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Transfer Pricing in the Decentralized Multinational Corporation

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Abstract

This paper considers how the multinational corporations transfer price responds to changes in international corporate effective tax rates. It extends the decentralized decision-making analysis of transfer pricing in the context of different tax rates. It adopts and extends Bonds (1980) model of the decentralized multinational corporation that assumes centralized transfer pricing. The direction of transfer price change is as expected, while the magnitude of change is likely to be less than predicted by the Horst (1971), centralized decision-making model. The paper extends the model further by assuming negotiated transfer pricing, where the analysis is partitioned into perfect and imperfect information cases. The negotiated transfer pricing result reverts to the Horst (1971), or centralized decision-making, result, under perfect information. Under imperfect information, the centralized decision-making result obtains when top management successfully informs division general managers or it successfully implements a non-monetary reward scheme to encourage division general managers to cooperate. Under simplifying assumptions, centralized decision-making dominates decentralized decision-making, while negotiated transfer pricing weakly dominates centralized transfer pricing.

The contents of this article are the opinions of the writers and do not necessarily represent the position of the Internal Revenue Service.

I. Introduction

Profit-maximizing multinational corporations choose their transfer prices in connection with international tax rates, since transfer prices influence global after-tax profit. Transfer prices also concern the tax authorities, since they influence a country's tax revenue. The transfer price values the good or service traded between divisions of a multinational corporation (related parties) and, therefore, reflects the interplay of internal corporate forces rather than (or in addition to) external market forces. The transfer price may equal the market (arm's-length) price by choice, by coincidence, or through the exertion of external market forces. The arm's-length price measures the market price, or range of market prices¹, that unrelated firms would use under the same (or similar) facts and circumstances as the multinational corporation's internal transaction. To the extent that a multinational corporation can adjust the transfer price, either within the arm's-length range or outside the arm's-length range under non-compliance², it can use the transfer price to improve its global after-tax profit. For example, when effective international corporate tax rates differ, the multinational corporation can manipulate the transfer price on intra-firm transactions to shift (at least some) profit to the relatively low-tax country. This rational behavior reduces the multinational corporation's global tax burden and increases its global after-tax profit. Since the transfer price shifts taxable income from one country to another, there is a zero-sum effect on reported income in each country. Therefore, if a multinational corporation adjusts its transfer price within the arm's-length range (outside the arm's-length range), taxable profit in the high-tax country is lower (taxable profit attributable to its business activity in the high-tax country is under-

¹ In practice, the arm's-length price is a range of prices that satisfies the transfer pricing regulations.

² Tax avoidance is the minimization of one's tax burden to the extent allowed by law, which reflects tax law compliance. Tax evasion is the minimization of one's tax burden beyond the

reported) and higher (over-reported) in the low-tax country. Given the importance of the relationship between tax rates and the multinational corporation's transfer price, our central concern is how multinational corporations adjust the transfer price when relative international tax rates change.

When tax rates differ, the multinational corporation wants to manipulate the transfer price to shift profit to the low-tax country. Under centralized decision-making, the multinational corporation adjusts the transfer price to either the highest or lowest allowable transfer price, the arm's-length price, which is an exogenous constraint that is imposed by the tax authorities. This assumes the arm's-length constraint is an effective or strict constraint. In addition, the centralized multinational corporation chooses the firm-wide optimal output level. This is the Horst (1971), or centralized decision-making, result. Under a weaker or less effective arm's-length constraint, non-compliance is possible and the centralized multinational corporation might choose a transfer price that lies outside the arm's-length range.

Centralized decision-making does not generally describe the operations of multinational corporations, however. Top management delegates some degree of decision-making authority to division general managements, while retaining other decisions. Therefore, decentralized decision-making more closely characterizes the dispersion of decision-making authority in the multinational corporation. Decentralized decision-making distinguishes between top management and division general management and provides a context for a meaningful examination of the principal-agent relationship between them. An agency-theory framework underlies the decentralized model. Division general managements maximize division profit because it affects their compensation. That reward scheme corrects the agency problems (agency costs) that

extent allowed by law, which reflects non-compliance with tax law. Non-compliance may also be the result of taxpayer miscalculation or mistake.

associate with the delegation of authority.³ The decentralized decision-making assumption also permits a comparative static analysis with respect to the transfer price. Since the model specifies the quantity of intra-firm trade to depend on the transfer price, top management's first-order condition defines the optimal transfer price.

We adopt Bond's (1980) specification of the decentralized multinational corporation, and complete the comparative static analysis that he began. He assumes centralized transfer pricing, which means that top management chooses the transfer price while division general managements choose the quantity of intra-firm trade and the multinational corporation's output. The comparative static results support our intuitive understanding of the relationship between tax rates and the transfer price. When tax rates differ, the transfer price shifts profit from the high-tax division to the low-tax division to maximize the multinational corporation's global after-tax profit, subject to an effective arm's-length constraint. The optimal transfer price may be an interior solution rather than the arm's-length price, however.

