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ABSTRACT

This paper presents a simple model of a partially decentralized multinational firm (MNF) in competition with a rival firm. It is shown that transfer pricing can be used as a rent-shifting device by the MNF to compete with the rival. This arises because the MNF headquarters uses the transfer price to manage different subsidiaries. The specific value of the transfer price chosen by the MNF depends on whether the rival firm produces the intermediate good or the final good or both of them, and whether the rival is integrated or not. In particular, both decentralization and competition with a fully integrated rival result in lower transfer prices.

1. Introduction

Recent studies of transfer pricing in the accounting and management literature emphasizes that the problem arises due to decentralization of firm activities (Amershi and Cheng 1990; Grabski 1985; Halperin and Srinidhi 1991; Hansen and Kimbrell 1991). Decentralization brings several benefits such as overcoming the limited information-processing capabilities of the headquarters, reducing the cost of control, providing better incentives for subsidiaries, and so on. However, decentralization also brings costs along benefits, namely, subsidiaries maximize their own branch profits, even if such actions may reduce total firm profitability. Due to these benefits and costs of decentralization, the central management desires `decentralized-centralization', that is, in order to reap the benefits and alleviate the costly behavior, it uses transfer pricing to manage different subsidiaries, and to maximize the total firm profits. Empirical studies such as Tang (1980) and Wu and Sharp (1979) support this view. They found that profit maximization of the whole firm and performance evaluation of the subsidiaries were the dominant objectives for transfer pricing.

Economic analysis of transfer pricing in the `decentralized (divisionalized)' multinational firm (MNF) includes Hirshleifer (1956), Bond (1980), Katrak (1983), Diewert (1985) Eden (1995), among others. An important result is that in the absence of tax rate differentials across countries, the transfer price is the marginal cost of the upstream branch; in the presence of tax rate differentials, the transfer price is a corner solution, that is, either the upper bound or the lower bound, exogenously imposed by regulating governments.

However, multinationals operate in markets that are not perfect. The above analysis treats the upstream branch as perfectly competitive, thus resulting in the transfer price being equal to the upstream branch's marginal cost in the absence of tax rate differentials. But in order to improve profit performance, the transfer price must be set at the `right' level so that there are autonomy and incentives in all divisions, since a higher transfer price increases the profits of the upstream branch, but at the expense of the

downstream branch. Thus, some affiliate control is necessary to induce efficiency.

Also, the literature on transfer pricing focuses on the interaction between governments and the MNF, and between branches of the MNF. The interaction between the MNF and other firms has been largely neglected. Yet it seems reasonable to expect that if the rival is an input supplier or just an output producer, then it relies on the MNF either for final output sales or for input supply. In such cases, the vertically integrated MNF may use transfer pricing to manipulate profit distribution across branches, to take advantage of the unintegrated rival. The fact that many unintegrated firms try to become fully integrated illustrates this point.[1]

This paper studies the problem on transfer pricing in ways that incorporate some of the above missing features. Namely, we consider decentralization of the MNF, and competition with a rival, which may be either vertically integrated or unintegrated. With these new features, we see clearly how the MNF actively use transfer pricing to shift profits between branches to compete against rival firms.

We assume a partially decentralized MNF so that the headquarters determines the transfer price, and the downstream branch determines the level of the final output. Thus, in this model both branches share decision making, and still the headquarters retains control of the transfer price. In determining the transfer price, the headquarters maximizes the total profits of the MNF, not just that of one branch. The governments in the two countries use tax rates to affect firm profits. This setup follows the approach recently emphasized in the accounting and management literature; that is, the transfer price may be used as an incentive scheme to induce efficiency in different divisions, in addition to minimizing taxes paid by the MNF. Recent theoretical models that use a similar structure include Elitzur and Mintz (1996), and Janeba (1996), which focused on corporate tax competition between two governments. Zhao (1998) investigated the impact of labor-management bargaining on transfer prices. In more general settings, Brander and Spencer (1985) analyzed the government's strategic use of subsidies (taxes) to shift profits between international duopolists, and Fershtman, Judd, and Kalai (1991) demonstrated how principals can use

agents strategically by delegating decision-making.

