

Vertically Integrated Enterprises and Strategic Trade Policy

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Discussion Paper No. 636: 2008

ISBN 978 - 952-10 - 4833-3

November 12, 2008

Abstract

This paper examines the profit-shifting motive of a government trade policy and investigates the effects of vertical structures and tariffs when markets are characterized by Cournot oligopolies. I also analyze the impact of competition on the price and output decisions of upstream producers. The direct impact of a tariff in the upstream sector of the market is to increase the price of the input which indirectly lowers domestic final good production and thus, welfare. In particular I show that vertical integration affects the direction in which the domestic country aims to switch trade flows by import tariffs. When foreign firms are vertically integrated downstream tariffs harm domestic input producers by lowering both the input price and output. However, under non-integration a tariff on the final good increases the domestic and foreign input supply. Increased competition in the upstream market has two effects. First, it decreases the price at which the input is traded. Second, it also lowers the output of each domestic intermediate good producer. Under intense competition in the upstream sector a tariff on intermediate good imports lowers output.

Keywords: Vertical Integration, Oligopolies, Upstream Competition, Foreclosure and Tariffs

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This research is supported by the Yrjö Jahnsson Foundation. I am very grateful to Tapio Palokangas and Pertti Haaparanta for their advice. I also wish to thank Hecer seminar participants for comments and discussions. The usual disclaimer applies.

1. Introduction

The anticompetitive effects of vertical mergers have long been an issue of policy debate in economics and antitrust, especially in markets where downstream firms depend on key inputs supplied by a dominant vertically integrated firm. Theory suggests that vertical integration may alter the pricing incentives of upstream firms which could result into market foreclosure¹. According to Salop and Scheffman (1983, 1987), the strategic effect of vertical integration is to “raise rivals’ cost” of production in the final good sector. A fundamental insight of this theory is that vertical integration can reduce industry competition, raise prices of both intermediate and final goods and thereby affect consumer welfare. Vertical integration can be viewed also as a pre-emptive strategy that deters entry. On the other strand of the debate is the efficiency gain issue. First, vertical mergers could result in the elimination of the double mark-up when a downstream firm merges with a more efficient upstream firm by enabling the merged firm to produce the same output at a lower cost.² Second, vertical integration might shift output from the less efficient fringe producer to the more efficient dominant firm. The impact of vertical mergers from a welfare point of view is therefore not clear-cut as it offers little increasing welfare trade-offs when mergers have both efficiency gains and anticompetitive effects. Thus the welfare analysis of vertical integration requires assessing the relative importance of the various effects.

In practice domestic competition among industries of varying degrees of integration raises a number of antitrust questions. This is even evident when the industries involved have different national identities. In this paper we are concerned with competition in the intermediate good sector and government trade policy. Francois and Wooton (2000a) have shown that increasing competition in the intermediate good sector have positive welfare effects on consumers of the transported product. Brander and Spencer (1985) model of strategic trade policy has shown that, the profit shifting effects of the use of subsidies could be welfare enhancing in a setting where the home firm competes with a foreign rival in a Cournot-Nash quantity game in a third market. However a legitimate argument for the use of export subsidy in this case requires a very specific oligopolistic market structure. According to Eaton and Grossman (1986) the nature and details of the optimal export policy conclusions are very sensitive to the specification of the market structure and depend very much on the form of competition between oligopoly firms. In a Bertrand duopoly where firms commit to prices they show that the appropriate policy is a production or export tax. Dixit (1984) has extended the Brander and

¹ Hart and Tirole (1990) and Ordover, Saloner and Salop (1990)

² See Perry (1990), Williamson (1979) and Salinger (1988) for discussions of these effects.

Spencer model in a more general Cournot oligopoly where there are many firms and the home market is also involved and established that in equilibrium an export subsidy is optimal only when there are few domestic firms involved in the market. Horstman and Markusen (1986) show the effects of free entry in eroding the gains from strategic trade policy. Dixit and Grossman (1986) analyse the effects of subsidy when many oligopoly firms compete for a scarce resources and show that strategic intervention may not be the most desirable policy if this may cause the price of the scarce input to rise. Krugman (1984) allows for increasing returns to scale at the margin in a multi-market Cournot competition model and concludes that protection shifts the duopoly equilibrium to the home market's favour by lowering the home firm's marginal cost which enables it to increase its market share to the disadvantage of the foreign firm. In a similar study however Krishna (1989) show that the nature of the optimal policy needed to correct for the divergence between price and marginal cost is dependent on the extent of product differentiation assumed to exist in the market