When firms adjust the transfer price to minimize their tax burden, the centralized multinational corporation might adjust its transfer price to a price outside the arm's-length range. The decentralized multinational corporation also might set the transfer price outside the arm's-length range, but it is more likely to choose a transfer price closer to the arm's-length boundary, because of the decentralized multinational corporation's internal constraints. Therefore, if multinational corporations are decentralized, the degree of compliance with the transfer pricing regulations is likely to be more than that predicted by the centralized Horst (1971) model.

³ Underlying the assumption that top management maximizes the multinational corporation's profit, which is the shareholders' goal, is a perfect board of directors or another means to correct the agency problems between shareholders and top management.

We extend the model to consider negotiated transfer pricing under perfect and imperfect information, where division general managements choose the transfer price (as well as the multinational corporation's output). With perfect information, division general managements know that their negotiation is a positive-sum game. Therefore, cooperation dominates a negotiation impasse and the Horst (1971) result emerges; the transfer price equals the arm's-length price (under tax law compliance) and the firm-wide optimal output is chosen. With imperfect information, top management must either facilitate the division general managements' learning that the game is positive-sum or implement a non-monetary reward scheme to promote cooperation. If successful, division general managements cooperate and the Horst (1971) solution emerges, but if not successful, a negotiation impasse occurs. With negotiation impasse, top management sets the transfer price and the centralized transfer pricing solution emerges.

Our decentralized decision-making analysis shows that centralized decision-making dominates decentralized decision-making when tax rates differ, but centralized decision-making is not generally applicable to the multinational corporation. In the context of decentralized decision-making and different tax rates, top management weakly prefers negotiated transfer pricing to centralized transfer pricing, since the profit potential under negotiated transfer pricing is greater. Also, a comparison of centralized and negotiated transfer pricing shows that the transfer price is sensitive to who sets it. An interior solution is more likely under centralized transfer pricing, while the Horst (1971) solution – a boundary solution – is more likely under negotiated transfer pricing (assuming an effective arm's-length constraint).

II. Literature Review

A General Framework

The following model provides a general framework to discuss the existing literature on transfer pricing as well as the model in Section III. The multinational corporation has two divisions – the parent company in the home country (country 1) and its wholly owned subsidiary that is located in and incorporated under the laws of the foreign country (country 2). Trade flows from the parent to the subsidiary, where this intra-firm trade reflects the multinational corporation's horizontal or vertical integration strategy. The multinational corporation maximizes its global after-tax profit, subject to effective constraints. The global after-tax or net profit is:

$$\Pi_N^{dc} = (1 - t_1)\Pi_1^{dc} + \frac{1}{e}(1 - t_2)\Pi_2^{fc},$$

where Π_1^{dc} is the domestic currency value of the parent division's before-tax profit, Π_2^{fc} is the foreign currency value of the subsidiary division's before-tax profit, t_1 and t_2 are country 1's and 2's effective corporate income tax rates, respectively, and e is the foreign currency price of the domestic currency. Furthermore,

$$\Pi_1^{dc} = P_1 X_{11} + P_{12}^{dc} X_{12} - C_1(X_1) \text{ and}$$

$$\Pi_2^{fc} = P_2 Y_2 - \gamma_2(Y_2) - P_{12}^{fc} X_{12},$$

where the parent produces good 1 (X_1), a tangible intermediate product, the subsidiary produces good 2 (Y_2), a tangible final product,⁴ X_1 equals the quantity of good 1 produced, X_{11} equals the quantity of good 1 sold in country 1 at the market price P_1 , X_{12} equals the quantity of good 1 sold to the subsidiary in country 2 (this is the quantity of intra-firm trade, which is invoiced and sold at an internal transfer price of P_{12}^{dc}),

$X_1 = X_{11} + X_{12}$, C_1 equals the parent's total cost of producing good 1, the subsidiary sells Y_2 at the market price P_2 , γ_2 equals the subsidiary's cost of transforming good 1 into the final good 2,⁵ and $P_{12}^{fc} X_{12}$ equals the subsidiary's resource cost in terms of the foreign currency.⁶

By convention, the subsidiary possesses a fixed coefficient production function with the coefficient equal to 1; it takes one unit of X_{12} to produce one unit of Y_2 , so $Y_2 = f(X_{12}) = X_{12}$. In addition, no outside market for the intermediate good exists, so that $X_{11} = 0$ and $X_1 = X_{12}$. Also, the subsidiary's output market exhibits perfect competition, so that $P_2 = \overline{P}_2$. Finally, let $e = 1$. Therefore, the general model reduces to:

$$\Pi_N = (1 - t_1)\Pi_1 + (1 - t_2)\Pi_2, \quad (1)$$

$$\Pi_1 = P_{12} X_{12} - C_1(X_{12}), \text{ and} \quad (2)$$

$$\Pi_2 = \overline{P}_2 X_{12} - \gamma_2(X_{12}) - P_{12} X_{12}. \quad (3)$$

All variables now are in domestic currency units, since $e = 1$.

Centralized Decision-Making

Horst (1971) models the centralized multinational corporation and its transfer pricing. The basic model in equations (1), (2), and (3) are modified to incorporate the following assumptions. Horst assumes the multinational corporation faces an import tariff or duty in country 2, d_2 , on the quantity of intra-firm trade, and the multinational corporation

⁴ If the subsidiary simply resells good 1 in country 2, good 2 is a tangible intermediate product, say X_2 .