With the above setting, we first show that partial decentralization of the MNF lowers the transfer price. Because from the headquarters' point of view, the downstream branch with market power produces too little output, a lower transfer price lowers the marginal cost of the downstream branch and induces more output. This result contrasts with those in Katrak (1983), who shows that `indigenisation' of ownership under global profit maximization may induce the subsidiary to produce a smaller output, in a setting in which the parent and the subsidiary produce similar (and therefore competing) products.

We add a rival firm to this framework, and show that transfer pricing can be used as a rent-shifting device by the MNF to compete against the rival. Special cases where the rival produces (i) only the final output, or (ii) only the intermediate input are also investigated. One might expect the MNF to charge a lower transfer price compared with the case when the rival is fully integrated, because in case (i) the MNF needs to induce more final output from the downstream branch to compete with the rival, and in case (ii) the MNF needs a lower transfer price to force a lower input price from the rival. However, we find that, surprisingly, the optimal transfer prices are higher for given levels of output, compared with the case when the rival is fully integrated.

Finally, we demonstrate that because of decentralization, and the possibility of profit-shifting by the MNF, the optimal transfer price may be in the interior, in contrast to the boundary prices obtained in the literature.

Recently, a number of economists have studied trade in vertically related markets, for instance, Holm (1997), Ishikawa and Lee (1997), Ishikawa and Spencer (1996), Madan (1992), Spencer and Jones (1991, 1992) and Ziss (1997). These authors analyze the impact of government policies in shifting rents between a domestic firm and a foreign firm (either or both can be vertically integrated or unintegrated), and between intermediate input producers and final output producers. By contrast, the present paper analyzes competition in vertically related markets from a different perspective; that is, we focus on the

MNF's active use of transfer pricing, instead of on the strategic trade policies of governments. To the best of our knowledge, the role of transfer prices as a rent-shifting device under oligopoly has not been previously analyzed.

Section 2 presents the basic model, section 3 analyzes the case when the rival firm produces only the final output, section 4 considers the case when the rival produces only the intermediate input, and section 5 concludes.

2. The Basic Model

Consider an MNF consisting of two subsidiaries, with the upstream branch and the headquarters located in the home country, and the downstream branch located in the foreign country. The upstream branch produces one intermediate input, with a gross profit function of

$$\pi_u = mx - c(x), \tag{1a}$$

where m is the transfer price of `selling' the intermediate input to the downstream branch, x is the quantity of the intermediate input, and c(x) is the cost of producing x, with c'>0 and c''≥0 . The downstream branch uses both the intermediate input and labor to produce the final output. Since we do not focus on the substitutability between the intermediate input and labor, we simply assume that one unit of the final output requires one unit of the input and labor respectively, by a proper choice of units. The downstream branch's gross profit function can be written as

$$\pi_d = (p-m-w)x, \tag{1b}$$

where w is the unit wage cost, p=p(x+y) is the inverse demand function for the final output, sold in the foreign country only, and y is the output of the foreign firm, to be explained below.

In the foreign country, there is also a rival firm, which is initially assumed to be `fully integrated'.

By this, we mean it produces both the intermediate input and the final output in a single location and internal transfer pricing is not needed. We first consider the case in which there is no outside sales of the intermediate input. Cases in which the rival firm produces just the final output or just the input are left to sections 3 and 4.

The rival firm uses a similar technology as the MNF to produce output y, which is also sold in the foreign country only. Then its net profit function can be written as

$$\pi^* = (1-t^*)[p-c^*(y)-w]y, \tag{2}$$

where t^* is the corporate tax rate in the foreign country.

The profit of the MNF is the sum of the joint profits from the two subsidiaries, net of corporate taxes, which can be written as

$$\pi = (1-t)\pi_u + (1-t^*)(1-\theta)\pi_d, \tag{3}$$

where t is the corporate tax rate in the home country, and θ is the repatriation tax rate imposed by the foreign government on the MNF's downstream branch profits.

