prime} > 0$, we see that $dp^*/d\tau < 0$ provided that $d(p/q)/d\tau > 0$, that is, provided that the tariff leads to a higher increase in the price of the importable than the domestic good. But this condition is easily confirmed from Figure 7.7. With a rightward shift of the foreign reaction curve, and a dampened response of the domestic price q, the new equilibrium given by point D will lie *below* a ray from the origin going through the initial equilibrium given by point B. In other words, the relative price of the importable (p/q) must rise, and it follows from (7.30) that the net-of-tariff foreign price falls, which is a terms of trade gain for the importer.

To calculate the change in social welfare under Bertrand duopoly, we re-write the social welfare function as $W[p, q, L+\tau p^* x + qy - C(y)]$, including both the import price $p = p^*(1+\tau)$ and domestic price q. Totally differentiating this, and using similar steps as in (7.3), we find that the welfare change due to the change in the *ad valorem* tariff is:

$$\frac{dW}{d\tau}=\tau p^*\frac{dx}{d\tau}-x\frac{dp^*}{d\tau}+[q-C'(y)]\frac{dy}{d\tau}. \qquad (7.31)$$

The first term on the right of (7.31) vanishes for small tariffs, and the second term is positive when $\eta^{*\prime}(p/q) > 0$ and $\eta'(q/p) > 0$, so there is a terms of trade gain. The third term in (7.31) depends on the change in equilibrium output from point B to point D, and is of ambiguous sign in general: the increase in prices from point B to point D reduces demand, while the fall in (p/q) shifts demand towards the domestic good, so the effect on domestic output depends on the relative strength of these effects. It turns out that if the increase in domestic price is not too large, then an increase is domestic output occurs. The condition to ensure this is that the elasticity of the home reaction curve does not exceed $\frac{dq}{dp}\frac{p}{q} = r_p(p)\frac{p}{q} < \left(\frac{\eta - 1}{\eta}\right)$.[8] In that case, domestic output increases due to the tariff, which generates a welfare gain additional to the terms of trade gain.

The finding that domestic output may rise due to the tariff depends on our maintained assumption that total expenditure I on the import and domestic products is *constant*. This would apply, for example, with a Cobb-Douglas utility function between an aggregate of the products (d, d*) and all other goods in the economy, but would not be true otherwise. Generally, total expenditure on the import and domestic products can *rise or fall* due to the tariff, and the latter case could lead to a fall in domestic output and a welfare loss.[9] So the "profit shifting" motive for import protection is not that robust, as we also found under Cournot competition. Instead, the terms of trade motive for tariffs becomes the best indicator of gain or loss for the importing country. Under our assumptions that the elasticity of demand is *increasing* in price or decreasing in quantity, there is a terms of trade gain for the importer, and the optimal tariff is positive for that reason. Conversely, with constant elasticities of demand the optimal tariff is zero. Finally, in the somewhat unusual case where the elasticity of demand is *decreasing* in price or increasing in quantity, then an import subsidy is optimal.

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[8] See problem 7.6.

[9] The change in domestic output due to tariffs is investigated in a monopolistic competition model by Helpman (1990), using a utility function that allows for expenditure on the differentiated good to change. He confirms that output of the domestic good can rise or fall due to the tariff. The latter possibility was first suggested by Markusen (1990), who referred to the phenomena as a "de-rationalizing tariff." This might hold, for example, if the imported goods are intermediate inputs, and the tariff leads to reduced sales of the industry using the inputs. This was found to hold in a simulation model of the Mexican automobile industry by Lopez de Silanes, et al (1994).

Tariffs on Japanese Truck and Motorcycles

We have found that with imperfect competition, a terms of trade argument for a tariff is likely but not guaranteed. The "strategic" response of foreign firms in adjusting their price p* then becomes an interesting empirical question. Feenstra (1989) provides some empirical evidence on this for two U.S. tariffs initially applied during the early 1980s: a 25% tariff on imports of compact trucks, coming from Japan; and a temporary, declining tariff beginning at 45% on imports of heavyweight motorcycles from Japan. The history of how these tariffs came to be applied is itself an important lesson in trade policy.

In 1979, Paul Volcker was appointed as Chairman of the Board of Governors of the Federal Reserve Bank in the United States. Inflation exceeded 10%, and showed signs of getting worse, so Volcker was committed to bring this down. A period of tight monetary policy followed, which led to very high interest rates, a strong dollar and a deep recession beginning in January 1980. There may well have been long-term gains resulting from this policy, since following the recovery from the recession in late 1982, the U.S. began nearly two decades of expansion, interrupted only by a mild recession in 1990-91. But at the same time, there were short-term costs in terms of unemployment, and one of the sectors hardest hit was automobiles.

Accordingly, in June 1980 the United Automobile Workers applied to the ITC for protection, under Section 201 of U.S. trade laws. A similar petition was received in August 1980 from Ford Motor Company. As described at the beginning of the chapter, Section 201 protection can be given when increased imports are a "substantial cause of serious injury to the domestic industry," where "substantial cause" must be "not less than any other cause." In fact, the ITC determined that the U.S. recession was a more important cause of injury in autos than were increased imports. Accordingly, it *did not* recommend that the auto industry receive protection.

With this negative determination, several congressmen from mid-western states continued to pursue import limits by other means. For cars imported for Japan, this protection took the form of a "voluntary" restraint on the quantity of imports, as described in the next chapter. For trucks imported from Japan, however, another form of protection was available. During the 1970s, Japan had exported an increasing number of compact trucks to the U.S., most as cab/chassis with some final assembly needed. These were classified as "parts of trucks," which carried a tariff rate of 4%, whereas "complete or unfinished trucks" carried a tariff rate of 25%. That unusually high tariff was a result of the "Chicken War" between the U.S. and West Germany in 1962. At that time, Germany joined the European Economic Community (EEC), and was required to adjust its external tariffs to match those of the other EEC countries. This resulted in an increase in its tariff on poultry, which was imported from the United States. In retaliation, the U.S. increased its tariffs on "complete or unfinished trucks" and other products, so the 25% tariff on trucks became a permanent item of the U.S. tariff code. With prodding from the Congress, in 1980 the U.S. Customs Service announced that effective August 21 import lightweight cab/chassis would be reclassified as complete trucks. This raised the tariff rates on nearly all Japanese trucks from 4% to 25%, which remains in effect today.[10]

A second increase in tariffs occurred during the 1980s on heavyweight motorcycles (i.e. over 700 cc displacement), produced by Harley-Davidson. That company also applied to the ITC for Section 201 protection, in 1983. It was being impacted not so much by the U.S. recession, as from a long period of lagging productivity combined with intense competition from Japanese producers. Two of these (Honda and Kawasaki) had plants in the U.S. and also imported, whereas two others (Suzuki and Yamaha) produced and exported from Japan. In the

[10] Japanese producers sued in U.S. court to have the reclassification reversed, but lost that case.

early 1980s, these firms were engaged in global price war that spilled over into the U.S. market. As a result, inventories of imported heavyweight cycles rose dramatically in the United States: the ITC estimated that inventories as of September 1982 exceeded actual U.S. consumption during January – September of that year (USITC, 1983, p. 13).