Several papers³ have examined the optimal policy or effects of policy instruments on welfare within an environment of imperfect competition. There have been extensions of this basic model structure by integrating into it imperfectly competitive intermediate input markets. Spencer and Jones (1991) examine trade and protection of a scarce national raw material in a vertically related market, and show that an export restriction at the intermediate level can increase a country's exports of the final product. In this paper we present an analysis based on a simple two-country model of international trade under imperfect competition to explain vertical linkages between the intermediate good producers (upstream producer) and the final good sector (downstream producers). More specifically, we examine the effects of the use of tariffs (or subsidies) by the domestic government to strategically shift rents vertically or horizontally.

In a similar paper Rodrik and Yoon (1989) show that a tariff placed on the imports of the input by the domestic home government will be borne entirely by the foreign vertically-integrated firm and will be welfare increasing. This is only evident if the foreign firm recognizes that any increases in the price of the input would decrease its sales to zero. However, if the application of the tariff by the domestic government increases the domestic price of the input, then an internal solution occurs in which the intermediate product is both imported and produced domestically. A tariff in this case would not act as a perfect rent-shifting device and could actually reduce home country welfare.

³ Bernhofen (1997), Ishikawa and Lee (1997) Ishikawa and Spencer (1999), Hokari, Hwang and Ohta (2003), Chang and Sugeta (2004), Nese and Straume (2007), Yanasa and Kawabata (2008)

In this paper we show first, when foreign firms are vertically-integrated, a tariff on input imports could lead the foreign firm to shift their exports from the intermediate good to the final good. Second, tariffs increase the domestic input price which indirectly lowers final good production and thus, welfare. Third, upstream competition lowers the input price and output of each domestic input producer. Under intense competition in the upstream sector a tariff on input imports lowers output.

The paper is organized as follows. Section 2 describes the basic features of the model. Section 3 sets out the equilibrium conditions in the upstream and the downstream sector of the domestic market under non-integration in the presence of the domestic country tariff policy and Section 4 discusses the effects of the tariffs on profit shifting in the input and the final good market. Section 5 derives the comparative static effect of the imposition of a tariff by the domestic government. Section 7 examines the market equilibrium conditions when the foreign firm is vertically integrated. Section 8 looks at the vertical supply decisions of the foreign firm in relation to domestic tariff policy. Section 9 provides the concluding remarks.

2. The Model

The basic model setting is illustrated in Fig. 1. In the domestic country and the foreign

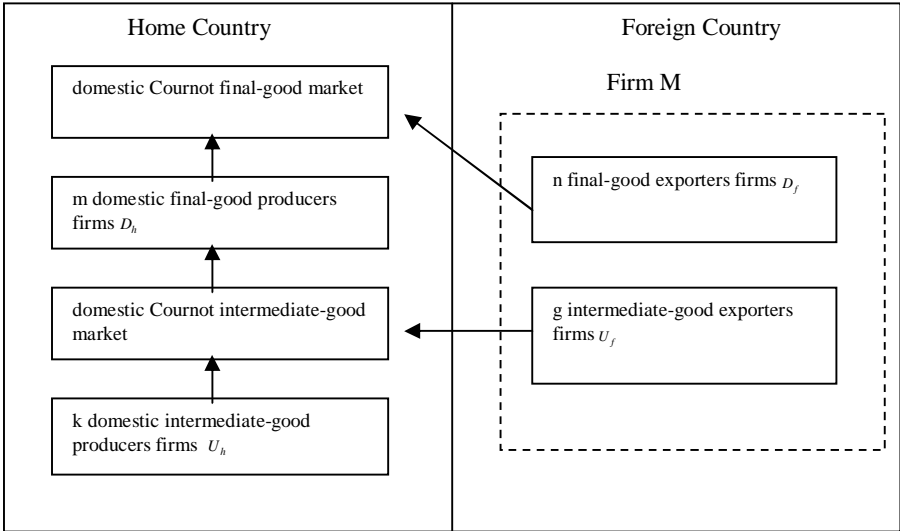


Fig. 1. Market structure

country there are two vertically related activities where an upstream firm (U_h) supplies an intermediate input to a downstream firm (D_h) in the domestic market. In line with Spencer and Jones (1992), we compare this market structure to a foreign market where a vertically integrated foreign firm (M) exports to the domestic country in the two markets. Alternatively we assume that a foreign monopoly firm (U_f), exports only the input and another foreign firm (D_f) produces and export the final good using its own input supplies. In this case we introduce asymmetry in the ownership structure between the foreign and domestic firm by assuming that only the foreign firm is vertically integrated. This asymmetry could stem from differences in government policy which is evident in differences in antitrust policies among countries. To keep the analysis fairly simply we assume there is no consumption of the good in the exporting country. We attempt to highlight a situation where a downstream firm depends on a key input from an upstream firm in the domestic or foreign country.