We assume that the MNF is partially decentralized so that both the upstream and downstream branches share the decision making, following the empirical evidence in the accounting and management literature. Specifically, the downstream branch decides the level of the final output, while the headquarters determines the transfer price. In order to let the headquarters' decision affect that of the subsidiary so that the MNF can maximize the total profits from all branches, we assume a two stage problem. In the first stage, the headquarters determines the transfer price; in the second stage, given the transfer price, the downstream branch competes with the foreign firm for final output sales in the foreign country. To ensure consistency, the problem is solved backwards, that is, we first find the subsidiary's and the foreign firm's output levels as functions of the transfer price in the second stage, then substitute the solution into the

headquarters' problem in the first stage and determine the optimal transfer price.

In the second stage, the downstream subsidiary and the rival firm choose the quantities of the final output to maximize their own respective profits simultaneously (net of the profit tax), yielding the following first order conditions

$$p + xp' - m - w = 0, \tag{4a}$$

$$p + yp' - c - w = 0, \tag{4b}$$

which implicitly give the optimal final outputs as

$$x(m), \qquad\qquad y(m). \tag{5}$$

Total differentiation of (4) yields

$$x_m = \partial x/\partial m < 0, \qquad y_m = \partial y/\partial m > 0, \tag{6}$$

which implies that an increase in the transfer price reduces the downstream subsidiary's level of the final output, but increases that of the rival firm.

In the first stage, the MNF headquarters determines the transfer price by maximizing its total profits. Substituting (5) into (3) and maximizing (3) with respect to m, we obtain

$$\{(1-t)-(1-t^*)(1-\theta)\}x + (1-t)(m-c_x)x_m + (1-t^*)(1-\theta)xp'y_m = 0. \tag{7}$$

In deriving the above, condition (4a) has been used. Condition (7) implicitly determines the MNF's optimal internal transfer price.

The second order condition is

$$\pi_{mm} = [(1-t) - (1-t^*)(1-\theta)]x_m + (1-t)[(m-c_x)x_{mm} + x_m - xc_{xx}]$$

$$+ (1-t^*)(1-\theta)[(x_m y_m + x y_{mm})p' + (x_m + y_m)x y_m p''].$$ (8)

As is usual in two stage models, existence and uniqueness of equilibrium can be a problem. But as long as c_{xx} is large enough, that is, the marginal cost of producing the intermediate input increases rapidly, condition (8) will be negative, and we suppose this is the case.

We also assume that the home and foreign governments do not directly regulate the transfer price, but there are limits to it: $m \varepsilon [c(x)/x, p-w]$; that is, the lower bound of the transfer price is the one that leaves the upstream branch with zero profits, and the upper bound is the one that leaves the downstream branch with zero profits.

In the classical literature on transfer pricing, the rival firm is not considered, and the headquarters has control of both the transfer price and the level of output. Then in condition (7), expressions x_m and y_m would disappear. The transfer price would be either the upper-bound, or the lower bound, depending on the sign of expression $(1-t)-(1-t^*)(1-\theta)$. In the present model, we show that the MNF charges a lower transfer price, facing foreign competition, and a subsidiary that can choose output independently.

Proposition 1: Competition with a rival lowers the transfer price.

Proof: Condition (7) can be rewritten as

$$m-c_x = [\{(1-t)-(1-t^*)(1-\theta)\}x + (1-t^*)(1-\theta)xp'y_m]/\{-(1-t)x_m\},$$ (7')

which says that the difference between the transfer price and the marginal cost will be determined by two components: (a) the tax differential as usually considered in the literature (the first term in brackets on the RHS), and (b) a strategic effect (shown in the expression $(1-t^*)(1-\theta)xp'y_m < 0$). The former effect may lead to a transfer price that is either above or below the marginal cost, depending on the sign of $(1-t)-(1-t^*)(1-\theta)$. The latter effect is the effect of competition. It tends to lead to a transfer price that is below the marginal

cost. That is, a decrease in the transfer price reduces the output of the rival, from condition (6). This arises because a lower transfer price reduces the marginal cost of the MNF's downstream branch and induces it to produce more output, and in turn the rival reacts to this by contracting output. The MNF's headquarters takes into consideration this effect when determining the transfer price. Thus the transfer price in the present model plays the role of government export subsidies à la Brander and Spencer (1985), when competing with a rival.   QED

It may seem that with a positive repatriation tax in the foreign country, the MNF will set the transfer price to be equal to the *upper* bound so that the downstream branch pays zero tax. However, we can state:

Proposition 2: It is never optimal to set the transfer price equal to the upper bound.

