strategic trade policy

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Abstract

Strategic trade policy refers to trade policy that affects the outcome of strategic interactions between firms in an actual or potential international oligopoly. A main idea is that trade policies can raise domestic welfare by shifting profits from foreign to domestic firms. A well-known application is the strategic use of export subsidies, but import tariffs as well as subsidies to R&D or investment for firms facing global competition can also have strategic effects. Since intervention by more than one government can lead to a Prisoner's Dilemma, the theory emphasizes the importance of trade agreements that restrict such interventions.

Keywords

Cournot competition; Cournot oligopoly; Cournot–Nash equilibrium; Cramer's rule; economies of scale; export subsidy; game theory; international oligopoly; international trade (theory); international trade policy; intra-firm trade; intra-industry trade; Krugman, P.; monopolistic competition; multinational corporations; oligopoly theory; optimum tariff; Prisoner's Dilemma; profit shifting; research and development; Ricardo, D.; strategic trade policy; technology transfer
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Article

International trade policy is one of the oldest subject areas in economics, having generated serious academic debate at least as far back as the classical period of ancient Greece, well over two thousand years ago. A very informative description of classical Greek and Roman thought on international trade and trade policy is provided by Irwin (1996, ch. 1). Interestingly, for example, both Plato and Aristotle were at best ambivalent about the virtues of open trade. Our modern understanding of international trade policy is based largely on the principle of comparative advantage as developed by David Ricardo (1807) and has been the focus of much political as well as academic debate in the two centuries since Ricardo.

Consideration of strategic trade policy is a relatively recent addition to the trade policy debate, having started in the early 1980s. Although definitions of the term differ slightly, we believe the following definition captures the important concepts:

Definition: *Strategic trade policy refers to trade policy that affects the outcome of strategic interactions between firms in an actual or potential international oligopoly*.

As the definition suggests, the term 'strategic' in this context arises from consideration of the strategic interaction between firms. It does not refer to military objectives or the importance of an industry. Strategic interaction requires that firms recognize that their payoffs in terms of profit or other objectives are directly affected by the decisions of rivals or potential rivals. As a result, firms recognize that their own choices concerning such variables as output, price and investment depend on the decisions of other firms. The existence of strategic interaction is the defining characteristic of oligopoly.

The term 'trade policy' is interpreted broadly here as any policy directed primarily at the level or pattern of trade. In particular, policies that change the incentives for investment or research and development (R&D) in the context of international oligopoly represent an important application in the literature.

The requirement that the oligopoly be 'international' implies that production is actually or potentially carried out in two or more countries. Trade policy instruments set by one country then tend to affect the strategic choices of firms located in that country differently from firms located abroad. Strategic trade policy typically exploits these differential effects so as to achieve a domestic objective at the expense of welfare in other countries. In much of the literature the domestic objective is to maximize aggregate domestic welfare, but there is nothing that rules out political economy objectives, such as the use of trade policy to reward special interest groups that provide large donations to the government.

Most applications of strategic trade policy assume that firms differ by ownership as well as country of location. This assumption focuses attention on the importance of the policy in shifting profits from foreign to domestic firms. Indeed, strategic profit-shifting is often viewed as the hallmark of strategic trade policy. According to our definition, however, strategic trade policy

can apply even if all firms in the industry are owned by residents of just one country. For example, a country might be interested in fostering exports by foreign multinationals that compete with firms located abroad. Potential sources of domestic gain would include rents such as above-normal wages, captured by domestic employees of the multinational, and taxes on the multinational's profits.

A brief history of the origins of strategic trade policy

Strategic trade policy was one of the early applications of oligopoly theory in international economics. Formal treatment of oligopoly (and monopolistic competition) in international trade theory did not become well-established until the 1980s. Perhaps the first formal application was by Brander (1981), who explained intra-industry trade in identical commodities. Prior to the 1980s, most trade theory relied on the assumption of perfect competition, although monopoly also received some attention. There was an early 'distortions literature' that concerned second-best policies in imperfectly competitive markets, but strategic interaction between firms was not modelled (see, for example, Bhagwati, Ramaswami and Srinivasan, 1969). In the light of the empirical importance of competition between large firms in world markets, the introduction of oligopoly into international trade was a significant step forward in improving the relevance of international trade theory. Oligopoly turned out to be central for understanding and explaining a number of important phenomena that could not be understood in a perfectly competitive framework. In addition to strategic trade policy, these included intra-industry trade, intra-firm trade, multinational corporations, and the role of economies of scale, R&D and technology transfer in international trade.