⁵ If the subsidiary is a reseller, γ_2 is its processing (i.e., packaging, modifying, etc.) cost.

⁶ $P_{12}^{fc} = e \cdot P_{12}^{dc}$

exhibits horizontal integration. The subsidiary resells X_{12} as good 2, X_2 , and produces part of X_2 itself, X_{22} . Thus, the subsidiary's before-tax profit is:

$$\Pi_2 = \overline{P}_2 X_2 - C_{22}(X_{22}) - \gamma_2(X_{12}) - (1 + d_2)P_{12}X_{12},$$

where $X_2 = X_{22} + X_{12}$, C_{22} equals the subsidiary's on-site cost of producing the intermediate good, and $(1 + d_2)P_{12}X_{12}$ equals the subsidiary's import cost including the tariff. To simplify, let $d_2 = 0$. Horst assumes that the subsidiary's processing cost (γ_2) is zero. Thus, equation (3) becomes

$$\Pi_2 = \overline{P}_2 X_2 - C_{22}(X_{22}) - P_{12}X_{12}.^7 \quad (4)$$

Centralized decision-making in the multinational corporation means that the quantity of intra-firm trade does not depend on the transfer price. Centralized decision-making can be characterized as one of the following: (i) The owner-operated multinational corporation possesses no principal-agent problems, and the owner chooses the transfer price and quantity of intra-firm trade to maximize Π_N ; (ii) Top management of the multinational corporation chooses the transfer price and quantity of intra-firm trade to maximize Π_N , and no principal-agent problems exist⁸ so that division general management follows top management's instructions perfectly;⁹ or (iii) The multinational corporation is the traditional neoclassical firm, or "black box," with no decision-makers and agency relationships and the firm chooses the transfer price and the quantity of intra-firm trade to maximize Π_N . Since the multinational corporation

⁷ Horst (1971) assumes that the subsidiary sells its final good in an imperfectly competitive market. It is assumed here that the subsidiary sells in a perfectly competitive market. This assumption does not change Horst's conclusion, however.

⁸ Agency costs are zero because top management has implemented a perfect management control system that corrects all principal-agent problems.

⁹ In this scenario, there are three decision-making entities in the multinational corporation: Top management, the parent division general management, and the subsidiary division general management.

operates in different countries, top management typically delegates decision-making authority to division general managements and a principal-agent relationship exists between them. Therefore, the centralized decision-making assumption implies the existence of a perfect management control system that provides the incentives for division general managements to pursue top management's goal. The parent and subsidiary division general managements make decisions at the division level that are consistent with what top management wants, which effectively and perfectly centralizes decisions. Thus, top management chooses both the transfer price and the multinational corporation's output to maximize Π_N . When it changes the transfer price, each division general management does not respond by changing the quantity of the intra-firm good supplied or demanded.

Horst (1971) considers how the multinational corporation's transfer price responds to changes in tax rates by rearranging the multinational corporation's, or top management's, objective function as follows:

$$\Pi_N = \{(1-t_1)[-C_1] + (1-t_2)[\overline{P}_2 X_2 - C_{22}]\} + (t_2 - t_1)P_{12}X_{12}. \quad (5)$$

Focusing on the last term in equation (5), when $t_2 > t_1$ ($t_2 < t_1$), top management chooses the highest (lowest) allowable transfer price to maximize Π_N , given its optimal choice of X_{12} . The multinational corporation is implicitly constrained by the arm's-length price, an external constraint imposed by the tax authorities that is effective and binding.

Decentralized Decision-Making

Hirshleifer (1956, 1964) considers the domestic divisionalized firm and its transfer pricing. He assumes decentralized decision-making, where division general managements negotiate the transfer price (negotiated transfer pricing) and respond to changes in the transfer price by adjusting the quantity of the intra-firm good supplied or demanded. Bond (1980) extends Hirshleifer's (1956, 1964) decentralized domestic firm

to the multinational case, where top management chooses the transfer price (centralized transfer pricing).

In Hirshleifer (1956, 1964) and in Bond (1980), the quantity of intra-firm good trade depends on the parent's supply and the subsidiary's demand. Bond (1980) formally develops the supply and demand relationships. Given the transfer price set by top management, each division general management determines its optimal trade. The parent's and subsidiary's maximization problems and first-order conditions are given as follows:

$$\text{Max}_{X_{12}^s} (1-t_1)\Pi_1 \Big|_{P_{12}}, \quad (1-t_1)[P_{12} - C_1'] = 0 \quad (\text{parent})$$

$$\text{Max}_{X_{12}^d} (1-t_2)\Pi_2 \Big|_{P_{12}}, \quad (1-t_2)[\bar{P}_2 - \gamma_2' - P_{12}] = 0, \quad (\text{subsidiary})$$

where C_1' and γ_2' (marginal costs) are the derivatives of C_1 and γ_2 with respect to X_{12}^s and X_{12}^d , respectively. Taking the total differentials of the first-order conditions gives the

slope of the supply curve, $\frac{dP_{12}}{dX_{12}^s} = C_1'' > 0$ (increasing marginal cost), and the slope of the

demand curve, $\frac{dP_{12}}{dX_{12}^d} = -\gamma_2'' < 0$ (increasing marginal processing cost). Bond (1980) and

we assume that C_1'' and $-\gamma_2''$ are constants. Graphically, the multinational corporation's internal market is shown in Figure 1.