Proof: Because condition (4a) is satisfied for any m ε [c(x)/x, p-w] and x > 0, then m = p+xp'-w < p-w, i.e., the optimal transfer price is lower than the upper bound. Also, if $1-t \leq (1-t^*)(1-\theta)$, then the LHS of condition (7) becomes negative, implying that the optimal transfer price is the lower bound.   QED

Proposition 2 implies a couple of differences between the present model and those in the literature. Firstly, earlier work has shown that a higher corporate tax rate in the foreign country always pushes the transfer price to be equal to the upper bound, while in the present model, the upper bound is not in the solution set. This arises because the downstream subsidiary with market power prices above marginal cost. The headquarters thus charges a lower transfer price for the subsidiary to induce more output in order to compete with the rival and to maximize the total profits of the MNF; secondly, in the literature, corner solutions are driven by corporate tax rate differentials, while in the present model, the lower bound solution is driven by decentralization and rival competition.

3. The Rival Firm Produces only the Final Output

In this special case, the rival firm produces only the final output and imports the intermediate input from the MNF. We assume that the rival firm is an oligopolist with the MNF's downstream branch, but takes price as given when buying the input.[2]

Denote the price of the intermediate input m^* when the MNF sells to the rival firm. Then the rival's net profit function can be written as

$$\pi^* = (1-t^*)(p-m^*-w)y. \tag{9}$$

The profit function of the MNF's downstream branch is shown in (1b), but that of the upstream branch becomes

$$\pi = mx + m^*y - c(x+y). \tag{10}$$

And the MNF's net total profits correspondingly change to

$$\pi = (1-t)\pi + (1-t^*)(1-\theta)\pi_d. \tag{11}$$

The problem is again solved backwards. In the second stage, the MNF's downstream branch and the rival firm choose outputs simultaneously to maximize their respective profits, yielding the following FOCs

$$p + xp' - m - w = 0, \tag{12a}$$

$$p + yp' - m^* - w = 0, \tag{12b}$$

which implicitly give the optimal final outputs as

$$x(m,m^*), \qquad y(m,m^*). \tag{13}$$

Total differentiation of (12a) and (12b) yields

$$x_m = \partial x/\partial m < 0, \quad x_{m*} = \partial x/\partial m^* > 0, \quad y_m = \partial y/\partial m > 0, \quad y_{m*} = \partial y/\partial m^* < 0, \tag{14}$$

which implies that an increase in the transfer price reduces the downstream subsidiary's output, while an increase in the input price the rival firm receives raises the subsidiary's output. Exactly the opposite effects apply to the rival firm.

In the first stage, the MNF headquarters determines the transfer price and the input price charged to the rival firm simultaneously by maximizing the total profits of the MNF. Substituting (13) into (11), and maximizing (11) with respect to m and m^*, we obtain respectively

$$(1-t)d\pi/dm + (1-t^*)(1-\theta)d\pi_d/dm = 0, \tag{15a}$$

$$(1-t)d\pi/dm^* + (1-t^*)(1-\theta)d\pi_d/dm^* = 0, \tag{15b}$$

where $\quad d\pi/dm = x + (m-c_x)x_m + (m^*-c_y)y_m,$

$\quad d\pi_d/dm = x(p'y_m-1) < 0,$

$\quad d\pi/dm^* = y + (m-c_x)x_{m*} + (m^*-c_y)y_{m*},$

$\quad d\pi_d/dm^* = xp'y_{m*} > 0, \quad$ using condition (12a).