In this paper we assume static competition between upstream firms and downstream firms where the firms produce a homogenous good and use quantities as their strategic variables. Downstream firms take the price of the intermediate input and the output of its rival as given.

By an appropriate choice of units, the technology of production is simplified by assuming that one unit of intermediate input is required to produce one unit of the final good and there are no other factors of production. Without loss of generality we assume foreign and domestic markets to be segmented. Therefore, since marginal cost is assumed to be constant, each market could be independently analysed.

In what follows we consider two stages of decision. In stage 1, the foreign firm and the domestic firm commit to the quantities of the intermediate good to supply to the domestic market, so as to maximize profits taken rival's output as given. In stage 2, the domestic final good producers and the foreign firm set the output levels of the final good so as to maximize profits taking rivals output and the input price (r) as given. The input price is therefore the domestic market-clearing price which equates domestic demand by the final good producers to the supply. As usual this game is solved by backward induction.

3. Market Equilibrium

This section sets out to analyse the equilibrium conditions in the domestic country downstream (final good) and the upstream markets (intermediate good) under non-integration. This analysis is quite relevant because vertically integrated firms will have incentives that differ from those of non-integrated firms when competing in the downstream and upstream market. We further develop the effects of a tariff on the export decisions of the foreign firm in the input and final good market.

3.1 Downstream Market

Let y^h and y^f be the domestic firm and the foreign firm production of the final good respectively. We assume the inverse demand function of the final good to be $p = p(Y)$ where $p'(Y) < 0$. In this paper we assume a linear demand function for the final good as follows: $p = \alpha - \beta y^h - \gamma y^f$ where α , β and γ are parameters. In this set up we assume $\beta = \gamma$ which means domestic and foreign products are perfect substitutes. Since $\beta - \gamma$ determines the degree of product differentiation, when $\beta > \gamma$, then the domestic and foreign products are imperfect substitutes. Total output is represented as $Y = ny^h + my^f$. Letting t denote tariff applied to final good imports by the domestic country, a typical domestic firm and a foreign firm will then choose output to maximize the following profits:

$$\pi^h = (p - r - c^h)y^h \quad (1)$$

$$\pi^f = (p - t - c^f)y^f \quad (2)$$

where c^h and c^f are the constant marginal cost of the domestic and the foreign final good producers respectively. We assume that $c^h = c^f = 0^4$. Firms are assumed to determine the quantity of final good to produce taking the output of the other firm and the input price as given. We examine the second stage Cournot equilibrium for the final good. The first-order conditions for profit maximization are given as follows:

$$\frac{\partial \pi^h}{\partial y^h} = p + y^h \frac{\partial p}{\partial y^h} - (r + c^h) = 0 \quad (3)$$

$$\frac{\partial \pi^f}{\partial y^f} = p + y^f \frac{\partial p}{\partial y^f} - (t + c^f) = 0 \quad (4)$$

In the Cournot-Nash equilibrium the output of each downstream firm as a function of r and t is given as:

$$y^h = \frac{1}{D} [\alpha + mt - (m+1)r], \quad y^f = \frac{1}{D} [\alpha + nr - (n+1)t] \quad (5)$$

where $D = (m+n+1)\beta > 0$. For strategic policy considerations by governments, equation (5) indicates that a tariff by the domestic government would increase the home firm production of the final good. This is because higher values of t results in increased output by domestic firms while output of the foreign firm decreases. The idea is simple, the introduction of the tariff by the home government increases the marginal cost incurred by the foreign firm. This makes the foreign firm to decrease its production of the final good for a given output of its rival. Thus the tariff shifts rents horizontally towards domestic firms. That is why tariffs are an attractive policy option for the domestic government. An increase in the tariff increases the output of the home firm and decreases that of the foreign rival. Consequently, the home firms' market share expands at the cost of the foreign rival.

⁴ This assumption is made for the sake of technical simplicity, as this may not qualitatively affect the result.

