Original Article

Strategic Trade Policy in a Cournot Oligopoly with Convex Cost

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Abstract

We provide a simple reason for export tax in a third-country model of strategic trade policy. We show that the optimal policy under Cournot competition could be export tax in the presence of convex production costs. This happens whether or not the import competing country imposes import tariff.

JEL Codes: F12, F13

Keywords

Convex cost, export tax, strategic trade policy, third-country model

Introduction

Late Professor Ronald W. Jones was an influential international trade economist and a pioneer in the general equilibrium model of international trade with perfect competition. Though none of us were fortunate enough to be his direct students but given his India connect both of us were fortunate to have some of his greatest students as our teachers. Arijit Mukherjee's PhD thesis was supervised by Professor Sugata Marjit at the Indian Statistical Institute Kolkata. Professor Jones was one of the PhD supervisors of Professor Marjit, who received his PhD in Economics in 1985 from Rochester University. Uday Bhanu Sinha did his PhD under the supervision of Professor Anjan Mukherji at the Jawaharlal Nehru

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University, New Delhi. Professor Mukherji did his PhD from Rochester University during 1969–1973 in the area of general equilibrium theory. We were taught not only by our supervisors but by other economists who were students of Professor Jones in Rochester.

Over the years, trade theory moved towards imperfect competition models and started having serious overlap with Industrial Organisation theory. Oligopoly models became fashionable in trade theory since early eighties and it generated the scope for strategic trade policy. Even though Professor Jones' seminal contributions were in Ricardian model, Heckscher–Ohlin model and specific factor model, some of his contributions (Spencer & Jones, 1991, 1992) provide the foundation for global value chain and international production fragmentation. His teaching and research have overwhelming presence in our life as we were taught by many of his students from Rochester and became colleagues of some of his students. This article is our humble tribute to the memory of late Professor Ronald W. Jones.

Beginning with the seminal paper by Brander and Spencer (1985), the literature on strategic trade policy has come a long way and highlighted how different trade policies are appropriate in different imperfect market environments. In Brander and Spencer (1985), two firms from two different countries are engaged in Cournot competition for supplying a homogenous good to a third-country market. The main finding is that the optimal policies for the domestic governments are to subsidise exports which shift profits from rival foreign firms and improve domestic welfare. Neary (1994) showed that export tax is the optimal trade policy in a Brander–Spencer economy if the social costs of public funds are sufficiently higher than unity or there is learning by doing.

In a two-country model where firms compete in domestic and foreign countries, Dixit (1984) showed the implications of the number of foreign and domestic firms. He established that the optimal trade policy is export subsidy if the number of domestic firms is not too large; but if it is sufficiently large, the optimal policy would be export tax.

Eaton and Grossman (1986) showed, on the other hand, that the optimal policy would be export tax under Bertrand competition. However, Etro (2011) shows that, contrary to the ambiguous results of strategic trade policy for duopolies, it is always optimal to subsidise exports when entry is endogenous, under both quantity and price competition. The strategic trade policy literature is further extended to incorporate how the strategic trade policy is affected in vertically related markets (see, e.g., Bernhofen, 1997; Chang & Chen, 1994; Chang & Sugeta, 2004; Ishikawa & Spencer, 1999; Rodrik & Yoon, 1989; Spencer & Jones, 1991, 1992;).

We develop a simple three-country model of trade similar to Brander and Spencer (1985) but with symmetric n (≥ 1) number of firms in exporting countries when the firms face convex costs of production, which show soft capacity constraints as mentioned in Cabon-Dhersin and Drouhin (2020). We show that the standard profit shifting motive of the exporting countries may create their optimal export policies as export tax (rather than subsidy) *if the cost functions are sufficiently convex and there are at least two firms in each of the exporting countries*. Then, we show that the similar result will hold good if there are import competing

firms in the importing country, which imposes tariff (or provides subsidy) to the imports.

It is worth pointing that although Brander and Spencer (1985) allowed for convex costs, they always found export subsidy as the optimal trade policy since they considered one firm in each country. As we show, export tax can be the optimal policy provided the exporting firms from a country not only face competition from the foreign firms but also from the domestic firms.

As mentioned in Brander and Spencer (1985),

> [Export subsidies] do not appear to make much sense from the standpoint of two-good competitive models of international trade. Even in markets where the domestic country can exercise some influence over world prices, the domestic interest is served by trade restriction, not by subsidisation of trade (p. 83).… If the country were large enough to influence the price of the exported good, then an export tax would be appropriate so as to improve the terms of trade. (p. 90)

This observation motivates Brander and Spencer (1985) to look at the imperfectly competitive markets to understand the reasons for export subsidies found in Western countries. The rivalry between Boeing and Airbus is an influential example in this respect (see, e.g., Carbaugh, 2007).