In applying strategic trade policy, one key difference between oligopoly and other market structures is the existence of profits (or 'rents') that can be shifted from one firm to another in a given industry by altering the strategic interactions between firms. Under monopoly, profit-shifting between firms does not arise as there is only one firm. In standard models of perfect competition and monopolistic competition, long-run profits are zero so there are no profits to shift. There are variations of the basic models of perfect competition or monopolistic competition in which firms are heterogeneous, only marginal firms earn zero profits, and infra-marginal firms

can earn positive profits. However, such firms are not explicitly engaged in strategic interactions or 'games' with one another, so altering the outcome of strategic interactions is not an issue.

As the previous paragraph suggests, application of basic game theory is a feature of strategic trade policy that distinguishes it from much of the previous work in international economics. In addition to considering games between firms, strategic trade policy places particular emphasis on the sequential structure of decision-making, making it one of the first areas of application of game theory where the implications of sequential rationality were clearly understood.

Two papers often cited as pioneering contributions to strategic trade policy are Spencer and Brander (1983) and Brander and Spencer (1985). Both papers assume an international duopoly in which a domestic and a foreign firm compete based on Cournot oligopoly in a third-country market. Spencer and Brander (1983) develops a three-stage game in which a subsidy to R&D (or the combination of an R&D tax and an export subsidy) can increase domestic welfare by shifting profits from the foreign to the domestic firm. The R&D subsidy makes it credible for the domestic firm to commit to a higher level of R&D, causing the foreign firm to reduce its R&D and exports. Brander and Spencer (1985) uses a simpler two-stage game so as to emphasize the profit-shifting role of export subsidies in a more standard international trade setting in which a second good is used to achieve trade balance.

However, an earlier paper, Brander and Spencer (1981), may in fact be the first application of strategic trade policy. In Brander and Spencer (1981) a foreign firm chooses between entry deterrence based on the model of Dixit (1979) and Stackelberg leader–follower competition with a domestic entrant. The paper sets out cost conditions under which the domestic country can gain by increasing its import tariff above the entry-inducing level. The optimum tariff shifts sufficient profits from the foreign to the domestic firm so as to more than offset the loss in consumer surplus and tariff revenue. A drawback of the paper is that the game theory structure of the entry-deterrence model does not satisfy sequential rationality: it is not subgame perfect. The foreign firm prevents entry by setting its exports to the domestic country at a level that reduces domestic profits to zero. This is not subgame perfect since, if the domestic firm were to enter, the foreign firm would maximize profits by reducing its exports so as to accommodate entry. In a sequentially rational structure the domestic firm would be aware of this reaction and entry would

not be deterred. In a subsequent paper, Brander and Spencer (1984) examine the strategic use of a tariff to shift profits to a domestic firm in a sequentially rational structure in which a domestic and foreign firm engage in Cournot competition. Other early contributions to strategic trade policy include Krugman (1984), Dixit (1984) and Eaton and Grossman (1986).

Numerical examples

We first illustrate the idea that governments can use trade policy instruments to shift profits from foreign to domestically owned firms, thereby raising national economic welfare at the expense of other countries. The example draws on Brander (1986) and Krugman (1987).

Suppose that only two firms, Boeing, an American firm, and Airbus, a European firm, are capable of producing a certain type of passenger aircraft. To focus on profit-shifting, we abstract from effects on consumer welfare in Europe and America by assuming that the aircraft are all exported to a third country. The profit earned by each country's firm minus the cost of any subsidy is then the appropriate measure of each country's national benefit. Consider an initial situation where the third-country market is profitable if there is only one producer, but both firms would make losses if they both enter and must share the market. The European government is considering whether to subsidize the entry of Airbus.

Figure 1
Intervention by Europe

EUROPE

		Non-intervention		Entry subsidized by 6	
		Airbus		Airbus	
		Enter	*Not enter*	*Enter*	*Not enter*
Boeing	*Enter*	– 5, – 5	50, 0	– 5, 1	50, 0
	Not enter	0, 50	0, 0	0, 56	0, 0

Figure 1 shows the profits of each firm depending on whether or not each firm enters. The game tree on the left illustrates profits if there is no intervention or ‘free trade’, while the game tree on the right illustrates profits if Europe commits to pay a subsidy of 6 to Airbus in the event that it enters. The box diagrams show Boeing's profit as the first number in each cell, while the second number is the profit of Airbus.