3.2 Upstream Market

We next consider the intermediate good market. In the domestic country there are k identical firms that produce the intermediate good x^d . In the foreign country there are g identical firms that produce and export output x^F of the intermediate input to the home market. Firms are engaged in a Cournot-Nash competition and aggregate input supply in the domestic country is given by $X = kx^d + gx^F$ where kx^d is total domestic production and gx^F represents total foreign exports. In the first stage, both the domestic input producer and the foreign firm determine the price of the intermediate good r charged to the downstream firms to maximize profits taking into consideration the outcome of the second-stage game given by (5). Equating domestic input demand with the supply (i.e. $ny^h = X = kx^d + gx^F$) the derived demand from (5) is:

$$r = \frac{\alpha + mt}{(m+1)} - \frac{(m+n+1)\beta}{n(m+1)} X \quad (6)$$

Letting domestic policy towards the intermediate good be a specific import tariff T (a subsidy, if negative), the profits of the domestic intermediate good producers and that of the foreign intermediate good producers are represented as follows:

$$\pi^d = (r - c^d)x^d \quad (7)$$

$$\pi^F = (r - c^F - T)x^F \quad (8)$$

where we assume $c^d = c^F = 0$. The first order conditions for profit maximization of (7) and (8) are:

$$\frac{\partial \pi^d}{\partial x^d} = r + x^d \frac{\partial r}{\partial x^d} = 0 \quad (9)$$

$$\frac{\partial \pi^F}{\partial x^F} = r - x^F \frac{\partial r}{\partial x^F} - T = 0 \quad (10)$$

In the Cournot-Nash equilibrium, assuming there is an interior solution where the intermediate goods market is supplied by both domestic production and imports, the output of the intermediate good is:

$$x^d = \frac{n[\alpha + mt + g(m+1)T]}{(k+g+1)(m+n+1)\beta} \quad (11)$$

$$x^F = \frac{n[\alpha + mt - (k+1)(m+1)T]}{(k+g+1)(m+n+1)\beta} \quad (12)$$

This yields an equilibrium price of the intermediate good and the final good as:

$$r = \frac{\alpha + mt + g(m+1)T}{(k+g+1)(m+1)} \quad (13)$$

$$P = \frac{(k+g)(\alpha + mt) - g(m+1)T}{(k+g+1)(m+n+1)} \quad (14)$$

with a corresponding equilibrium outputs of the final good given as follows:

$$y^h = \frac{(k+g)[\alpha + mt] - g(m+1)T}{(k+g+1)(m+n+1)\beta} \quad (15)$$

$$y^f = \frac{[(k+g+1)(m+1) + n]\alpha - [(m+n+1)(k+g+1) + mn(k+g)]T + ng(m+1)T}{(m+1)(k+g+1)(m+n+1)\beta} \quad (16)$$

Total equilibrium supply of both the intermediate good and the final good are represented as follows:

$$X = \frac{n[(g+k)(\alpha + mt)] - g(m+1)nT}{(m+n+1)\beta(k+g+1)} \quad (17)$$

$$Y = \frac{[(m+n+1)(k+g+1) + n(k+g)]\alpha - [(m+1)(k+g+1) + n]mt - ng(m+1)T}{(m+n+1)\beta(k+g+1)(m+1)} \quad (18)$$

4. Tariff Policy and Profit-Shifting

Generally competing firms in importing country experience an increase in profit, whenever the effect of a tariff leads to a decrease in export by the foreign firm.⁵ A tariff on both the intermediate and the final good sector tends to increase the domestic price of both goods for any given level of output by other producers. Under Cournot competition, an import tariff is a successful profit-shifting device because the market share of the protected firm increases at the expense of the rival firm.⁶

In this section we examine the rent-shifting effect of tariffs in both the upstream and downstream sector of the industry. A unilateral application of a tariff by the domestic country in the upstream market affects the price of the input by increasing it. However the output of the domestic input production increases in (11) while that of foreign input production falls. There is therefore a rent-shifting effect when tariffs are applied to the intermediate good sector. However in equation (15) output of the final product is decreasing in own marginal cost of increases in the input price. Thus while domestic production of the final good decreases, foreign production of the final good increases (16). In this case a tariff policy applied to the domestic intermediate good sector may have a direct positive rent-shifting effect, but an indirect consequence of reducing domestic final-good production.