Equilibrium occurs in the internal market when top management sets the transfer price at P_{12}^0 . It sets the transfer price at P_{12}^0 only when $t_1 = t_2$.¹⁰ The short-side rule

¹⁰ When $t_1 = t_2$, no reason exists to use the transfer price to shift profit from one country to another. Top management is free to set the transfer price to induce autonomous division general managements to choose the optimum quantity of intra-firm trade (and output), which it does at

applies, so that when top management raises (lowers) the transfer price from P_{12}^0 , the multinational corporation is along the upper (lower) portion of the demand (supply) curve.

In Bond's (1980) model, top management chooses the transfer price to maximize Π_N , given the division supply and demand relationships. Formally, top management's maximization problem is $\text{Max}_{P_{12}} \Pi_N \Big|_{X_{12}^s(P_{12}), X_{12}^d(P_{12})}$. Bond (1980) calculates top management's first-order condition and evaluates it at the equilibrium transfer price, P_{12}^0 . The first-order condition evaluated at P_{12}^0 is:

$$\left. \frac{d\Pi_N}{dP_{12}} \right|_{P_{12}=P_{12}^0} = X_{12}^0 (t_2 - t_1). \quad (6)$$

From equation (6), Bond concludes that when $t_2 > t_1$ ($t_2 < t_1$), top management raises (lowers) the transfer price from P_{12}^0 to maximize Π_N , which is consistent with Horst's (1971) conclusion.

In Horst (1971), when tax rates differ the centralized multinational corporation raises or lowers the transfer price by the maximum amount allowed by tax law. How much does top management in Bond's (1980) decentralized multinational corporation raise or lower the transfer price? Bond answers this question by deriving the optimal markup and markdown conditions. The optimal markup rate is

$$\frac{P_{12} - C_1'}{P_{12}} = \frac{(t_2 - t_1)}{\eta(1 - t_1)},$$

and the optimal markdown rate is

P_{12}^0 . Since $\left. \frac{\partial \Pi_N}{\partial X_{12}} \right|_{P_{12}} > 0$ and the short-side rule applies, X_{12}^0 is the quantity that maximizes Π_N .

Also, see Appendix 3 for the derivation of the tax conditions.

$$\frac{(\bar{P}_2 - \gamma'_2) - P_{12}}{P_{12}} = \frac{(t_2 - t_1)}{\varepsilon(1 - t_2)},$$

where $\eta = \left(\frac{\partial X_{12}^d}{\partial P_{12}} \right) \left(\frac{P_{12}}{X_{12}^d} \right)$ is the subsidiary's transfer price elasticity of demand for X_{12} ,

and $\varepsilon = \left(\frac{\partial X_{12}^s}{\partial P_{12}} \right) \left(\frac{P_{12}}{X_{12}^s} \right)$ is the parent's transfer price elasticity of supply of X_{12} . Bond

concludes that when $t_2 > t_1$ ($t_2 < t_1$), the optimal markup (markdown) depends on the relative magnitude of the tax differential and the transfer price elasticity of demand (supply).

Bond's (1980) analysis raises the possibility of an interior solution for the transfer price. Under centralized decision-making, division general managements do not reduce the quantity of intra-firm trade (and output), so the multinational corporation chooses the highest or lowest allowable transfer price — a boundary solution. Under decentralized decision-making, division general managements may lower the quantity of intra-firm trade (and output) in response to a change in the transfer price. In that case, top management trades off the gain in Π_N that comes from profit-shifting (minimizing its global tax bill) with the loss in Π_N that comes from a loss in efficiency (resource misallocation). This tradeoff makes an interior solution within the arm's-length boundary possible. Top management, limited by the possible adverse effect of a fall in intra-firm trade on the multinational corporation's global after-tax profit, may adjust the transfer price by something less than the maximum allowed by tax law.

III. Comparative Static Analysis

Centralized Transfer Pricing

We begin by adopting Bond's (1980) decentralized model of the multinational corporation and completing the comparative static analysis. In Bond (1980),

decentralized decision-making means that top management chooses the transfer price (centralized transfer pricing) to maximize the multinational corporation's global after-tax profit, while division general managements choose division output to maximize division after-tax profit. We then conclude with the implications of negotiated transfer pricing.