In a duopoly Cournot model, Brander and Spencer (1985) show that export subsidy may make sense in an imperfectly competitive market where firms have market power. Although export subsidies in their paper reduce the terms of trade for the subsidising countries, the higher outputs sold at prices above marginal costs help to dominate the adverse terms of trade effect, and make export subsidy as the optimal trade policy.

In contrast, our article shows a result that is in line with the message coming from the competitive trade model. We show that if the number of firms is large, thus reducing the market power of the firms, export tax is the optimal trade policy even if the market is imperfectly competitive.

The article is organised as follows. In the second section, we describe the model and derive the optimal strategic trade policy when there is neither any import competing firm nor any trade policy in the third country. The third section extends the analysis by considering import competing firms and trade policy in the importing country. The fourth section concludes this article.

The Model and the Results

Consider an economy with two countries, called country 1 and country 2. Assume that there are n (≥ 1) firms in each country. We assume the same number of firms in each country to eliminate the effects of the asymmetric number of firms to create export tax as the optimal policies of countries 1 and 2, that is, to eliminate effects similar to Dixit (1984). These firms produce a homogeneous product and compete in a third country, called country 3. Assume that all firms have the same

cost function and the gth firm faces the cost of production cq_g^2, where q_g is the output of the gth firm, $g = 1, 2, ..., 2n$.

We assume that countries 1 and 2 provide export subsidies or impose export taxes to the respective domestic firms to maximise welfare of countries 1 and 2, respectively.

We consider the following game. At stage 1, countries 1 and 2 determine export subsidies/taxes simultaneously. At stage 2, firms determine their outputs simultaneously. We solve the game through backward induction.

We assume that the inverse market demand function is $P = 1 - q$, where P is the price and q is the total output.

The ith firm in country 1 and the jth firm in country 2 determine their outputs to maximise $(1-q-cq_i+s)q_i$ and $(1-q-cq_j+t)q_j$, respectively, where s is the subsidy provided (or tax imposed if $s < 0$) by country 1, and t is the subsidy provided (or tax imposed if $t < 0$) by country 2, $i, j = 1, 2, ..., n$.

The equilibrium output of the ith firm in country 1 and the jth firm in country 2 can be found, respectively, as $q_i^* = \frac{1+s+ns+2c(1+s)-nt}{(1+2c)(1+2c+2n)}$ and $q_j^* = \frac{1+t+nt+2c(1+t)-ns}{(1+2c)(1+2c+2n)}$. The second-order conditions are satisfied.

Countries 1 and 2 determine the respective subsidy (or tax) rates to maximise $n(1-q^*-cq_i^*)q_i^*$ and $n(1-q^*-cq_j^*)q_j^*$, where $q^* = nq_i^* + nq_j^*$. The equilibrium subsidy (or tax) rates are $s^* = t^* = \frac{1-2c(-1+n)}{4c^2+n(3+2n)+c(2+8n)} > (<)0$ for $c < (>)\frac{1}{2(n-1)} = c^*$. The second-order conditions are satisfied.

The above discussion gives the following result immediately.

Proposition 1: *It is optimal for countries 1 and 2 to impose export tax if* $n > 1$ *and* $c > \frac{1}{2(n-1)} = c^*$.

The reason for the above result is as follows. Like Brander and Spencer (1985), the motive to steal market shares of the firms from other countries creates the incentive for export subsidy. However, as the convexity of the cost function increases, it reduces this benefit from export subsidy. On the other hand, since a country's welfare increases with the gross total profits of that country's firms, that is, with the total profits of that country's firms excluding the subsidy payments, it gives a country the incentive to impose export tax to contract the total outputs of its firms whenever the number of domestic firms is more than or equal to two. Hence, if the cost functions are sufficiently convex, the former effect is dominated by the latter effect to create export tax as the optimal policy.

In Brander and Spencer (1985), export subsidies reduce the terms of trade for the exporting countries. However, export subsidies are the optimal trade policies

in that paper, since the expanded outputs sold at prices above marginal costs dominate the adverse terms of trade effect.

The analysis of this section is similar to Brander and Spencer (1985) with the exception that we allow for more than one firm in each country. In contrast to Brander and Spencer (1985), we find that if the number of firms is sufficiently large, such that, $c > \frac{1}{2(n-1)} = c^*$, the exporting countries impose export taxes, and the trade policies increase the terms of trade for the exporting countries compared to free trade, that is, when the countries are not using trade policies. If the countries use the optimal trade policies, the equilibrium price of the product in the third country market is $P^{TP*} = \frac{n+2c(1+2c+2n)}{4c^2+n(3+2n)+c(2+8n)}$. However, if there is free trade, the equilibrium price of the product in the third country market is $P^{FT*} = \frac{1+2c}{1+2c+2n}$. If $n > 1$, we get $P^{FT*} < P^{TP*}$ for $c > \frac{1}{2(n-1)} = c^*$.