A higher tariff on the downstream sector increases the output of both the domestic and the foreign intermediate good producers. However, while the intermediate good price increases, this does not affect the output of the domestic final good production, it also increases. Under this scenario the domestic final good firms increase at the cost of the foreign firms. This is because an increase in the tariff increases the marginal cost faced by the foreign exporters of the final product. Thus, there is a horizontal rent-shifting effect in favour of domestic firms. A domestic final good output expansion implies that the derived demand facing the upstream producers shifts outwards, causing both equilibrium output of the intermediate good and the price to increase. In effect downstream tariff increases the price and the output of the intermediate product and the final good, thereby increasing the profits of domestic upstream and the downstream firms. This is confirmed by deriving the expressions for the equilibrium profits. Setting $T = 0$ equilibrium profits are represented as follows:

⁵ Gruenspecht (1988)

⁶ Brander and Spencer (1985)

$$\pi^u = \frac{[(k+g)(\alpha+mt) - g(m+1)T]^2}{(m+n+1)^2 \beta (k+g+1)^2} \quad (19)$$

$$\pi^D = \frac{n[(\alpha+mt+g(m+1)T)]^2}{(m+n+1)\beta(k+g+1)^2(m+1)} \quad (20)$$

A tariff applied to the downstream sector in this model mirrors the standard strategic trade policy of Brander and Spencer (1985) where an export subsidy is optimal in the policy game. The domestic government therefore has an incentive to take prior policy action that alters the strategic interaction between foreign and domestic firms. In this case, a tariff policy on final good imports implies both a terms-of-trade and a profit-shifting effect to local firms. Thus, terms of trade and profit-shifting effects therefore could be viewed as a rationale for trade policy intervention.

5. A tariff on the Intermediate Good Imports: Comparative Static Analysis

To derive the comparative static effects of a tariff on the intermediate good imports we would assume as usual that, the second order conditions for profit maximization hold and the Cournot equilibrium is unique and that one firm's marginal profit declines with an increase in the output of the other firm (see Bulow et al, 1985). That is, $\frac{\partial \pi^d}{\partial x_d x_d} < 0$; $\frac{\partial \pi^d}{\partial x_d x_f} < 0$; $\frac{\partial \pi^f}{\partial x_f x_f} < 0$; $\frac{\partial \pi^f}{\partial x_f x_d} < 0$;

$$D = \frac{\partial \pi^d}{\partial x_d x_d} \frac{\partial \pi^f}{\partial x_f x_f} - \frac{\partial \pi^d}{\partial x_d x_f} \frac{\partial \pi^f}{\partial x_f x_d} > 0.$$

When we assume that the domestic policy towards the intermediate good sector involves an import tariff, then the impact of an increase in the tariff rate on the quantities supplied is found by totally differentiating the home market equations (9) and (10) to obtain:

$$\begin{bmatrix} (k+1)\beta & g\beta \\ k\beta & (g+1)\beta \end{bmatrix} \begin{bmatrix} dx^d \\ dx^f \end{bmatrix} = \begin{bmatrix} 0 & -\beta x^d & -\beta x^f \\ 1 & -\gamma x^d & -\beta x^f \end{bmatrix} \begin{bmatrix} dT \\ dk \\ dg \end{bmatrix}. \quad (21)$$

The solution is obtained by matrix inversion

$$\begin{bmatrix} dx^d \\ dx^f \end{bmatrix} = \frac{1}{D} \begin{bmatrix} -g\beta & -\gamma\beta x^d & -\gamma\beta x^f \\ (k+1)\beta & -\gamma\beta x^d & -\gamma\beta x^f \end{bmatrix} \begin{bmatrix} dT \\ dk \\ dg \end{bmatrix}. \quad (22)$$

where $D = (k + g + 1)\beta^2 > 0$.

The effects of the import tariff on the output produced by both domestic and foreign firms are similar to Brander and Spencer type models of strategic trade policy. Since the tariff increases the foreign intermediate good production cost, they affect negatively the foreign firm's output and positively the domestic input producers. The impact of the tariff is to directly decrease the total input supply (17), increase the price of the input (13) which indirectly negatively affects the total supply of the final good (18).

We know that an imposition of a tariff by the domestic government in the upstream market is to increase the price of the intermediate good (i.e. $\frac{dr}{dT} = -\beta \left[\frac{g\beta - (k+1)\beta}{D} \right] > 0$), thus a comparative static analysis effect of a change in the input price on domestic final good producers is to lower output, $\frac{dy^h}{dr} = \frac{(m+1)\beta}{D} < 0$. On the other hand output of the foreign final good producers rather increases $\frac{dy^f}{dr} = -\frac{n\beta}{D} > 0$. Thus a policy designed to protect the domestic intermediate good producers here has an indirect effect on the domestic final good producers.