Model and Analysis

We expand Bond's (1980) results for the vertically integrated multinational corporation by completing the comparative static analysis for $\frac{dP_{12}^*}{dt_1}$ and $\frac{dP_{12}^*}{dt_2}$. Bond's (1980) model appears in equations (1), (2), and (3), where $X_{12} = X_{12}^s(P_{12})$ and $X_{12}' > 0$ when the multinational corporation operates along the internal supply curve, and $X_{12} = X_{12}^d(P_{12})$ and $X_{12}' < 0$ when it operates along the internal demand curve. Top management's first-order condition implicitly defines the optimal transfer price. The total differential of the first-order condition is used to calculate the comparative static results, which are as follows:

$$\frac{dP_{12}^*}{dt_1} = \frac{(P_{12} - C_1')X_{12}' + X_{12}}{D_1} < 0, \text{ and} \quad (7)$$

$$\frac{dP_{12}^*}{dt_2} = \frac{(\bar{P}_2 - \gamma_2' - P_{12})X_{12}' - X_{12}}{D_1} > 0, \quad (8)$$

where $D_1 < 0$.¹¹ These results apply whether the multinational corporation operates along the internal supply or the internal demand curve.¹²

¹¹ Appendix 1 derives the results. The results in equations (7) and (8) generalize to non-linear marginal cost curves that produce non-linear internal supply and demand curves. With non-linear marginal cost curves, the denominator in equation (7) and (8) is CC rather than D_1 , and the second-order condition is $\Pi_N''(P_{12}) = CC$. See Appendix 1. Therefore, profit maximization implies that $\Pi_N''(P_{12}) = CC < 0$. The results in equations (7) and (8) are qualitatively consistent when CC replaces D_1 .

¹² Appendix 2 determines the signs of the results.

These results confirm our intuitive understanding of the relationship between international tax rates and the multinational corporation's transfer price. The transfer price can be used to shift profits to the lower-tax country to reduce the multinational corporation's global tax liability and improve its corporate after-tax profit. For example, when the multinational corporation operates along the supply or demand curve, an increase in country 1's tax rate leads the profit-maximizing multinational corporation to reduce the transfer price. This shifts some profit to the subsidiary in country 2, reduces the multinational corporation's global tax liability, and thereby increases its global after-tax profit.

Internal Profit Constraint and an Interior Solution

In Horst (1971), if the multinational corporation does not face an external arm's-length constraint (or if the arm's-length constraint is less than perfectly effective and not binding), it adjusts the transfer price to a level that shifts all of the high-tax division's profit to the low-tax division (Schjelderup and Sørsgard 1995). In that case, the high-tax division earns zero profit. Under decentralized decision-making, the multinational corporation faces a different internal profit constraint; no division earns zero (or negative) before-tax profit when the multinational corporation earns a before-tax profit.¹³ This ensures that not all of the high-tax division's profit shifts to the low-tax division, even if the multinational corporation does not face a binding arm's-length constraint. This occurs because top management, under decentralized decision-making, must balance the profit-shifting gain with the possible resource allocation loss when changing the

¹³ Schjelderup and Sørsgard (1995) suggest that the internal profit constraint of zero is an appropriate amendment to the Horst (1971) centralized decision-making model, but for a different reason than discussed in this paper. They argue that, since a negative profit cannot be repatriated to the parent corporation, the multinational corporation does not adjust the transfer price by a magnitude that makes the high-tax division earn less than zero profit. This argument does not consider the fact that some countries allow multinational corporations to carry a loss that is earned in one fiscal year forward (or backward) as a credit toward their tax liability in a future (or past) fiscal year, however.

transfer price. The reasoning is as follows. Top management of the vertically integrated multinational corporation cannot choose the transfer price that makes the high-tax division earn too small a profit, or else too little production occurs. Since the division production functions interconnect in the vertically integrated multinational corporation (i.e., $Y_2 = X_{12}$), the high-tax division must produce a large enough division output so that the multinational corporation's output and after-tax profit are sufficiently positive. The high-tax division only produces when the transfer price allows it to earn a profit. Therefore, the decentralized multinational corporation's profit-maximizing strategy differs from the centralized multinational corporation's, since it maximizes after-tax profit only when the autonomous divisions have the incentive to produce sufficient output. The decentralized multinational corporation adjusts the transfer price by less than the centralized multinational corporation when the arm's-length constraint does not bind, which limits the profit shift.

Mathematically, the multinational corporation faces a critical upper and a lower transfer price (P_{12}^{CU} and P_{12}^{CL}). Figure 2 illustrates. The profit-maximizing multinational corporation does not set the transfer price outside, or at, these critical values. If the arm's-length constraint does not bind (i.e., the arm's-length boundary lies outside, or on, the multinational corporation's critical upper and lower transfer prices), the multinational corporation shifts less profit than, or the same profit as, the tax authorities will allow.¹⁴

Negotiated Transfer Pricing

In the centralized transfer pricing analysis, we implicitly assume that top management knows each division's "reaction-function" (i.e., the parent's supply curve and the subsidiary's demand curve). Therefore, centralized transfer pricing with its underlying perfect-information assumption may involve an internal contradiction, however. The

¹⁴ Appendix 4 derives the critical upper and lower transfer prices.

assumption that top management chooses the optimal transfer price implicitly assumes that top management has perfect information about its divisions. But, if top management has perfect information about each division, then no need exists to structure the firm in a decentralized manner (Hansen and Kimbrell 1991). Top management makes all decisions from the center and division general managements follow instructions perfectly, since an all-knowing top management successfully corrects shirking and self-interested behavior without cost. Therefore, “impacted information”¹⁵ underlies a firm’s choice to decentralize and imperfect information is consistent with decentralized decision making.