Conditions (15a) and (15b) implicitly determine the MNF's optimal internal transfer price and the price it charges the rival firm for the input. Because the rival depends on the MNF for the input, the MNF may decide not to supply to the rival. Instead, it may choose vertical foreclosure. We are interested in how the policy variables t, t* and θ affect the MNF's foreclosure decision.

Proposition 3: (i). If $1-t = (1-t^*)(1-\theta)$, *the MNF vertically forecloses; (ii). a sufficiently large* θ *induces the MNF to supply the input to the rival.*

Proof: (i). If $1-t = (1-t^*)(1-\theta)$ [including the case if $t=t^*=\theta=0$], then expressions $1-t$ and $(1-t^*)(1-\theta)$ can be factored out of the MNF's profit function in (11) and the first order conditions (15a) and (15b); that is, the MNF can disregard t, t^* and θ when maximizing profits. The MNF obtains monopoly rents on final goods if it can force the rival out of the market. Because $x_{m^*} > 0$, and $y_{m^*} < 0$ from (14), then the MNF can charge m* above a critical level such that y(m, m*)=0. As a consequence, the MNF becomes the monopoly producer in the final good market. But it also is a monopoly supplier of the intermediate input. Forcing the rival out of the final goods market reduces the MNF's profits from input sales. Thus there is a trade-off. However, the literature on vertical integration (see, for instance, Waterson 1982) has shown that when one input is monopolized and priced above marginal cost, then merger between the input supplier and downstream producers can remove successive markups at different stages in favor of a single mark-up, which increases firm profits. Applied to the present model, it implies that the MNF is better off foreclosing the rival.

(ii). From the above, suppose in the neighborhood of $1-t = (1-t^*)(1-\theta)$, the parameter θ increases by a small amount, ceteris paribus, the MNF still chooses not to supply the input to the rival. From (11) and (15b), an increase in θ reduces the MNF's profits and marginal profits from final output sales, because $d\pi_d/dm^* > 0$. If the increase in θ is large enough, then the trade-off between the sales of the final output and the intermediate input turns in favor of the latter, that is, the MNF chooses to supply the input to the rival.

Similarly, increases in t* give rise to the same effects.   QED

Proposition 3 implies that the MNF may choose to vertically foreclose under specific conditions. The foreign government can raise the repatriation tax or the corporation tax to induce the MNF to supply the input.

We now compare the levels of the two prices determined by (15a) and (15b) with that in the case when the rival firm is fully integrated, assuming that the structure of the repatriation and corporate taxes induces vertical supply.

Comparing (15a) with (7), we see that (15a) has one more positive term $(m^*-c_y)y_m$ contained in $d\pi$/dm. This arises because the MNF obtains profits from selling the input to the rival firm. Thus the optimal transfer price is higher in (15a) for each level of x.

Comparing (15b) with (15a), we see that the difference arises in the second terms on the LHS in both conditions. While $d\pi_d/dm = x(p'y_m-1)$ in (15a) is negative, $d\pi_d/dm^* = xp'y_{m*}$ in (15b) is positive. The latter arises due to the following effect: raising m^* reduces y, which in turn increases the equilibrium x. Thus in equilibrium m^* is higher than m for each level of the final output.

We are now in a position to state the following:

Proposition 4: If the rival produces only the final output, under vertical supply the optimal transfer price is higher than in the case of a fully integrated rival, and the MNF charges an even higher price for the input sold to the rival.

Proposition 4 may seem counter intuitive at first glance. The intuition behind is that since the rival firm depends on the MNF for the intermediate input, if the transfer price is low (the marginal cost for the downstream subsidiary becomes low), then the subsidiary produces a large output. This in turn reduces the rival's output, which eventually reduces the MNF's profits from selling the input to the rival. Thus the MNF charges a higher transfer price than in the case when the rival is fully integrated. The reason that the

MNF charges an even higher price for the input sold to the rival is as follows: because the MNF controls the supply of the input, it would like to foreclose the rival if possible (see proposition 3). However, the tax structure still allows vertical supply. The MNF thus sets m^* as high as possible, ceteris paribus. A high m^* also reduces the rival's final output, and in turn increases the output of the MNF's downstream branch.[3]

4. The Rival Firm Produces only the Input

In this structure, the rival produces only the intermediate input and sells to the MNF's downstream branch. Because the MNF is the monopsony buyer, we consider two cases. (I) The MNF's downstream branch does not exercise monopsony power, and the rival becomes an oligopolist with the MNF's upstream branch, which determines the input price it charges the MNF. The downstream branch takes the input prices as given; (II) The MNF's downstream branch exercises monopsony power, and the input price is negotiated between the MNF's downstream branch and the rival. We will study the two cases separately. Some interesting results arise.