The outcome of the game in Figure 1 is indeterminate under non-intervention. If either firm enters, the other firm loses from entry. Thus, if Boeing enters while Airbus does not, then Boeing earns 50, but both Boeing and Airbus lose 5 if Airbus enters. By contrast, if Airbus is given a subsidy of 6 when it enters, the outcome is a Nash equilibrium in which Airbus enters and Boeing does not. The subsidy makes entering a dominant strategy for Airbus. If Boeing enters, Airbus earns 1 from entry, which is better than the zero it gets if it does not enter. If Boeing does not enter, then Airbus gains 56 by entering. Given that Airbus enters, Boeing will not enter, for it will lose 5.

To move back one stage to Europe's subsidy decision, it is clear that Europe is made better off by the subsidy. If Boeing would have entered under no intervention, Europe gains 50 by preventing the entry of Boeing: Airbus earns 56, but Europe's payoff is reduced by 6 due to the cost of the subsidy to taxpayers. If there is a 50 per cent chance that Airbus would have captured the market in the absence of intervention, the expected gain to Europe is 25 from intervention. It is notable that a small subsidy can give rise to a large payoff as a result of the effect of the subsidy in changing the outcome of the strategic interaction between firms.

As this example illustrates, strategic trade policy requires that governments have the ability to commit to policy: that is, government policy must be ‘credible’. This requirement is captured in the game-theoretic structure by the order in which parties make decisions. Credibility of policy requires that the government move first by committing to its policy, prior to the decisions by firms. Commitment means that the government cannot subsequently change its policy. If Boeing did not believe that Europe would follow through on its subsidy, then the subsidy would not have any effect.

Having established the advantage to Europe from a subsidy, the obvious next question is whether the US government would also have an incentive to subsidize the entry of Boeing. In this example, the outcome of the policy game is indeterminate. Both countries lose if both countries subsidize leading to the entry of both firms, but each country has an incentive to subsidize if the other does not. Consequently, to gain a richer insight, we slightly change the example so that each government is considering an export subsidy in a situation where, without intervention, both firms earn profits from exports to the third-country market.

Figure 2 illustrates the payoffs to each country in a symmetric game in which both Airbus and Boeing earn 25 in the absence of intervention (bottom-right cell). If Europe subsidizes exports, say by 6, and the US does not, the profits of Airbus are assumed to increase by 16, so that, net of the subsidy, Europe earns 35 (bottom-left cell). The subsidy makes it credible that Airbus expands its sales at the expense of Boeing, which then earns 5. Due to the overall expansion in sales, the buyers of aircraft enjoy lower prices and the net industry profit (after the European subsidy is subtracted) falls from 50 to 40. Consequently, for the subsidy to benefit Europe, the shift in sales from Boeing to Airbus must be sufficient to offset the fall in price. The same situation applies to the United States if it subsidizes exports but Europe does not. If both countries subsidize exports, the expansion of sales by both firms reduces net industry profit to 20, with each country gaining 10 (top-left cell).

Figure 2
Intervention by both Europe and the United States

		EUROPE: Subsidy	EUROPE: No subsidy
United States: Subsidy		10, 10*	35, 5
United States: No subsidy		5, 35	25, 25

This policy game involves a Prisoner's Dilemma. In a non-cooperative one-shot game in which countries move simultaneously, the dominant strategy is for each country to subsidize its exports. Consequently, at the Nash equilibrium, both countries use strategic trade policy with a payoff of 10 each (upper-left cell). However, both countries would be better off if they could cooperate so as to achieve the higher payoff of 25 (bottom-right cell). As pointed out by Spencer and Brander (1983), one means of cooperation would be to negotiate a trade agreement that binds the countries to free trade. Also, if the game is repeated through time, a government might hope that current cooperation (that is, choosing not to intervene) might induce future cooperation from the other government.

The analysis of strategic trade policy provides a helpful framework for understanding the incentives facing governments in trade policy negotiations. In particular, strategic trade policy provides a rationale for the Prisoner's Dilemma mentality that pervades real-world trade policy negotiations. Under perfect competition, countries would not use export subsidies since they would simply benefit foreign consumers. In a world of strategic trade policy it makes sense that each government might reasonably view reducing or eliminating its own subsidies or tariffs as 'giving up' something, but might be willing to do so if other countries do the same. Each country faces a unilateral incentive to use activist trade policy but all can benefit if they can collectively agree to abandon such policies.

A formal model of the role of export subsidies

In the examples given so far, payoffs to firms and countries have been specified as convenient numbers. For a convincing analysis, it is important to model the underlying structure that gives rise to these payoffs. In this section we provide an algebraic demonstration of the argument for the profit-shifting effects of an export subsidy.