Perhaps no contradiction exists, however. Consider two arguments. First, negotiated transfer pricing contradicts and, in fact, nullifies the multinational corporation’s vertical (or horizontal) integration strategy. Under negotiated transfer pricing in the decentralized model, the multinational corporation becomes a union of completely independent businesses—a conglomerate. Top management must exercise at least some central control or the firm *disintegrates*. Since only two choice variables exist, the transfer price and output, top management must retain control over at least one. As in Bond (1980), top management controls the transfer price.

Second, even under negotiated transfer pricing, top management still chooses the management control system and the transfer pricing policy. That is, although autonomous division general managements directly choose the transfer price through negotiation, the profit-maximizing top management chooses the transfer pricing policy that it expects to yield the transfer price that maximizes the multinational corporation’s

¹⁵ Williamson (1975) defines impacted information as an information asymmetry that cannot be resolved at low cost. With respect to the agency relationship between top management and division general management, division general managements have division information that top management cannot learn at low cost.

global after-tax profit. Under negotiated transfer pricing, top management indirectly chooses the transfer price. Therefore, centralized transfer pricing is a strategic simplification that is consistent with negotiated transfer pricing.¹⁶

Nevertheless, since negotiated transfer pricing exists in practice (Tang 1979, Wu and Sharp 1979, Price Waterhouse 1984, Eccles 1985, Chalos and Haka 1990), we relax the centralized transfer pricing assumption and consider negotiated transfer pricing. The analysis considers two cases. Each division general management either has perfect or imperfect information about whether the negotiation is a positive-sum game. The transfer price negotiation is a simultaneous game, since the negotiated outcome (an agreement), once concluded, is a mutual and joint decision. Also, the negotiation is a repeated game, since repeated interaction between division general managements in the multinational corporation is common.

Perfect Information. Under negotiated transfer pricing, a cooperative solution (i.e., an agreement prior to the end of the negotiation period) occurs when rational profit-maximizing division general managements realize that they play a positive-sum game. Division general managements receive rewards based on division profit, so as rational decision-makers they maximize division profit. The game between division general managements possesses a positive-sum, which means that a higher after-negotiation profit exists for at least one division while the other division's after-negotiation profit is not lower. If the relatively weaker bargaining division general management faces a probable negotiation outcome that lowers its profit (and therefore its compensation), it vetoes the other division general management's offer. Unless the stronger bargaining

¹⁶ This argument ignores the fact that top management cannot control autonomous division general managements perfectly. It also ignores the fact that negotiated transfer pricing may influence the multinational corporation's after-tax profit through other avenues besides inducing division general managements to choose the centralized transfer price.

division general management presents another offer that leaves the vetoing division general management with at least its before-negotiation profit (conflict payoff), a negotiation impasse occurs. With negotiation impasse, each division general management receives the profit that it started with, its conflict payoff, or lower.¹⁷ If the relatively stronger division general management offers a concession that makes the weaker division general management at least not worse off, a cooperative outcome occurs where the stronger division receives at least some gain in its after-tax profit while the weaker division receives at least its conflict payoff. A concession leads to cooperation and some gain for the stronger division general management, which dominates no gain or a loss.

The bargaining sequence occurs in a two stages. In stage one, division general managements first cooperate and choose the transfer price and quantity of intra-firm trade. If an agreement does not emerge before the end of the negotiation period, top management steps in and sets the transfer price (centralized transfer pricing). Therefore, cooperation weakly dominates a negotiation impasse,¹⁸ and a cooperative solution obtains. In stage two, the two divisions divide the joint gain in after-tax profit, if any. Since the bargaining outcome reflects each party's relative bargaining power (Chalos

¹⁷ Top management steps in and chooses the transfer price if a negotiation impasse occurs. In effect, negotiation impasse leads the centralized transfer pricing result.

¹⁸ Let “*” indicate the optimum result under centralized transfer pricing. With a negotiation impasse, top management chooses the transfer price, P_{12}^* , which may lie inside the arm's-length boundary. With cooperation, division general managements negotiate a transfer price, $P_{12}^{Neg.}$, at the upper- or lower-arm's-length boundary, P_{12}^{UAL} and P_{12}^{LAL} respectively (this will be shown later). With an impasse, centralized transfer pricing occurs and the quantity of intra-firm trade is determined by the short-side rule, so that when $P_{12}^* > P_{12}^0$, $X_{12}^* \leq X_{12}^0$. With cooperation, division general managements choose $X_{12}^{Neg.} = X_{12}^0$. Therefore, the cooperation solution, $P_{12}^{Neg.} = P_{12}^{UAL}$ or P_{12}^{LAL} and $X_{12}^{Neg.} = X_{12}^0$, weakly dominates the non-cooperative solution, $P_{12}^{UAL} \geq P_{12}^* \geq P_{12}^{LAL}$ and $X_{12}^* \leq X_{12}^0$.

and Haka 1990, Chatterjee and Samuelson 1987, Abdel-Khalik and Lusk 1974, and Dopuch and Drake 1964), the generalized Nash bargaining solution allocates the joint gain. Specifically, the relative bargaining strength of division general managements determines the allocation.