In the previous section, we have shown cases in which the MNF can foreclose the rival. In this section, it is not efficient for the MNF's downstream branch to refuse to buy from the rival, because the marginal cost of producing the input is increasing. However, it is possible for the MNF and the rival to merge into one firm. As will become clear soon, the determination of the transfer price and the input price the rival charges is the same as in case (I), because the merged rival would become an upstream branch.

Denote the price of the intermediate input m^* when the rival firm sells to the MNF's downstream branch. Then the rival's net profit function can be written as

$$\pi^* = (1\text{-}t^*)\{m^*y \text{ - } c^*(y)\}. \tag{16}$$

The gross profit function of the MNF's upstream branch is shown in (1a), but that of the downstream branch changes to

$$\pi = (p-w)(x+y) - mx - m^*y. \qquad (17)$$

And the MNF's net total profits correspondingly become

$$\pi = (1-t)\pi_u + (1-t^*)(1-\theta)\pi. \qquad (18)$$

(I). The MNF's downstream branch does not exercise monopsony power

The problem is again solved backwards. In the second stage, the MNF's downstream branch chooses outputs x and y (equal to inputs) simultaneously to maximize profits, yielding the following FOCs

$$p + (x+y)p' - m - w = 0, \qquad (19a)$$

$$p + (x+y)p' - m^* - w = 0, \qquad (19b)$$

which implicitly give the optimal final outputs as

$$x(m,m^*), \quad y(m,m^*), \text{ with } x_m < 0 \quad \text{and } y_{m*} < 0. \qquad (20)$$

In the first stage, the MNF's headquarters determines m, and simultaneously the rival firm determines m^* by maximizing their respective profits. Substituting (20) into (18) and (16), and differentiating yields respectively

$$\{(1-t)-(1-t^*)(1-\theta)\}x + (1-t)(m-c_x)x_m = 0, \qquad (21a)$$

$$y + (m^*-c_y)y_{m*} = 0. \qquad (21b)$$

In deriving (21a), we used condition (19a). Conditions (21a) and (21b) implicitly determine the MNF's optimal internal transfer price and the price the rival charges for the input. Now we compare the level of

these two prices with that in the case when the rival is fully integrated.

Comparing (21a) with (7), we see that (7) has one more negative term $(1-t^*)(1-\theta)xp'y_m$. This arises because in the case of the fully integrated rival, the MNF considers this strategic effect: lowering m reduces y; while in the present case, the rival does not produce the final output. Thus, the quantity of the input sold by the rival, y, is internalized by the downstream branch of the MNF, and the strategic effect in (7) no longer exists. Thus the optimal transfer price is higher in (21a) than in (7) for each level of x.

From (19a) and (19b), $m = m^*$ in equilibrium. This arises because the subsidiary buys the input from both suppliers up to the point at which marginal revenue is equal to marginal cost.

The results above are reported below.

Proposition 5: If the rival produces only the input and the MNF's downstream branch takes the input price as given, then the internal transfer price is equal to the price the rival charges in equilibrium, which is higher than the transfer price if the rival is fully integrated.

The interpretation is that since the rival does not produce the final output but supplies the input to the MNF's subsidiary, there is no need for the MNF to reduce the transfer price for the downstream branch to compete against the rival. And the subsidiary purchases inputs from the MNF and the rival up to the point at which marginal cost is equal to marginal revenue.