As in Brander and Spencer (1985), a domestic and a foreign firm are assumed to act as Cournot competitors in exporting to a third-country market. Entry barriers, such as high fixed costs, prevent entry. Let x and y represent the exports of the domestic and foreign firm, c and c^* their respective marginal costs, and $p = p(x + y)$ the price of the homogeneous product. If an export subsidy, s, is applied per unit of domestic exports, the profit functions of the domestic and

foreign firm are:

$$\pi(x,y;s) = xp(x + y) - cx + sx \quad and \quad \pi^*(x,y;s) = yp(x + y) - c^*y. \qquad (1)$$

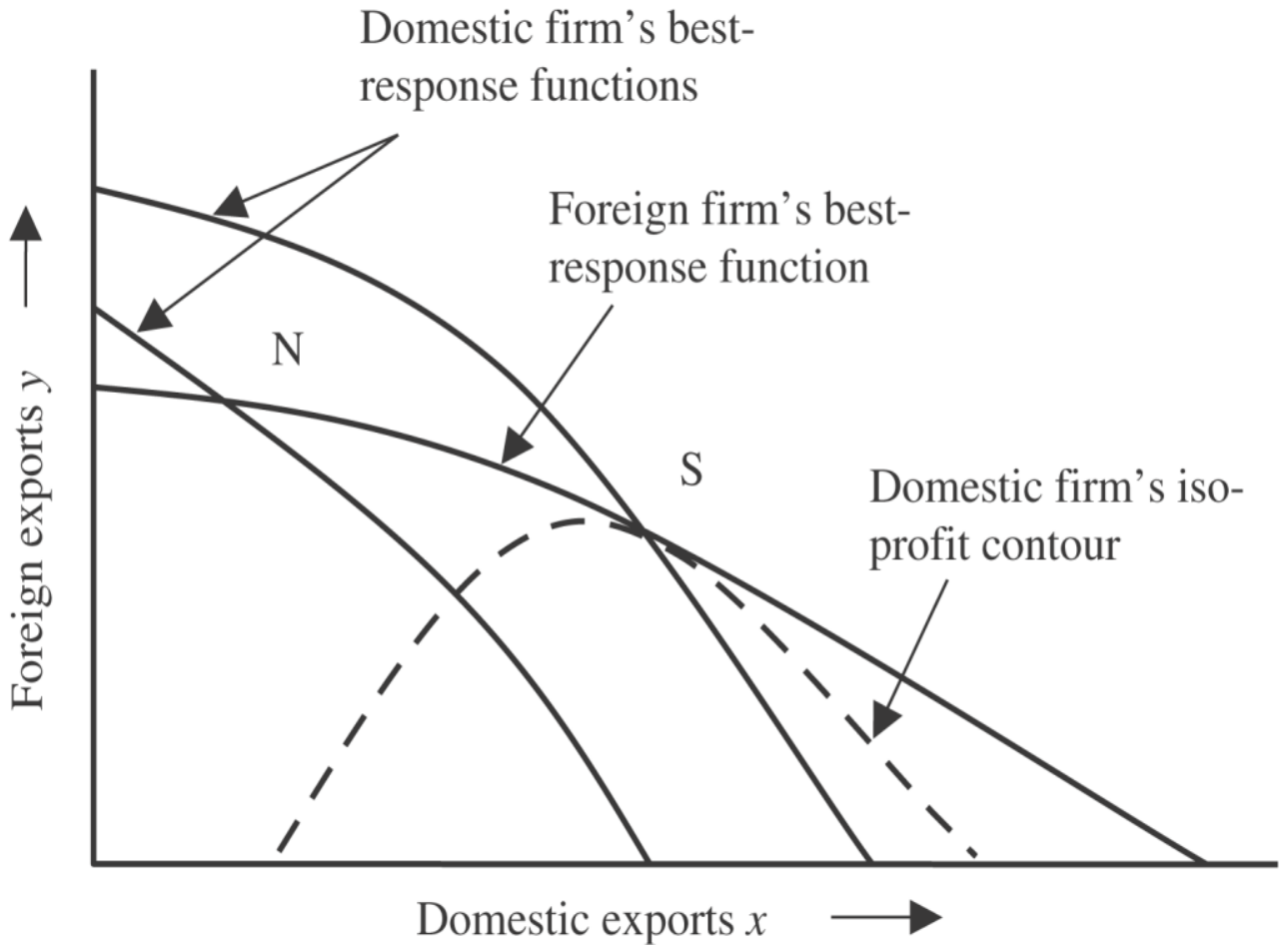
At the Cournot–Nash equilibrium, each firm sets output to maximize its profit given the output level of its rival. The first order conditions are $\pi_x = 0$ and $\pi^*_y = 0$, where subscripts denote partial derivatives. From total differentiation of the first order conditions with respect to x, y and s, and use of Cramer's rule, it follows that a domestic subsidy always raises domestic exports: that is, $dx/ds = -\pi^*_{yy}/D > 0$ where $\pi^*_{yy} < 0$ and $D \equiv \pi_{xx}\pi^*_{yy} - \pi_{xy}\pi^*_{yx} > 0$ from the second order and stability conditions. To ensure that a domestic export subsidy reduces the output of the foreign firm (that is, $dy/ds = \pi^*_{yx}/D < 0$), an important assumption identified by Brander and Spencer (1985) is