Table 1: Comparative static effect of government tariff on output produced under non-integration in the home country

Government Policy	Input production		Total input production	Final-good production		Total final-good production
	Domestic output	Foreign output		Domestic output	Foreign output	
	(x^d)	(x^f)	(X)	(y^h)	(y^f)	(Y)
Tariff on intermediate input	+	-	-	-	+	-
Tariff on final good	+	+	-	+	-	-

6. Upstream Competition

Interest in this issue arises from the commonly expressed view that to promote competition in the final good production, the intermediate good sector has to be protected to prevent

excessive entry so as to keep the home industry strong enough to withstand foreign competition. An example of such protection is the United States' anti-dumping tariff on computer chips (DRAM) imported from Korean companies in 1993.⁷ To protect local production of inputs some governments also regulate the intermediate good sector by requiring that foreign firms located in the home market use a certain given proportion of locally manufactured inputs. This is known in the literature as Local Content Requirement (LCR). The growing importance of rules of origin with the creation of regional trade blocs such as the North American Free Trade Association (NAFTA) provides an example of such LCRs. The aim is to enhance the competitive position of both the domestic intermediate and the final good producers. However on the other strand of the argument is the view that encouraging competition in the intermediate good sector lowers the price of the input, increase the output of final good producers and therefore increase welfare. Thus the existence of competition therefore makes the domestic anti-trust policy unnecessary.

To see the effects of competition in the intermediate good sector on the price of the input, we differentiate (13) with respect to k to get:

$$\frac{dr}{dk} = - \frac{[\alpha + mt + g(m+1)T]}{(k + g + 1)^2(m+1)} \quad (23)$$

which is negative, from (23) when the number of foreign intermediate good firms is held fixed a change in the number of home intermediate good firms lower the price of the intermediate input. Similarly the output of the intermediate good also decreases, inferring from (22) and using (11) this can be written as follows:

$$dx^d = - \frac{n[\alpha + mt + g(m+1)T]}{(k + g + 1)^2(m + n + 1)\beta} dk \quad (24)$$

Increased competition in the domestic intermediate good market therefore has two effects. First, it increases the number of input suppliers which, other things equal lowers the price at which the input is traded. Second, increased competition lowers the output of the each domestic intermediate good producer. It is evident from (23) and (24) that with falling prices and lower output profits of each intermediate good firm fall. Under intense competition in the intermediate good sector a tariff on intermediate good imports has the same effect, it lowers

⁷ Ishikawa and Lee (1997)

output. In this sense competition policy acts as a substitute for strategic trade policy, *a` la* Brander and Spencer (1985).

Total input supply ($X = kx^d + gx^F$) on the other hand increases as the number of input producers increase. That is,

$$dX = kdx^d + x^d dk + gdx^F$$

with the linear example using (22) we obtain

$$dx^d = \frac{n[\alpha + mt + g(m+1)T]dk}{(k+g+1)(m(k+g) + (n+1)(k+g) + (m+n+1))\beta} \quad (25)$$

While an increase in the number of intermediate good firms decreases the output of each firm (24), on the other hand the overall total output of the intermediate good producers increases. With lower input prices, domestic output of the final good increases. Thus competition in the intermediate good sector benefits the domestic final good producers and improves domestic welfare, this is because whenever the total supply of the final good rises, consumers gain.

7. Vertical Integration

To examine the effects of vertical integration on the production decisions of each domestic and foreign firm, we consider the case where only the foreign firm is vertically-integrated. This section therefore looks at the situation where the intermediate good and the final good are produced and exported to the domestic market by a single foreign firm labelled as firm *M*. We still maintain the same game analysed in the case of non-integration.

7.1 Downstream Market

Similarly letting *t* denote tariff applied to final good imports by the domestic country, the domestic and the foreign final good firm will choose output to maximize the following profits:

$$\pi^h = (p - r - c^h)y^h \quad (26)$$

$$\pi^M = \pi^f + \pi^F = (p - t - c^f)y^f + (r - c^F - T)x^F \quad (27)$$

In (27) the profit of the vertically-integrated foreign firm includes the profits it earns in the export of the intermediate good to the domestic market. The Cournot-Nash equilibrium in the downstream sector when the foreign firm is integrated is similar to the case under non-integration. The derived demand for the input remains unchanged.