From our description of Section 201 at the beginning of the chapter, recall that protection can be recommended if increased imports are a "substantial cause of serious injury, *or threat thereof*, to the domestic industry." The very high level of inventories held by Japanese producers was judged by the ITC to be a threat to the domestic industry, and protection was indeed granted. This protection took the form of a five-year declining tariff schedule: 45% effective April 16, 1983, and then declining annually to 35%, 20%, 15% and 10%, and scheduled to end in April 1988.[11] In fact, Harley-Davidson petitioned the ITC to end the tariff early, after the 15% rate expired in 1987, by which time it had cut costs and introduced new and very popular products, so profitability had been restored.

U.S. imports of compact trucks and heavyweight cycles from Japan provide ideal industry cases to study the pass-though of the tariffs to U.S. prices. We are especially interested in whether Japanese producers absorbed part of the tariff, which would be a terms of trade gain for the United States, or whether they fully passed it through to U.S. prices. There are few studies of the pass-through of tariffs, but many studies of the pass-through of exchange rates, i.e. the response of import prices to change in the value of the exporter's currency. Most studies at either the aggregate or disaggregate level suggest that the pass-through of exchange rates is *less*

[11] Actually, the protection took the form of a "tariff-rate quota," which means that the declining tariffs rates were applied to imports of heavyweight motorcycles from each source country when imports *exceeded* a quota limit for the exporting country. The U.S. was also importing heavyweight cycles from BMW in Germany, but that country was granted a quota large enough that none of the imports were subject to the tariff. In contrast, Japan was allocated a quota (ranging from 6,000 to 10,000 units per year) that was less than its imports, so that declining tariffs applied to all imports in excess of this amount.

than complete, and averages about 0.6 (Goldberg and Knetter, 1997, p. 1250), though this depends on the industry being studied.[12] We will argue below that the pass-through of tariffs and exchange rates ought to be "symmetric" in a given industry, and will test this hypothesis for trucks and motorcycles. In addition, we will include U.S. import of Japanese cars before the VER in our sample, though for that product we will only estimate the pass-through of the exchange rate.

Estimating the Terms of Trade Effect

To obtained an estimating equation, let us begin with the first-order condition of a typical foreign exporter, in (7.28a), where we treat foreign marginal costs $C^{*\prime}$ as constant, and re-write this as c*, in the foreign currency. We need to convert this to the domestic currency using an expected exchange rate e, so we re-write (7.28a) as:

$$p\left(1-\frac{1}{\eta^*}\right)=(1+\tau)ec^*. \qquad (7.32)$$

Using the assumption that the income elasticity of demand is unity, we express the elasticity of import demand, $\eta^*(p/q)$, as a function of the import/domestic price ratio. More generally, $\eta^*(p,q,I)$ will depend on consumer income, too, but is homogeneous of degree zero in (p,q,I).[13] So treating the domestic price, income, tariff rate, exchange rate and foreign marginal cost as parameters, (7.32) is one equation in one unknown – the import price p. We can therefore solve for the import prices as a function of the parameters,

[12] The disaggregate results of Knetter (1989, 1993) show that exchange rate pass-through varies quite substantially across products and source countries, with U.S. exporters absorbing the *least* of any exchange rate change. In recent work, Campa and Goldberg (2002) investigate the pass-through of exchange rates in broad import sectors of the OECD countries, and find average long run elasticities ranging from 0.61 – 0.89 across sectors.

[13] See problem 7.4.

$$p = \phi[(1+\tau)ec^*, q, I]. \tag{7.33}$$

With $\eta^*(p,q,I)$ homogeneous of degree zero in (p,q,I), it is readily verified that $\phi[(1+\tau)ec^*, q, I]$ is homogeneous of degree one in its arguments. This is our first testable hypothesis, which checks the overall specification of the pricing equation. Second, notice that we have written the tariff, exchange rate and marginal costs as multiplied together in the arguments of $\phi[(1+\tau)ec^*, q, I]$, because that is how they appear in the first-order condition (7.32). This is another testable hypothesis. To implement both these tests, let us specify (7.33) as a log-linear function of its arguments, which are indexed by time t:

$$\ln p_t = \alpha_t + \sum_{i=0}^{L} \beta_i \ln\left(c_t^* s_{t-i}\right) + \beta \ln(1+\tau_t) + \sum_{j=1}^{M} \gamma_j \ln q_{jt} + \delta \ln I_t + \varepsilon_t . \tag{7.34}$$

The first term on the right of (7.34), α_t, is a simple quadratic function of time, which will allow import price to change in a smooth fashion for reasons not specified elsewhere in the equation. To obtain the second term, we specify that the expected exchange rate e_t is a weighted average of lagged spot rates, s_{t-i}, i = 0,1,…,L (in $/yen). This allows us to write $\ln(c_t^* s_{t-i})$ as having the coefficients β_i, i = 0,1,…,L, the *sum* of which will indicate the *total* pass-through of the exchange rate to import prices. Next, we write the *ad valorem* tariff $\ln(1+\tau_t)$ as having the coefficient β, which is the pass-through of the tariff. The hypothesis of *symmetric pass-through* of the tariff and exchange rate is therefore tested as:

$$\sum_{i=0}^{L} \beta_i = \beta \ . \tag{7.35a}$$

The next terms appearing on the right of (7.34) are the price of domestic or rival import products, j=1,…,M. For Japanese imports, this would include the average price of U.S. products, as well as German imported cars or motorcycles. Finally, total consumer expenditure on the broad category of transportation equipment is included as a measure of "income." Notice that if the income elasticity of demand is unity, then the foreign elasticity $\eta^*(p/q)$ does not depend on I, and neither will the optimal price p_t in (7.34), so $\delta=0$. In any case, the hypothesis that the whole equation is homogeneous of degree one can be tested by:

$$\sum_{i=0}^{L} \beta_i + \sum_{j=1}^{M} \gamma_j + \delta = 1 \qquad (7.35b)$$

The results of estimating (7.34) using quarterly data for U.S. imports are shown in Table 7.2. The first row indicates the sample period of quarterly data used for each product. There are two distinct samples used for heavyweight motorcycles. The first sample consists of *interview* data reported by the United States ITC (1983, Table 8 and 1983-84). The advantage of this data is that it gives the unit-value of imports for *consumption*, inclusive of duty, for the major Japanese importers (Honda, Suzuki and Yamaha). However, the disadvantage is that the data end in 1984:4 and include a small amount of German heavyweight motorcycles within the reported unit-value. A second source was collected at the border by the U.S. Dept of Commerce giving the unit-value of imports *shipments*, distinguishing Japanese and German heavyweight cycles up to 1987:1.[14] We experiment with both data sources, and also the pooled sample.

In the first regression of Table 7.2 for Japanese imported cars, the coefficients on the exchange rate terms sum to 0.71, which is the estimate of the pass-through elasticity. For Japanese imported trucks, the sum of coefficients on the exchange rates is 0.63, while the

[14] Import shipments include motorcycles going into inventory. These data were adjusted to include the tariff.

Table 7.2: Regressions for Japanese Imported Products
Dependent Variable – Import Price

	Cars	**Trucks**	**Cycles (consumption)**	**Cycles (shipments)**	**Cycles (pooled)**
Period:	74.1-81.1	77.1-87.1	78.1-84.4	78.1-87.1	78.1-87.1
$c^*_t s_t$	0.44*	0.28*	0.29	0.80	0.45*
	(0.11)	(0.06)	(0.26)	(0.72)	(0.21)
$c^*_t s_{t-1}$	0.32*	0.14*	0.17*	-0.042	0.10
	(0.04)	(0.03)	(0.10)	(0.28)	(0.09)
$c^*_t s_{t-2}$	0.17*	0.06	0.12	-0.34	-0.031
	(0.08)	(0.050)	(0.15)	(0.57)	(0.16)
$c^*_t s_{t-3}$	-0.01	0.05	0.12	-0.083	0.042
	(0.05)	(0.03)	(0.08)	(0.23)	(0.087)
$c^*_t s_{t-4}$	-0.21*	0.10	0.19	0.72	0.32
	(0.10)	(0.08)	(0.23)	(0.82)	(0.22)
Exchange rate[a]	0.71*	0.63*	0.89*	1.05*	0.89*
	(0.10)	(0.08)	(0.36)	(0.56)	(0.22)
Tariff	-	0.57*	0.95*	1.39*	1.13*
	-	(0.14)	(0.22)	(0.30)	(0.16)
U.S. price	1.00	0.03	0.68	1.14	0.57
	(0.93)	(0.40)	(0.60)	(2.17)	(0.59)
German price	0.08	-	0.06	0.12	0.06
	(0.09)	-	(0.11)	(0.23)	(0.11)
Income	-0.03	-0.03	-0.23	-0.23	0.02
	(0.12)	(0.06)	(1.69)	(0.65)	(0.01)
N, K[b]	29, 9	41, 9	28, 13	37, 13	65, 13
R^2	0.988	0.989	0.907	0.769	0.833
Durbin-Watson	2.43	1.75	2.73	1.69	-

Notes:

*Significant at the 95% level with conventional t-test. Standard errors are in parentheses.

[a] Sum of coefficients for $\ln(c^*_t s_{t-i})$, i=0,1,…,4, where c^*_t is an aggregate of foreign factor prices, and s_{t-i} is the spot exchange rate ($/yen).

[b] N is the number of observation and K the number of independent variables. Coefficients for time trends and quarterly dummies are not reported.

coefficient on the tariff is 0.57. The hypothesis (7.35a) that these are equal is easily accepted, as is hypothesis (7.35b) that the pricing equation is homogeneous of degree one. When both of these restrictions are imposed then the pass-through elasticity (for the exchange rate or the tariff) becomes 0.58. Thus, there is strong evidence that the increase in the truck tariff was only partially reflected in U.S. prices: of the 21% increase, about $0.58 \cdot 21 = 12\%$ was passed through to U.S. prices, whereas the other 9% was absorbed by Japanese producers, leading to a terms of trade gain for the United States.

For Japanese imports of heavyweight motorcycles, however, the story is quite different. Regardless of which sample is used (consumption, shipments, or pooled), we find that the pass-through of the exchange rate or the tariff are both insignificantly different from *unity!* So while the hypothesis (7.35a) of "symmetric" pass-through is still confirmed, as is (7.35b), it is no longer the case that the United States experienced a terms of trade gain in this product. Rather, the *full amount* of the tariff in each year was passed through to U.S. prices.

What explains the differing results for compact trucks and heavyweight motorcycles? In the case of trucks, we note that prior to the increase of the tariff in August 1980, nearly all compact trucks sold in the U.S. were produced by Japanese firms, some of which were marketed through American auto companies. But after the tariff was imposed, U.S. producers introduced their own compact truck models, with very similar characteristics to the Japanese imports (see Feenstra, 1988). The Japanese producers (Isuzu and Mitsubishi) that had formerly been selling to American firms began to market compact trucks independently. In this environment of relatively intense competition, we can expect that Japanese firms would be reluctant to pass-through the full amount of the tariff and risk losing more market share in the United States.

In heavyweight motorcycles, by contrast, recall that there was already a global price war, so that prices were likely close to marginal cost. This leaves little room for Japanese producers to absorb part of the tariff. This is reinforced by the fact that the tariff was temporary, and that U.S. inventories were high: there would be little reason to sell to the U.S. at a reduced price in one year, if instead sales could be made out of inventory and some exports delayed to a later year when the tariff was lower.[15] By this logic, it is not surprising that the pass-through of the tariff in motorcycles was complete.