Division general managements' joint after-tax division profit equals the multinational corporation's global after-tax profit, Π_N . Therefore, in stage one, division general managements maximize their joint gain by choosing the highest (lowest) allowable transfer price when $t_1 < t_2$ ($t_1 > t_2$), ceteris paribus, which is the upper (lower) arm's-length boundary, $P_{12}^{Neg.} = P_{12}^{UAL}$ ($= P_{12}^{LAL}$). In addition, they choose the equilibrium quantity of intra-firm trade, $X_{12}^{Neg.} = X_{12}^0$, since it maximizes their joint gain, ceteris paribus. In a positive-sum negotiation under perfect information, rational division general managements, who face an incentive system that rewards them based on division performance, choose a negotiated transfer price at the upper- or lower-arm's-length boundary and the centralized output, which is the Horst (1971) or centralized decision-making solution.

In stage two, the generalized Nash bargaining solution captures how division general managements divide the joint gain (see Sopher 1993). Let $\Pi_N^{J.G.}$ measure the cooperative joint gain in after-tax division profit, where

$$\begin{aligned} \Pi_N^{J.G.} &= \Pi_N^{J.New} - \Pi_N^{J.Old} \\ &= (1-t_1)[\Pi_1^{New} - \Pi_1^{Old}] + (1-t_2)[\Pi_2^{New} - \Pi_2^{Old}] \geq 0 \end{aligned}$$

The joint gain is restricted to being greater than or equal to zero, since profit-maximizing assumption rules out a negotiation impasse.¹⁹ The generalized Nash bargaining solution

¹⁹ Under imperfect information, $\Pi_N^{J.G.} > 0$.

is as follows: Player A receives share X of $\Pi_N^{J.G.}$ and player B receives share $\Pi_N^{J.G.} - X$ of $\Pi_N^{J.G.}$. If player A and B do not cooperate, $\Pi_N^{J.G.} \leq 0$, and each player ends up with its conflict payoff or lower.

The generalized Nash bargaining problem “maximize[s] the weighted product of utility gains received by the two players to the bargain” (Sopher 1993, p. 70). Each player’s utility equals its share of the joint gain, X and $\Pi_N^{J.G.} - X$, respectively. Let γ be the parent division general management’s bargaining power, where its complete dominance (impotence) in the negotiation is denoted by $\gamma=1$ ($\gamma=0$). Similarly, let $\beta=(1-\gamma)$ be the subsidiary division general management’s bargaining power, where $(1-\gamma)=1$ [$(1-\gamma)=0$] denotes its complete dominance (impotence).²⁰ An increase in the parent division general management’s absolute bargaining power matches an equal decrease in the subsidiary division general management’s absolute bargaining power, or $\frac{d\gamma}{d\beta} = \frac{d\gamma}{d(1-\gamma)} = -1$. By convention, the maximization problem that represents the

generalized Nash bargaining process is

$$\text{Max}_X \left[(X)^\gamma \cdot (\Pi_N^{J.G.} - X)^{1-\gamma} \right],^{21}$$

which produces the following bargaining solution: $X^* = \gamma \Pi_N^{J.G.}$ (the parent’s share) and $(\Pi_N^{J.G.} - X^*) = (1-\gamma) \Pi_N^{J.G.}$ (the subsidiary’s share).²² That is, the bargaining outcome

²⁰ That is, $(0 \leq \gamma \leq 1)$.

²¹ See Nash (1950, 1953) for his theoretical presentation of the bargaining process. Also see others who use the generalized Nash bargaining solution in economic applications (e.g., Hoel 1991, Linhart *et al.* 1989). In this paper, the objective function is maximized subject to the implicit constraint that $d\{(1-t_1)\Pi_1\} \geq 0$ and $d\{(1-t_2)\Pi_2\} \geq 0$.

²² When analyzing the second stage of negotiation, “*” refers to the optimum allocation of the joint gain.

allocates the joint gain in division after-tax profit according to each division general management's relative bargaining power as follows:

$$\Pi_N^{J.G.} = X^* + (\Pi_N^{J.G.} - X^*) = \gamma \Pi_N^{J.G.} + (1 - \gamma) \Pi_N^{J.G.}. \quad (9)$$

For a domestic firm, Hansen and Kimbrell (1991) show that division general managements first cooperate and choose their output jointly at the firm's optimal output level and the transfer price allocates the gain. In the domestic case, the transfer price does not affect the firm's after-tax profit, so it can allocate the gain in stage two of the negotiation without affecting the firm's after-tax profit. In contrast, Halperin and Srinidhi (1991) analyze the case of the multinational corporation that faces different tax rates. Like Hansen and Kimbrell (1991), they conclude that the transfer price allocates the gain. In that case, global after-tax profit responds to a change in the transfer price. Therefore, no guarantee exists that division general managements will choose a negotiated transfer price on the arm's-length boundary, since division general managements' relative bargaining powers determine the allocation of the joint gain. Only in the special case where their relative bargaining powers lead to a negotiated transfer price at the arm's-length boundary is the joint gain in division after-tax profit (and the multinational corporation's global after-tax profit) maximized.