$$\pi^*_{yx} = p' + yp'' < 0 \text{ and } \pi_{xy} = p' + xp'' < 0 \qquad (2)$$

where prime and double prime represent first and second derivatives. Condition (2) is now known as the requirement that x and y be 'strategic substitutes': an increase in x reduces the rival firm's marginal profit from an increase in y and vice versa. Given Cournot competition, this holds for linear demand (since $p'' = 0$) and, more generally, if the inverse demand curve is not too convex.

The effect of the export subsidy is illustrated in Figure 3 showing the best response or reaction functions of each firm. Since domestic marginal cost falls, the subsidy increases domestic exports for any given level of the rival's exports, as shown by the outward shift in the best-response function of the domestic firm. As a result, the subsidy moves the Cournot–Nash equilibrium from point N to point S, reducing the output of the foreign firm.

Figure 3
A domestic export subsidy



The optimal subsidy is determined by maximizing domestic welfare with respect to *s*. As there is no domestic consumption, welfare, denoted *W*, consists only of the profit of the domestic firm minus the cost of the subsidy:

$$W(s) = \pi(x(s), y(s); s) - sx(s) = xp(x + y) - cx. \qquad (3)$$

Setting $dW/ds = \pi_y\, dy/ds - sdx/ds = 0$ yields $s = -\pi_y\, \pi^*_{yx}/\pi^*_{yy} > 0$. Consequently, an export subsidy increases domestic profits by more than the subsidy payment leading to a rise in domestic welfare. But why is it that we need government intervention to do this?

At the initial Cournot–Nash equilibrium, domestic profits are lower than they would be if the domestic firm were able to somehow act first as a Stackelberg leader so as to take into account

the reaction of the foreign firm. Government commitment to an export subsidy makes it credible for the domestic firm to expand within the confines of a Cournot–Nash equilibrium in which no one firm has the ability to act first. Indeed, if only one government intervenes, the optimal export subsidy increases domestic exports to the (unsubsidized) Stackelberg-leader level. As illustrated in Figure 3, the profits of a domestic leader-firm (and domestic welfare) are maximized at S, which is the point of tangency between the domestic firm's iso-profit curve and the foreign firm's reaction function.

Further analysis of this case shows that both governments have a unilateral incentive to subsidize exports. There is a domestic profit-shifting gain even if the foreign government also subsidizes exports. The outcome is a Prisoner's Dilemma in which both are made worse off than if they could agree not to use export subsidies. Thus, as previously discussed, an understanding of strategic trade policy helps us make sense of international trade agreements that disallow export subsidies.

Limitations and extensions

There are significant difficulties in implementing strategic trade policy. A main problem is that strategic trade policy incentives depend very much on the nature of the underlying oligopolistic interaction. In particular, the strategic argument for export subsidies requires that outputs be strategic substitutes, which typically holds for a Cournot duopoly. However, as shown by Eaton and Grossman (1986), outputs are typically strategic complements under Bertrand competition ($\pi^*_{yx} > 0$ and $\pi_{xy} > 0$), giving rise to an incentive to tax rather than to subsidize exports. Other conditions, such as a greater number of domestic relative to foreign firms, can also change optimal policy from a subsidy to a tax.

These findings imply that governments need to know a lot about a particular industry in order to correctly identify whether to target exports with a subsidy or a tax. As a practical matter, there is also the political economy argument that governments might choose to target unprofitable 'sunset industries' rather than profitable industries (see Spencer, 1986, for consideration of what should be targeted). In addition, the argument for subsidies is weakened once we recognize that the marginal cost of raising revenue to pay for a subsidy is increased by the distortionary effects

of taxation. However, strategic trade policies that use taxes or tariffs are made more attractive by recognizing the full value of government revenue.

Notwithstanding the various limitations of strategic trade policy, the basic insight that governments may have a unilateral incentive to influence the outcome of strategic interactions in international oligopoly remains. Also, strategic trade policy has been analysed in a wide range of contexts and is robust to a range of generalizations. These extensions include consideration of the effects of unionization of the industry, dynamic effects on investment and R&D, vertical integration and trade in intermediate and final goods, and extension to general equilibrium.

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