How should we assess the efficacy of the tariff in these two products? The tariff on trucks led to a terms of trade gain, and if this exceeds the deadweight loss, then it would generate a welfare gain for the United States. This is not the case for the tariff on motorcycles, however, where there is a deadweight loss but no offsetting terms of trade gain. By our conventional welfare criterion, then, the tariff on trucks looks better than the tariff on heavyweight cycles. But this criterion ignores the fact that the tariff on motorcycles was *temporary,* whereas that on trucks is still in place today. Furthermore, it is well documented (see Reid, 1990) that Harley-Davidson was on the brink of bankruptcy in 1982-83, and was able to secure a bank loan only after receiving protection, so the tariff may well have contributed to its continued survival. Its near-bankrupt status was due to problems of poor management and lagging productivity, while its revival after 1983 was due to the introduction of improved products and production techniques. It cannot be argued that this broad change in company practices was *caused* by the tariff, but it appears that the temporary tariff bought it some breathing room.[16] In view of the

[15] It was still the case that exports from Japan of heavyweight motorcycles (over 700 cc) were positive in every year of the tariff. In addition, Japanese firms began to sell a 699 cc motorcycle in the United States, which was a way to evade the tariff. See the discussion in Irwin (2002, pp. 135-137).

[16] This is the view expressed by the chief economist at the ITC at the time: "if the case of heavyweight motorcycles is to be considered the only successful escape-clause, it is because it caused little harm and it helped Harley-Davidson get a bank loan so it could diversify" [Suomela (1993, p. 135) as cited by Irwin (2002, pp. 136-37)].

improved products later offered by Harley-Davidson (which were emulated by its Japanese rivals), the temporary tariff may well have contributed to long-run welfare gains for consumers. In contrast, the compact trucks introduced by American firms after the tariff were quite similar to the existing Japanese models, and brought little additional welfare gain (Feenstra, 1988b).

Infant Industry Protection

Our discussion of the motorcycle tariff in the U.S. suggests a case where protection may have allowed the domestic industry to avoid bankruptcy. Without arguing that this was definitely the case, let us use this as a possible example of "infant industry" protection. Theoretically, infant industry protection is said to occur when a tariff in one period leads to a sufficient increase in output, and therefore a reduction in future costs, that the firm survives, whereas otherwise it would not. This is a very old idea, dating back to Hamilton (1791), List (1856) and Mill (1909).[17] An essential assumption of the infant industry argument is that the firm needs to earn positive profits each period to avoid bankruptcy. That is, there must be some reason that the capital market does not allow the industry to cover current losses by borrowing against future profits. A model of infant industry protection is developed by Dasgupta and Stiglitz (1988), and more recent treatment is in Melitz (2002). A historical example to the U.S. steel rail industry is provided by Head (1994).

An infant industry is an example of *declining marginal costs*, i.e. when the future marginal costs are a decreasing function of current output. We have pretty much ignored this case throughout the chapter, and have treated the marginal costs as either constant or increasing in output. When marginal costs are declining, however, then there may be additional scope for

[17] Cited by Baldwin (1969), who provides a number of reasons why the "infant industry" argument is *not* valid. See also the survey of Corden (1984, pp. 91-92).

"strategic" trade policies. Krugman (1984) uses a model of declining marginal costs to argue that import promotion might act as export promotion: that protecting an import industry today might turn it into an export industry tomorrow. This intriguing idea is investigated for the production of random access memory chips by Baldwin and Krugman (1988a), and further empirical work would be desirable.

Dumping

If there is a case to be made for infant industry protection, whereby an increase in the import price allows a firm to survive, then the reverse should also be true: a decrease in the import prices might lead a firm to shut down. This would be an example of "predatory dumping," whereby a foreign exporter would lower its prices in anticipation of driving rivals in the domestic country out of business. A model of predatory dumping is developed by Hartigan (1996), and like the infant industry argument, it relies on a capital market imperfection that prevents the home firm from surviving a period of negative profits.

To the extent that predatory dumping occurs at all, it is presumably rare. In contrast, allegations of dumping are a widespread phenomena and growing ever more common. Furthermore, charges of dumping are often made against trading partners in the same industry, e.g. the U.S. will charge European countries and Japan with dumping steel in the U.S., and likewise those other countries will charge the U.S. with dumping steel there! This does not sound like "predatory dumping" at all, but must have some other rationale.

In his classic list of reasons for dumping, Jacob Viner referred to "long-run" or "continuous" dumping, to "maintain full production from existing facilities without cutting prices" (Viner, 1966, p. 23, as cited by Staiger and Wolak, 1992, p. 266). This can occur in markets with oligopolistic competition and excess capacity. Ethier (1982) presents a model emphasizing demand uncertainty and excess capacity, leading to dumping. But subsequent literature has focused on a simpler framework without uncertainty, where dumping is a natural occurrence under imperfect competition as oligopolists enter each other's markets. This is demonstrated in the next section, using the "reciprocal dumping" model of Brander (1981) and Brander and Krugman (1983).

Reciprocal Dumping

To model the oligopolistic competition between foreign and domestic firms, we return again to the Cournot model used earlier in the chapter, but now allow for a number of firms N in the home country and N* abroad. The home firms sell y_i in the home market and export y_i^*, i=1,…,N, while the foreign firms sell x_j in the home country and x_j^* in their own local market, j=1,…,N*. The equilibrium price in the home market will be denoted by p(z), where $z = \sum_{i=1}^{N} y_i + \sum_{j=1}^{N^*} x_j$, and the foreign price is p*(z*), where $z^* = \sum_{i=1}^{N} y_i^* + \sum_{j=1}^{N^*} x_j^*$.

Let us also assume that there are "iceberg" transportation costs involved in delivering the product from one country to the other, as in chapter 5: the amount T > 1 of the product must be shipped in order for one unit to arrive, so that (T-1) "melts" along the way. The home price p(z) denotes the c.i.f. (cost, insurance, freight) price, while the f.o.b. (free on board) price received by the foreign exporter per unit shipped is p/T. This can be compared to p*, which is the price received by the foreign firms in its own market. Notice that when computing prices to assess allegations of dumping, the U.S. DOC works with these f.o.b. prices, i.e. it *deducts* transportation costs from import prices before assessing whether dumping has occurred. So it would conclude that dumping has occurred at home if p/T < p*. Similarly, the f.o.b. price received by the home firm per unit exported is p*/T, and it could be charged with dumping in the foreign market if p*/T < p.

From this setup, it is apparent that if we had an equilibrium where the c.i.f. prices *were equal* across the countries, p = p*, then "reciprocal dumping" must be occurring, i.e. p/T < p* and p*/T < p. This was the outcome obtained by Brander and Krugman (1983) in a symmetric model, where the home and foreign markets were equal in size and had identical marginal costs. More generally, we are interested in whether reciprocal dumping will occur more in markets that are not necessarily the same size. Let us suppose that the home and foreign firms have identical marginal costs, but that the demand curves p(z) and p*(z*) are not the same. Then when will we observe reciprocal dumping?