7.2 Upstream Market

The profit of the domestic firm is presented as follows

$$\pi = (r - c)x^d. \quad (28)$$

The profit function of the foreign vertically integrated firm is the same as in (27). Under vertical integration the first-order conditions for the home firm and the foreign intermediate good firm is as follows:

$$\frac{d\pi^d}{dx^d} = r + x^d \frac{dr}{dx^d} = 0 \quad (29)$$

$$\begin{aligned} \frac{d\pi^M}{dx^F} &= \pi_{y^h}^f \frac{dy^h}{dr} \frac{dr}{dX} + \pi_{y^f}^f \frac{dy^f}{dr} \frac{dr}{dX} + \pi_r^f \frac{dr}{dX} + \pi_{x^F}^F = 0 \\ &= (r + x^F \frac{dr}{dx^F} - T) + p'y^f = 0 \end{aligned} \quad (30)$$

where subscripts denote partial derivatives and $p'y^f = -\beta y^f$ in the linear example. The first term in (30) is the marginal revenue less marginal cost of intermediate good export by the foreign firm. The second term is the strategic term which measures the effect of an increase in output of the intermediate good on profits earned by the foreign firm on final good exports given the price r charged for the intermediate good. Joint control of the two exports markets gives firm (M) the additional consideration of the strategic effect. Thus the integrated firm anticipates losses to be incurred on the downstream sector as its intermediate product export increases. The integrated firm (M), would be more accommodating in the upstream sector of the market and would therefore export less of the intermediate good relative to the firm (D_f).

Under vertical integration the equilibrium values are as follows:

$$x^d = \frac{n[(g(m+1) + (m+n+1))\alpha - (mng + (g-m)(m+n+1)t + g(m+1)(m+n+1)T)]}{(m+n+1)((m+1)g + (k+1)(m+n+1))\beta} \quad (31)$$

$$x^f = \frac{n(m+1)[-k\alpha + (k(n+1) + (m+n+1))t - (k+1)(m+n+1)T]}{(m+n+1)((m+1)g + (k+1)(m+n+1))\beta} \quad (32)$$

$$X = \frac{nk\alpha + (mn(g+k) + ng)t - gn(m+1)T}{((m+1)g + (k+1)(m+n+1))\beta} \quad (33)$$

$$r = \frac{(g(m+1) + (m+n+1))\alpha - (mng + (g-m)(m+n+1))t + g(m+1)(m+n+1)T}{(m+1)((m+1)g + (k+1)(m+n+1))} \quad (34)$$

$$y^h = \frac{k\alpha + (m(g+k) + g)t - g(m+1)T}{((m+1)g + (k+1)(m+n+1))\beta} \quad (35)$$

$$y^f = \frac{((m+1)(g+k+1) + n)\alpha - (mn + (g+k)(mn + m + n + 1) + (n+1))t + ngT}{((m+1)g + (k+1)(m+n+1))\beta} \quad (36)$$

$$Y = \frac{((m+1)(g+k+1) + n(m+k))m\alpha - (m(g+k)(n+1) + k)mt - gnT}{((m+1)g + (k+1)(m+n+1))\beta} \quad (37)$$

8. Vertical Supply Decision and Domestic Country Policies

In this section we will follow Spencer and Jones's (1991) analysis of an international duopoly in which a vertically-integrated foreign firm produces a key intermediate product at a lower cost than the domestic firm and competes with the domestic firm in a Cournot market for the final product. Spencer and Jones show how trade in the intermediate input can arise as an equilibrium in such a framework. They analyse the strategic behaviour of the vertically integrated firm in the presence of the government trade policy and suggested the possibility that an export subsidy would be desirable on both the input and on the final good. This section however differs from that of Spencer and Jones in that, while they consider policies of the government of the integrated firm as well as the vertical supply and vertical foreclosure decisions of the foreign firm, we rather carry out our analysis from the perspective of the non-

integrated firm and its home government policies i.e. tariff on both intermediate and final good import.