(II). The MNF's downstream branch exercises monopsony power

In this case, the input price m* and quantity y are negotiated between the MNF's downstream branch and the rival, through a Nash bargaining process. We adopt this type of `branch bargaining', because it is the downstream branch that actually buys the input from the rival.[4] The MNF's headquarters influences the bargains only through the transfer price m.

There is quite some literature, especially in accounting and management, which assumes that the transfer price is negotiated between the headquarters and the branch. In the present paper, in order to analyze how the MNF uses the transfer price to compete with the rival, we assume that the downstream branch can not bargain with the headquarters over the transfer price. However, because the downstream branch is the monopsony buyer of the rival firm's output, a situation similar to bilateral monopoly arises. Thus the price of the rival's output is negotiated. As a result, asymmetry arises as to the determination of the transfer price and the rival's price.

We assume there are two stages in the problem. In the first stage, the MNF's headquarters determines the transfer price. In the second stage, the MNF's downstream branch determines x, and simultaneously bargains with the rival for m* and y.

Let us first solve the second stage problem. The MNF's downstream branch maximizes its own profits by choosing x, resulting in the same first order condition as given by (19a).

Simultaneously it also bargains with the rival. If bargaining breaks down, then the rival's profits go down to zero, while the MNF's downstream branch still obtains positive profits, by using the input from the MNF's upstream branch. Write the threat point payoff for the MNF's downstream branch as

$$\pi_0 = \{p_0(x) - w - m\}x, \tag{22}$$

where $p_0(x)$ is the price at the threat point, if the rival does not produce any input. Obviously, $p_0(x) > p(x+y)$. Note that profit maximization of the MNF's downstream branch and the Nash bargains occur simultaneously. Once x is chosen, even if bargaining breaks down, the MNF's downstream branch does not change x.

Given the above bargaining structure, then the two parties maximize the following Nash product (Nash 1953)[5]

$$H(m^*, y) = (\pi - \pi_0)\pi^*. \tag{23}$$

The first order conditions are

$$\pi^* = \pi-\pi_0, \tag{24a}$$

$$\{p+(x+y)p'-w-m^*\}\pi^* + (m^*-c)(\pi-\pi_0) = 0. \tag{24b}$$

Condition (24a) says that the two parties choose m^* in such a way that the incremental profits (net gains from the bargains) are equalized. Substituting this into condition (24b), and using condition (19a) to give

$$c - m = 0, \tag{25}$$

which implies that the negotiated quantity of the input produced by the rival depends on the transfer price charged by the MNF. If the transfer price increases, then the MNF's downstream branch buys more input from the rival.

Conditions (19a), (24a) and (25) jointly determine x, m^* and y as functions of m, that is, x(m), $m^*(m)$ and y(m). Totally differentiating these three conditions, we obtain

$$x_m = -2y\{2p'+(x+y)p''-c_y\}/D < 0, \tag{26a}$$

$$y_m = 2y\{2p'+(x+y)p''\}/D > 0, \tag{26b}$$

$$m^*_m = \{2(m-m^*)[2p'+(x+y)p'']+(p_0+xp_0'-m-w)[2p'+(x+y)p''-c_y]\}/D, \tag{26c}$$

where $D = 2yc_y\{2p'+(x+y)p''\} < 0$, and the expression $(p_0+xp_0'-m-w)$ in (26c) is the marginal profit of the MNF's downstream branch at the threat point. This term is positive by condition (19a), since $p_0+xp_0' > p+(x+y)p'$.

The sign of condition (26c) depends on the equilibrium values of m and m^*. Because we are

using general demand and cost functions, we can not explicitly compare the levels of m and m*. But from (26c), one sees that if m≥m*, then this condition is positively signed, that is, an increase in m raises m*. This is intuitive, because a higher m makes it easier for the rival firm to negotiate a higher m* with the downstream branch.

In the first stage, the MNF's headquarters maximizes its overall profits by choosing the transfer price m, resulting in the following F.O.C

$$(1-t)d\pi_u/dm + (1-t^*)(1-\theta)d\pi/dm = 0,$$ (27)

where $d\pi_u/dm = x + (m-c_x)x_m,$

$d\pi/dm = -x + (m-m^*)y_m + ym^*_m,$ using condition (19a).