To answer this, denote the marginal cost of producing in either country by c. The fixed costs of production are α. A firm located in country i and selling to country j will face "iceberg" transport costs, so the marginal cost of delivering one unit abroad is cT. The home firms solve the profit maximization problem:

$$\max_{y_i, y_i^*} \ \pi = [p(z) - c]y_i + [p^*(z^*) - cT]y_i^* - \alpha, \tag{7.36}$$

with the first-order conditions,

$$\pi_{y_i} = p(z) + y_i p'(z) - c = 0 \ , \tag{7.37a}$$

$$\pi_{y_i^*} = p^*(z^*) + y_i^* p^{*\prime}(z^*) - cT = 0 . \tag{7.37b}$$

Divide these conditions by $p'(z)z$ and $p^{*\prime}(z^*)z^*$, respectively, and impose the symmetry condition that every home firm is selling the same amount in each of the home and foreign markets, so $y_i = y$ and $y_i^* = y^*$. Then the first-order conditions are written as:

$$p\left(1-\frac{(y/z)}{\eta}\right)=c, \quad p^*\left(1-\frac{(y^*/z^*)}{\eta^*}\right)=cT, \tag{7.38}$$

where $\eta = z/p'(z)p$ and $\eta^* = z^*/p^{*\prime}(z^*)p^*$ are the home and foreign demand elasticities.

In a similar manner, we can derive the first-order conditions for the foreign firms,

$$p^*\left(1-\frac{(x^*/z^*)}{\eta^*}\right)=c, \quad p\left(1-\frac{(x/z)}{\eta}\right)=cT \tag{7.39}$$

where each of these firms is selling x* in its own market and x in the home market.

By adding up the market shares of all firms selling in each country, we must obtain:

$$\begin{aligned} N(y/z) + N^*(x/z) &= 1, \\ N(y^*/z^*) + N^*(x^*/z^*) &= 1. \end{aligned} \tag{7.40}$$

Notice that we can write this simple system in matrix notation as:

$$(N, N^*)\begin{bmatrix}(y/z) & (y^*/z^*) \\ (x/z) & (x^*/z^*)\end{bmatrix}=(1,1), \tag{7.40'}$$

which can be inverted to solve for the number of firms in each country:

$$(N, N^*)=\frac{(1,1)}{D}\begin{bmatrix}(x^*/z^*) & -(y^*/z^*) \\ -(x/z) & (y/z)\end{bmatrix} \quad \Rightarrow \quad \begin{aligned} N &= \frac{1}{D}\left(\frac{x^*}{z^*}-\frac{x}{z}\right), \\ N^* &= \frac{1}{D}\left(\frac{y}{z}-\frac{y^*}{z^*}\right), \end{aligned} \tag{7.41}$$

where D is the determinant of the 2x2 matrix of market shares shown in (7.40'). From the first-order conditions (7.38) and (7.39) it is clear that $(y/z) > (x/z)$ and $(x^*/z^*) > (y^*/z^*)$, so that local sales in each county exceed imports (due to the assumption of equal marginal costs but positive transport costs). This ensures that D > 0.

Notice that the solutions for N and N* from (7.41) are not guaranteed to be positive, though this occurs if each firm sells more in its local market than in its export market, (y/z) > (y*/z*) and (x*/z*) > (x/z). To determine when this will be the case, let us make the simplifying assumption that the elasticity of demand is equal in the two markets, $\eta = \eta^*$. Then we can substitute the market shares from the first-order conditions (7.38) and (7.39) into (7.41), and use $\eta = \eta^*$ to obtain:

$$N = \frac{\eta}{D}\left(\frac{cT}{p} - \frac{c}{p^*}\right) > 0 \quad \text{if and only if} \quad p/T < p^* , \tag{7.42a}$$

$$N^* = \frac{\eta}{D}\left(\frac{cT}{p^*} - \frac{c}{p}\right) > 0 \quad \text{if and only if} \quad p^*/T < p . \tag{7.42b}$$

Thus, we have obtained the following result:

Theorem (Weinstein, 1992; Feenstra, Markusen and Rose, 1998)

When the elasticities of demand and marginal costs of production are equal across countries, and firms in both countries are selling in both markets, then reciprocal dumping necessarily occurs: $p/T < p^*$ and $p^*/T < p$.

Remarkably, reciprocal dumping is guaranteed whenever the firms are selling in both markets! Our hypothesis that the elasticities of demand are equal across countries is a simplifying assumption: Weinstein (1992) establishes the theorem *without* this assumption (but using the weak condition (7.17'), that the market's marginal revenue curve is steeper than the demand curve). Weinstein also discusses what happens as the number of firms in one country grows. As N* grows, the equilibrium price p* in the foreign market falls. For a sufficiently high number of foreign firms, the inequality $p/T < p^*$ becomes an equality, and at this point the number of domestic firms from (7.42a) is zero: import competition has eliminated the domestic industry. However, note from (7.42b) that we still have $p^*/T < p$, so that the foreign firms are dumping into the domestic market. Thus, even when the number of firm in one country has grown large enough to eliminate competition in the other, unilateral dumping still occurs.

Welfare Effect of Trade

This model of reciprocal dumping is an alternative explanation for "intra-industry" trade, which we studied in chapter 5 under a monopolistic competition model. In that case, we argued that trade would bring extra gains, due to the increased variety of products and also economies of scale. But in the Cournot model we are studying, the firms are selling a homogeneous product so that there are no gains due to product variety, but instead losses due to wasted transportation costs in "cross hauling." On the other hand, trade brings a reduction in the exercise of monopoly power, due to the competition introduced from foreign firms. So this raises the question of which effect dominates: the social loss due to wasted transportation, or the social gain due to reduced monopoly power?