According to Spencer and Jones (1992) the export decisions of firm (M) depends critically on profit margins earned in the export of the intermediate good and the final good to the domestic market evaluated at the Cournot equilibrium. Thus using first order conditions (4), equation (30) can be rewritten as:

$$(r - T) - (p - t) = -x^F r' \quad (38)$$

From (38) the foreign integrated firm would export both the intermediate good and the final good if and only if the profit margin from the export of the intermediate good exceeds the gain from final good exports. However examining this condition from the perspective of the domestic firm, it is evident that the domestic firm will enter the market for the final good if and only if the profits of final good sales exceed that of intermediate good sales ($\pi^h > \pi^d$) which means that $p > r$. If $(p - t)$ is therefore the profits earned from final good export by the firm (M) and $(r - T)$ from intermediate good exports, it could be the case that final good sales $(p - t)y^f$ exceeds that on intermediate-good sales $(r - T)x^F$. The foreign firm at the margin would prefer to export more of the final good but less of the intermediate-good. Thus any further increases in r by the foreign firm would result in vertical foreclosure where imports are driven to zero ($x^F = 0$). Setting $t=0$ and $T=0$ we see from Eq (38) that when imports are forced to zero the foreclosure price given as r^p is equal to p . The foreign firm would vertically supply the inputs to the domestic firm if and only if any reduction in r below the foreclosure price would increase its overall profits.⁸ However if $r \geq r^p$ then vertical foreclosure occurs as imports become prohibitively expensive and $x^F = 0$.

Domestic government policies and the cost of input production are factors that also determine whether foreclosure occurs or not. As Spencer and Jones (1989) show, vertical foreclosure of the input may occur if it would "raise rivals' cost" of production in the final good market and also, when marginal cost of input production is sharply increasing. As shown by (32), increases in the level of the tariff on intermediate good imports lowers foreign exports of the input. At an excessively higher tariff rates imports could be driven to zero ($x^F = 0$). To induce vertical supply of the input a tariff on the final good imports increases the supply of the input by the

⁸ See Spencer and Jones (1991) for a detailed discussion of this issue

vertically integrated foreign firm [cf. equation.32]. This situation arises because of the presence of the strategic effect, an increase in the tariff increase the cost of this effect. However, because the strategic effect is negative this is the same as a decrease in the marginal cost of the foreign vertically integrated firm leading to an increase in intermediate good exports see equation [cf. equation. 30].

Examining the domestic government tariff policy under non-integration shows that a tariff on final good import increases both domestic firm and the foreign firm intermediate good output, however the same is not true under vertical integration. From Eq. (31), an increase in the level of the tariff on the final good would raise the domestic supply of the intermediate good if and only if $g - m < 0$ hold. That is when foreign final good exports exceed input supply. Intuitively, since increases in the level of the tariff on the final good increases the marginal cost of final good exports, the vertical integrated firm will reduce the final good export and raise the export of the intermediate good, see (32). Domestic input production is therefore likely to fall. Thus a tariff on the final good by the domestic government is an effective instrument in protecting domestic final good producers against foreign competition.

The effect of an increase in the level of the tariff in the intermediate good market under vertical integration is similar to that of non-integration examined in section 3.2. However when firms are vertically integrated downstream tariff lowers the price of the intermediate good (34) and domestic input production (31). Profit of input producers falls, while profit of domestic final good producers rather increases.

Conclusion

We have considered a domestic market that is served by a domestic firm and a foreign vertically integrated firm characterised by Cournot competition in the presence of government tariff policy in the upstream and downstream sector of the market. We examined the effect of this policy on the profits of the domestic input and final good producers and the vertical supply decisions of the foreign vertically integrated firm, but the main focus of the paper has been to demonstrate that tariff policy designed to protect the upstream producers has an indirect effect of lowering domestic production of the final good. This is because output of domestic final good producers falls while output of the foreign firm rather increases thereby increasing the profit of foreign firms to the disadvantage of domestic firms. Thus restriction of input trade not only affects prices in that market but disturbs conditions in the final good's market as well, and

these indirect effects must be taken into consideration in determining what is optimal in terms of national welfare.

One interesting result of this paper is that vertical integration affects the direction in which policy by the importing country aims to switch trade flows. If the industries in both countries are not integrated, then a domestic tariff policy on final goods import increases both local and foreign input supply. However under vertical integration where the foreign firm has joint control over the input and final good market, domestic input production falls while the foreign export of the input increases. Vertical supply of the input is induced by a tariff on the final good. This shift in the supply of the input is possible when the marginal cost of the final good export is increasing due to the tariff.

Extending the result obtained in the previous literature on competition in the upstream market, we have shown that increased competition in the domestic upstream market lowers the price of the input and the output of each firm. However output of the industry as a whole increases. This indicates that as the number of domestic upstream firms increases, each individual upstream firm becomes relatively smaller (its Cournot output declines), but total industry output increases thereby lowering prices of the input.

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