We now compare conditions (27) and (21a). The former has two more positive terms $(m-m^*)y_m$ and ym^*_m, contained in $d\pi/dm$, if $m \geq m^*$. This implies that the MNF headquarters charges a higher internal transfer price when its downstream branch exercises monopsony power against the rival, than when the downstream branch simply takes price as given. The reason is, when m* and y are negotiated, the MNF headquarters can use transfer price to affect the bargained outcome. If m increases, then the rival supplies a larger quantity of input according to condition (25). But this does not mean that the rival's profits increase. In fact, condition (24a) must be satisfied to keep the net bargaining gains equalized. This in turn implies two cases: (a). if the marginal cost c does not increase fast enough, then we must have m* < m in equilibrium; (b). if it increases very fast, then m* = m is possible.

Summing up the above, and comparing with proposition 5, we establish

Proposition 6: The MNF's internal transfer price is higher if the downstream branch can negotiate with the rival input supplier than if it takes the input price as given, and higher than in the case if the rival is

fully integrated and does not sell to the MNF.

In this special setting, the MNF is a Stackelberg leader versus the rival. As condition (25) shows, the rival's equilibrium output is a function of the MNF's transfer price. By raising the transfer price, the MNF can increase the rival's cost.

5. Conclusions

There have been numerous studies on the transfer pricing problem, especially in the accounting and management literature. In this paper, we extended the study in a model of a partially decentralized MNF, and obtained the transfer price as an interior solution. We analyzed various cases in which the vertically integrated MNF can use transfer pricing to compete with the rival, which can be integrated or unintegrated. We showed that decentralization reduces the transfer price, so does competition. One general conclusion is that the MNF charges a lower transfer price if the rival is `strong', that is, fully integrated. These results contrast with the boundary transfer prices obtained in the literature. They also contrast with the literature of strategic trade policy in vertically related markets, in which different governments actively use commercial policies to shift rents between home and foreign firms (and countries).

The insight that the MNF uses transfer pricing to compete against rivals is appealing. It can be a reason for mutual penetration of markets, since each firm wants to be located in several countries and use transfer pricing to shift profits between branches, to prey on a local firm.

Our results are obtained based on assumptions that the MNF headquarters must be able to commit to the transfer price and this transfer price must be observable to the rival. The MNF headquarters might be able to do even better by making the transfer price unobservable to the rival.

In practice, many countries have tax regulations to limit the MNF's `abuse' of transfer pricing. For instance, in the U.S., the relevant regulation is Section 482 of the Internal Revenue Code, which requires

that transfer prices be set at arm's length prices. The regulations acknowledge the difficulty often involved in the establishment of arm's length prices. Section 482 specifies that, if `comparable' third-party transactions exist, then they must be used in determining arm's length prices. Hence, in a situation like section 4 (II), the MNF may be forced to set the transfer price at the level of the rival's price.

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Endnotes

1. For instance, Korean automobile maker Hyundai used to import engines and other parts from Japanese maker Mitsubishi. Now it produces its own engine.

2. In practice, it is possible that the actual level of the transfer price is not revealed to parties outside of the MNF, including the home and foreign governments, and the rival firm (see Prusa 1990). In the present paper, our concern is to show that even in the absence of information asymmetry, the MNF can use the transfer price strategically.

3. Proposition 4 implies that the MNF performs price discrimination when selling the input. In practice, this may not be allowed by different governments, because transfer prices have important revenue consequences.

4. Negotiation could take two possible forms: headquarter bargaining and branch bargaining. Under the former, the MNF's headquarters bargains with the rival, and under the latter, the MNF's downstream branch does the negotiation. The difference is, the headquarters takes into account the MNF's total profits, while the downstream branch just considers its own profits. Thus, if bargaining breaks down, the loss is bigger for the MNF under headquarter bargaining. For a detailed comparison, see Zhao (1998).

5. We have implicitly assumed equal bargaining powers for both parties for simplicity. It could be generalized to allow for different bargaining powers.