Brander and Krugman (1983) argue that with a *fixed* number of firms, moving from autarky to free trade has an *ambiguous* effect on global welfare. This is illustrated in Figure 7.8. for a single home and foreign firm. Autarky occurs at the monopoly price p_0. Provided that this price is above the marginal costs for the foreign firm of exporting, cT, then with free trade the

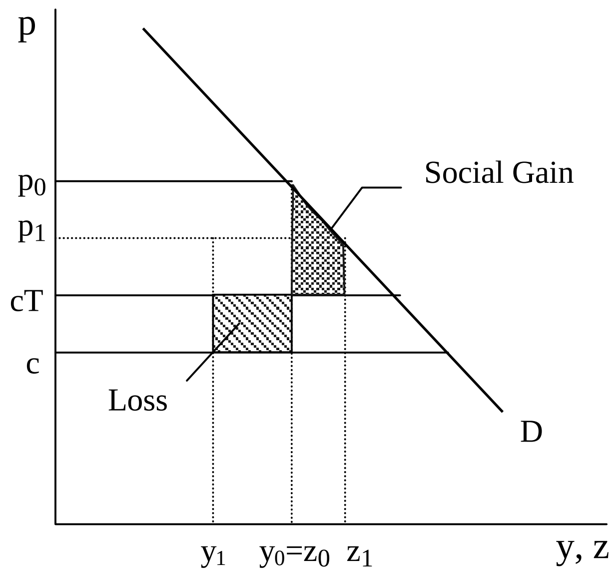

Figure 7.8

foreign firm will indeed sell to the home market.[18] Suppose that imports are $(z_1 - y_1)$, and these reduce the home price to p_1. This brings a rise in global welfare of the area shown (the top triangle of this area is consumer surplus in the importing country, and the remainder is profits of the foreign exporter), but a loss in global welfare due to added transport costs shown by the rectangle. A similar diagram would apply in the foreign country. The relative sizes of these areas are ambiguous, so we do not know whether trade raises or lowers global welfare.

However, with free entry of firms in both countries, Brander and Krugman argue that global welfare necessary improves due to free trade. The welfare function with multiple firms is $W(p, L + tm + N\pi)$, where π is the profits of each home firm, but with profits equal to zero this becomes $W(p, L + tm)$. Furthermore, comparing autarky and free trade we have zero tariff revenue in each case, so welfare is just $W(p, L)$. Thus, welfare will rise going from autarky to free trade if and only if the import price falls. Brander and Krugman argue that this is indeed the case: with import competition, prices unambiguously fall, so welfare in both countries improves. The fall in prices is also reflected in a fall in average costs (since price equals average costs from zero profits), which implies the output of each firm increases going from autarky to free trade. So similar to the monopolistic competition model of chapter 5, we have that trade brings gains due to the exercise of economies of scale. But unlike the monopolistic competition model, these gains come despite the fact that trade is intrinsically wasteful due to the homogeneous product and transportation costs.

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[18] As noted by Brander and Krugman (1983), the condition to observe trade with a single firm in each country is that the monopoly price, $p_0 = c\,\eta/(\eta-1)$ exceeds marginal cost of cT. This is written as $\eta/(\eta-1) > T$, or alternatively, $\eta < T/(T-1)$. So transport costs cannot be too high relative to the elasticity.

Impact of Anti-Dumping Duties

Suppose that instead of comparing global welfare under free trade and autarky, we instead consider the effect of an anti-dumping duty imposed by one country. When the number of firms is fixed at, say, one in each country, this corresponds to the case of Cournot duopoly analyzed earlier in the chapter. We found there that a small duty was likely to improve the terms of trade for the importing country, and may also contribute to an efficiency gain through increasing the output of the home firm. For both reasons, a small tariff was welfare improving for the importer. Should we think of anti-dumping duties in the same way?

The answer is no. Rather than leading to an improvement in the terms of trade, the application of anti-dumping law can often lead to a *worsening* of the terms of trade and a welfare loss for the importing country. To understand this, we need to review the administration of these laws in the United States. As discussed by Staiger and Wolak (1994), antidumping actions go through several distinct phases: an initial investigation by the DOC, which determines whether or not the imported product is being sold at "less than fair value;" followed by an initial investigation by the ITC to determine whether or not the domestic industry is "materially injured;" followed by a final determination of both agencies; followed by the application of duties if both findings are affirmative and the case is not withdrawn; and then also an annual administrative review in cases where duties are imposed (Blonigen and Haynes, 2002). Let us consider how each of these stages affects prices.

Initial Investigation

In the first stage of an investigation, which we call period 1, the DOC compares the prices of imported products with their prices (or costs) abroad. This calculation involves comparing the f.o.b. price received by the foreign exporter, which we denote by p_1/T, with their own home price of p^*. If $p_1/T < p^*$ then there is pricing at “less than fair value.” In nearly 95% of cases brought before the DOC, it concludes that this occurs and recommends duties in period 2 of $(1+\tau_2) = p^*/ (p_1/T) > 1$.

Notice that the duty applied in period 2 *depends* on the price charged by the exporter in period 1. In this sense, we must treat the anti-dumping duty as *endogenous,* and the exporter will have an incentive to raise its period 1 price so as to lower the period 2 duty.[19] Furthermore, this increase in price occurs even *before* the duty has been imposed, so that the importing country does not collect any tariff revenues. This increase in the import price amounts to a pure terms of trade loss for the importer. Because there is no tariff revenue collected, and still allowing for free entry of home firms, the welfare criterion is modified from $W(p, L + tm)$ to $W(p, L)$. Thus, any increase in the import price leads to a welfare loss.

There is evidence that this investigation stage of dumping actions does indeed lead to an impact on imports, though this is often measured by the effect on quantities rather than prices. Using a sample of all antidumping cases in the United States from 1980-85, Staiger and Wolak (1992) find that the initiation of an investigation has a substantial impact on imports, reducing them by about one-half as much as that would have occurred under duties. The implication is that import prices must increase, leading to a loss for the importer.

Withdrawal of Cases

While the DOC finds evidence of “pricing at less than fair value” in most cases, the ITC rules in favor of “material injury” in only about one-half of the cases it considers. Thus, of some 400 cases in the U.S. during 1980-88, about 150 were rejected by the ITC and another 150 had

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[19] See problems 7.7 and 7.8 to demonstrate this in a model with Bertrand competition.

duties levied. As shown in Table 7.1, the remaining 100 cases or one-quarter of the total were *withdrawn* prior to a ruling by the ITC. As described by Prusa (1991, 1992), in these cases the U.S. firms can negotiate with the foreign firm on the level of prices and market shares. Prusa finds that withdrawals have about the same impact on reducing import quantity as do actual duties, which is also found by Staiger and Wolak (1992). Again, the implication is that import prices would rise, with a direct welfare loss for the importing country.