Import Competing Firms with Trade Policies of Country 3

By considering a third-country structure like Brander and Spencer, we have shown above that the optimal export policies are export taxes if the cost functions are sufficiently convex and there are at least two firms in each of countries 1 and 2. Now we want to show that similar result will hold even if there are import competing firms in the importing country, country 3, which imposes tariff on (or provides subsidy to) the outputs of the firms from countries 1 and 2.

We consider in this subsection that there are n (≥ 1) firms in each of country 1, country 2 and country 3. Assume that the gth firm faces the cost of production cq_g^2, where q_g is the output of the gth firm, $g = 1, 2, ..., 3n$.

We consider the following game. At stage 1, all three countries determine their trade policies simultaneously; countries 1 and 2 determine their export subsidies/taxes and country 3 determines tariffs/subsidies. At stage 2, firms from all the countries determine their outputs simultaneously. We solve the game through backward induction.

The ith firm in country 1, the jth firm in country 2 and the kth firm in country 3 determine their outputs to maximise $(1-q-cq_i+s-w)q_i)$, $(1-q-cq_j+t-w)q_j$ and $(1-q-cq_k)q_k$, respectively, where s is the subsidy provided (or tax imposed if $s < 0$) by country 1, t is the subsidy provided (or tax imposed if $t < 0$) by country 2, and w is the tariff imposed (or subsidy provided if $w < 0$) by country 3, $i, j, k = 1, 2, ..., n$.

The equilibrium output of the ith firm in country 1, the jth firm in country 2 and the kth firm in country 3 can be found, respectively, as $q_i^* = \frac{1+s+2ns+2c(1+s-w)-w-n(t+w)}{(1+2c)(1+2c+3n)}$, $q_j^* = \frac{1+t+2nt+2c(1+t-w)-w-n(s+w)}{(1+2c)(1+2c+3n)}$ and $q_k^* = \frac{1+2c-n(s+t-2w)}{(1+2c)(1+2c+3n)}$. The second-order conditions are satisfied.

Countries 1, 2 and 3 determine the respective subsidy (or tax) and tariff (subsidy) rates to maximise $n(1-q^*-cq_i^*-w)q_i^*$, $n\left(1-q^*-cq_j^*-w\right)q_j^*$ and $n(1-q^*-cq_k^*)q_k^*+w(nq_i^*+nq_j^*)+\frac{1}{2}q^{*2}$, where $q^*=nq_i^*+nq_j^*+nq_k^*$. The equilibrium subsidy (or tax) rates imposed by countries 1 and 2 and the equilibrium tariff (or subsidy) imposed by country 3 are

$$s^*=t^*=-\frac{\left(-1+2c\left(-1+n\right)-n\right)\left(1+2c\left(2+2c+n\right)\right)}{\left(1+2c\right)^3\left(1+4c\right)+\left(1+2c\right)^2\left(7+22c\right)n+\left(1+2c\right)\left(11+36c\right)n^2+3\left(1+6c\right)n^3}>(<)0$$

for $c<(>)\frac{1+n}{2(n-1)}=c^{**}$ and

$$w^*=\frac{\left(1+2c\right)^4+\left(1+2c\right)\left(3+2c\left(7+6c\right)\right)n+\left(3+2c\right)\left(1+4c\right)n^2}{\left(1+2c\right)^3\left(1+4c\right)+\left(1+2c\right)^2\left(7+22c\right)n+\left(1+2c\right)\left(11+36c\right)n^2+3\left(1+6c\right)n^3}>0.$$

The above discussion gives the following result immediately.

Proposition 2: *It is optimal for countries 1 and 2 to impose export tax if* $n>1$ *and* $c>\frac{1+n}{2(n-1)}=c^{**}$.

The reason for the above result is similar to that of Proposition 1. However, the critical value $c^* < c^{**}$. This happens since the presence of the firms in country 3 increases the incentive for export subsidy, as it helps to shift profits from both countries 2 and 3. Hence, the convexity of the cost function that is required to make export taxes as the optimal policies of countries 1 and 2 is higher in Proposition 2 compared with Proposition 1.

Conclusion

We provide a simple reason for export tax to be the optimal trade policy in a third-country model like Brander and Spencer (1985).

We have shown in the third-country structure of Brander and Spencer (1985) with no firms in the importing country and no trade policy of the importing country that export tax is the optimal trade policy of the exporting countries under Cournot competition if the cost function is sufficiently convex and there are at least two firms in each country. We show that similar results hold even if there are firms in the importing country and the importing country imposes tariffs. It can be verified easily that export tax will occur in equilibrium also for the intermediate case where the importing country does not set any trade policy but there are firms in the importing country.

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