Continuing Investigations

Consider now the case where an anti-dumping duty has been imposed, and denote the period 2 import price (inclusive of duty) by p_2. Suppose that there is an administrative review to re-calculate the amount of duty imposed in period 3. In calculating dumping margins during the administrative review, the DOC *removes* the tariff from the import price p_2, and also removes any transport costs, obtaining $p_2/[T(1+\tau_2)]$ as the f.o.b. price for the foreign exporter. This is compared to the exporters home price of p^* to determine whether the foreign firm is continuing in its practice of "pricing at less than fair value." Whenever $p_2/[T(1+\tau_2)] < p^*$, then duties of $(1+\tau_3)=p^*/[p_2/T(1+\tau_2)] > 1$ are imposed in period 3.

Notice that these duties can be re-written as $(1+\tau_3)= (1+\tau_2)[p^*/(p_2/T)]$, so there is a built in "continuation" of the anti-dumping duties: even if the foreign firm chooses $p^* = p_2/T$, so there would have been no initial evidence of dumping, then it will *still* be faced with a tariff of $(1+\tau_3) = (1+\tau_2)$ in period 3. In other words, to avoid a charge of continued dumping during the administrative review, the foreign firm would not only need to increase its period 2 price above what was charged in period 1, it would need to further increase the period 2 price by the *full* *amount* of the period 2 duty. In the above notation, a charge of dumping is avoided in period 2 if and only if,

$$p_2/[T(1+\tau_2)] \geq p^* \iff p_2 \geq p^* T(1+\tau_2) > p_1(1+\tau_2), \quad (7.43)$$

where the last inequality is obtained because dumping occurred in period 1, $p_1/T < p^*$.

Using the last inequalities in (7.43), we see that to avoid continuing anti-dumping duties the import price must rise between period by the amount $p_2/p_1 > (1+\tau_2)$, so there is *more than complete pass-through* of the period 2 duty. This hypothesis receives strong support from Blonigen and Haynes (2002). They estimate that the pass-through of the initial anti-dumping duties can be as high as 160% for the cases that are subject to an administrative review. This occurs because, as explained above, the DOC removes existing tariffs from import prices when computing the dumping margin. So in order to avoid duties after an administrative review, the tariff-inclusive price must rise by *more than* the amount of duties.

From a welfare point of view, this result very likely violates the criterion for welfare improvement. With the pass-through of duties exceeding unity, then $dp^*/dt > 0$ so there is a terms of trade loss. Then the only way that welfare could rise is if there is a large increase in domestic output with the associated efficiency gain (i.e. if the final term in (7.3) is positive). However, this source of gain vanishes if there is free entry into the domestic industry so that profits are zero. In that case, the criterion for welfare gain is (7.26) rather than (7.3), and welfare can rise only if $dp/dt < m/d(p)$, meaning that the pass-through of the duty is less than the import share. This is clearly violated when the pass-through is greater than unity. Thus, in all three stages we have considered – initial investigation, withdrawal of cases, and continuing investigations – the presumption is that anti-dumping duties will lead to a welfare loss for the importer. This occurs because the duties being imposed are treated by the exporter as endogenous, and create an incentive to raise prices so as to avoid the duties.

Conclusions

Since this chapter has covered a large number of different models, a summary is appropriate. Consider tariffs that are *exogenously* imposed, such as under the escape clause provision of the GATT/WTO. In general, this will have three welfare effects on the importing country: (a) a deadweight loss; (b) a terms of trade effect; (c) a reduction in the monopoly distortion if the output of home firms increase (without leading to inefficient entry). The deadweight loss always harms the importer, but is of the second-order of smalls for a small tariff. The change in the output of home firms, sometimes referred to as a "profit shifting" effect, is of ambiguous sign and cannot be relied upon to generate gains for the importer. Accordingly, the best indicator of the welfare impact of small tariffs is the terms of trade effect.

It is sometimes argued that countries must be very large in their sales or purchases of a product on world markets for their tariff to have an impact on the terms of trade. Even the United States, it is argued, should be treated as "small" in nearly all markets.[20] I disagree with this assessment. Under imperfect competition, it is quite plausible that foreign exporter will absorb part of the tariff so the import price does not rise by its full amount; our detailed analysis of the Cournot and Bertrand cases has identified the exact conditions under which this occurs. This depends on exporters treating their foreign markets as segmented (i.e. charging different prices to each), and holds regardless of the size of the importing country. The abundant evidence on partial pass-through of exchange rates (surveyed in Goldberg and Knetter, 1997) suggests that

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[20] See Irwin (2002, p. 63).

the same is true for tariffs, though the exact magnitude of pass-through will depend on the industry being considered. For the comparison of the U.S. tariffs on truck and motorcycles we found quite different pass-through behavior, with the tariff on trucks generating a terms of trade gain but not the tariff on motorcycles.

Even if we accept that in many industries there will be a terms of trade and welfare gain due to a small tariff, this hardly justifies their use: the terms of trade gain comes *entirely* at the expense of foreign exports, so this is a "beggar thy neighbor" policy. The use of tariffs can therefore invite retaliation from trading partners. A very recent example of this has occurred in the steel industry in the U.S., which received Section 201 protection in March 2002.[21] Declining tariffs ranging from 8% to 30% were applied for three years to a range of steel products and various importers.[22] Shortly after these tariffs were imposed the European Union, Japan, and Korea announced plans to file protests with the WTO, and retaliate with tariffs of their own applied against U.S. products. Such retaliation means that the use of tariffs becomes a negative sum game, i.e. they can end up harming both trading partners.

What can prevent a country from attempting to move the terms of trade in its favor? One view of the GATT is that it was designed with exactly this goal in mind. Bagwell and Staiger (1999, 2002) argue that the provisions of GATT such as "reciprocity" (i.e. tariff reductions should be reciprocal across countries) are effective in preventing countries from using tariffs to improve their terms of trade. We will discuss this further in chapter 9. By a similar logic, I think that the escape clause provision of the GATT should be viewed as a way to promote free trade

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[21] This was the first instance of a Section 201 action that was initiated by the President (and followed from a campaign promise made by George W. Bush while campaigning in steel producing states).

[22] Some of the tariffs took the form of "tariff-rate quotas," which means that the tariffs are applied only for imports from each source country *in excess* of some amount. These quotas can be varied preferentially across source countries without violated the MFN principle of the GATT. Canada, Mexico, Israel and Jordan are entirely exempt from the tariffs because of their free trade agreements with the United States.

while allowing for exceptions in specific circumstances. The linkage was made explicit in the recent Section 201 protection to the steel industry in the U.S., where the Bush administration hoped to secure additional votes for "fast track" authority.[23] So Article XIX of the GATT and Section 201 of U.S. trade law need to be assessed in a broader political-economy context of securing industry support for free trade. Given that these provisions are used rarely, and only temporarily, they can be viewed as rather effective.

The same is not true of the anti-dumping provisions of GATT. As we have argued, the GATT definition of dumping will apply in many markets subject to imperfect competition, and there has been an increasingly widespread use of the dumping provisions. The anti-dumping duties that are imposed must be treated as *endogenous:* they depend on the prices chosen by the exporter prior to, and during, the dumping action. This creates an incentive for exporter to raise their prices before dumping duties are imposed, and to raise them even further before an administrative review of the dumping case. These actions correspond to a terms of trade loss for the importer, as indicated by the empirical evidence of Blonigen and Haynes (2002). This can also be reflected in an increase in the price of import-competing products, of course, so the anti-dumping duties act so as to promote more collusive behavior. Gallaway, et al (1999) estimate the combined welfare cost of anti-dumping and countervailing duty legislation in the U.S. to be some $4 billion in 1993. In the next chapter, we will also find that import quotas can lead to more collusive behavior among firms, so that along with anti-dumping legislation, these must be judged as very costly policies.

[23] "Fast track" authority refers to the ability of the executive branch to present to the U.S. Congress a proposal for an expansion of free trade, for an "up or down" vote without allowing amendments. This authority is used, for example, when negotiating free trade areas, which the Bush administration intends to pursue in the Americas. Fast track authority was renewed by the U.S. House of Representatives in July 2002, by a narrow vote in favor.

Problems

7.1 Derive the optimal specific tariff from (7.12) in the case where there is a single foreign firm, and the demand curve d(p) is linear.

7.2 Derive conditions under which the Cournot reaction curves in Figure 7.4 are both downward sloping.

7.3 By totally differentiating the equilibrium condition (7.22), show that:

(a) $dy/dt > 0$ provided that $p'(x+y) + yp''(x+y) < 0$;

(b) The total change in home profits π due to the tariff is positive.

7.4 In this problem we derive the properties of the elasticities used with Bertrand competition.

(a) First review problem 1.2 of chapter 1, and show that if a function $y = f(v)$ is homogeneous of degree α, meaning that for all $\lambda > 0$, $f(\lambda v) = \lambda^{\alpha} f(v)$, then its first derivative is homogeneous of degree α-1.

(b) Thus, if demand $d(p,q,I)$ is homogeneous of degree zero in (p,q,I), then $d_q(p,q,I)$ is homogeneous of degree minus one. Use this to show that $\eta(p,q,I) = qd_q(p,q,I)/d(p,q,I)$ is homogeneous of degree zero in (p,q,I).

(c) Now assume that the income elasticity is unity, so that demand is written as $d(p,q,I) = \phi(p,q)I$. Show that the elasticity η does not depend on I. Therefore, show that the elasticity η can be written as a function of q/p.

7.5 Using the results from problem 7.4, assume that $\eta^{*\prime}(p/q) > 0$ and $\eta'(q/p) > 0$.

(a) Then by differentiating the first-order conditions (7.28), show that the reaction curves $p = r^*(q,\tau)$ and $q = r(p)$ both slope upwards, as shown in Figure 7.6, with elasticities less than unity.

(b) Also compute the elasticity of the foreign reaction curve $p = r^*(q, \tau)$ with respect to τ.

(c) Use the results in (a) and (b) to solve for the total change in q and p due to the tariff.

7.6 (a) Output of the home firm is $y = d(q,p,I)$. Use the fact that $d(q,p,I)$ is homogeneous of degree zero in (q,p,I) to show that $d_q q + d_p p + d_I I = 0$. Then use the assumption that the income elasticity of demand is unity to show that $d_p p/d = (\eta - 1)$.

(b) Using (a), compute the total change in home output $y = d(q,p,I)$ as p increases along the home reaction curve. Show that output increases if $0 < q\eta'/p\eta < (\eta - 1)^2$.

7.7 Under Bertrand competition, show that foreign profits fall due to the tariff when $\eta^{*\prime}(p/q) > 0$ and $\eta'(q/p) > 0$.

7.8 Consider the problem of an exporting firm facing the threat of an anti-dumping duty. Given the period 1 import price chosen by the exporting firm, the duty imposed in period 2 equals $(1+\tau_2) = p^*/p_1$ whenever $p_1 < p^*$. This tariff is imposed with probability θ, and conversely, with probability $(1-\theta)$ there will be no duty. Denote the value of period 2 profits when the duty is imposed by $\pi_2^*(\tau_2)$, where from problem 7.7 we have that $\pi_2^{*\prime}(\tau_2) < 0$. Let $\pi_2^*(0)$ denote the maximized value of period 2 profits for the foreign firm in the case of zero duty. Then the period 1 problem can be stated as:

$$\max_{p_1} \ \pi^*(p_1, q_1) + \delta[\theta\pi_2^*(\tau_2) + (1-\theta)\pi_2^*(0)] \quad \text{s.t.} \quad (1+\tau_2) = p^*/p_1 \,. \qquad (7.44)$$

We suppose that the home firm chooses q_1, under Bertrand competition. Derive the first-order conditions for the home and foreign firms, and show that the threatened duty leads to an *increase* in the foreign price p_1.

Empirical Exercise

In this exercise, you are asked to reproduce some of the empirical results from Feenstra (1989). To complete the exercise, the files "cars.csv, trucks.csv, cycon.csv, cyship.csv, cypool.csv" should be stored in the directory: c:\Empirical_Exercise\Chapter_7\. Each of these can be used in STATA programs "cars.do, trucks.do, cycon.do, cyship.do, cypool.do"
to create a dataset with the variables described in "Documentation_Chp7.doc." Use these "do" programs to answer the following:

7.1 Replicate Table 7.2, i.e., run the specifications of (7.34) without imposing the tests of symmetry or homogeneity. Duplicate all of the coefficients that are reported in this table, except the Durbin-Watson statistics.

7.2 Then replicate Feenstra's Table 7.2 by imposing the tests of homogeneity and symmetry, shown in (7.35a) and (7.35b). Instead of conducting the Wald test, as done in Feenstra (1989), instead conduct the analogous F-test. Do you accept or reject the hypotheses of symmetry and homogeneity?