In the multinational case under different tax rates, the assumption that the transfer price allocates the joint gain is not consistent with the assumption that division general managements maximize profit. Division general managements should choose the upper- or lower-arm's-length transfer price in stage one of their negotiation, and then use another mechanism to allocate the gain in stage two. That is, the negotiated transfer price allocates before-tax profit between divisions in a way that satisfies the arm's length constraint. Therefore, the before-tax (taxable) profits reported on the parent's and subsidiary's tax returns reflect compliance with tax law. Then division general managements implement their stage two allocation of the joint gain in *after-tax profit*

between themselves using another means, instead of the transfer price. This allocation need require actual money payments between divisions.²³ Since division general managements receive rewards based on division performance, division general managements communicate the negotiated allocation of the joint gain and the resulting division of after-tax profits to top management. Top management then compensates division general managements based on that information. To do so, it calculates alternative division profit measures, for internal purposes only, that are based on the information communicated by division general managements. Top management then enters those profits into the corporation's management compensation formula, so that division general managements' quarterly or yearly bonus properly reflects the negotiated allocation of the joint gain.

Imperfect Information. Hansen and Kimbrell (1991) point out that even though "the assumption of complete information may be reasonable, there is certainly a need for additional research to assess the impact of relaxing the assumption" (p. 96).²⁴ That assumption is relaxed here. Under imperfect information, division general managements may not know that their negotiation is a positive-sum game. Therefore, believing that the game is zero-sum, the dominant division general management exercises its full

²³ If actual money payments allocate the gain between divisions, those payments may be subject to taxation.

²⁴ Hansen and Kimbrell (1991) present three reasons why complete information between the division general managements makes good sense: (1) Top management has the incentive to assimilate the information to encourage division general managements to choose the centralized outcome; (2) division general managements are "reasonably informed about their division's operating environment even without information being supplied by a central authority" (p. 88); and (3) since division general managements can communicate with each other and they are rational and profit-maximizing, they have the capability and the incentive to identify joint cooperative gains when they exist (pp. 87-88).

bargaining strength to negotiate the most favorable transfer price possible.²⁵ Since the relatively weaker bargaining division general management is made worse off by accepting the dominant division general management's offer, it rejects the offer. In fact, since the game is perceived as zero-sum, every offer that makes the stronger division general management better off seems to make the weaker division general management worse off. The weaker division general management rejects every offer and a negotiation impasse occurs. With negotiation impasse, top management sets the transfer price and the centralized transfer pricing result obtains.

Under imperfect information, top management can facilitate division general managements' learning that their negotiation is positive-sum. For example, Hansen and Kimbrell (1991) suggest that top management can take on "the role of *supplying information to managers*" [italics in original] (p. 88) by telling them directly.²⁶ If division general managements believe top management, then they become aware of the opportunity to achieve a mutual gain and, in the pursuit of their self-interest (maximum division profit), they cooperate. The perfect information solution obtains, which is the Horst (1971) or centralized decision-making result, and then they split the gain according to their relative bargaining powers.

If division general managements do not believe top management, a time-limit rule may encourage cooperation. Such a rule will not work, however, since division general managements remain ignorant of the fact that they face a positive-sum game.

²⁵ This is an extreme case, since it is implicit that division general managements have an adversarial relationship. In practice, even though they have imperfect information, they know the nature of the internal dynamic in the corporation. The incentives to be a team player probably leads the stronger division general management to propose a less extreme transfer price, which tends to promote a cooperative solution even in the absence of perfect information.

²⁶ Hansen and Kimbrell (1991) argue that top management's role of information assimilator does not undermine the firm's decentralized decision-making structure, since "gathering and disseminating information does not constitute an infringement on the decision-making rights of divisional managers" (p. 88).

Another option is a non-monetary reward scheme.²⁷ Division general managements receive a non-monetary reward, such as the use of the multinational corporation's box seats at a popular event or the use of its time-share in a tropical vacation spot, when an agreement is reached.²⁸ Under certain conditions, even though division general managements do not realize that the negotiation is a positive-sum game, the negotiation becomes a positive-sum game in their minds through the implementation of the non-monetary reward scheme.

As long as the weaker division general management expects that its gain from the non-monetary reward exceeds its loss from accepting the stronger division general management's offer, cooperation occurs. Its expected loss is not the expected reduction in division after-tax profit, but rather the expected reduction in management compensation that occurs in response to the reduction in division after-tax profit. Since they have imperfect information, they may not succeed in choosing a transfer price on the arm's-length boundary. If, by chance or educated guess, they succeed, a joint gain occurs after the first negotiation round. This indicates that their negotiation is a positive-sum game, which promotes cooperation. Top management does not have to offer the non-monetary reward thereafter, since the realization of a joint benefit informs division general managements that they face a positive-sum game. Therefore, the negotiations possess a momentum of their own. On the other hand, if division general managements choose a transfer price further from the arm's-length limit, they realize a joint loss, indicating that they should move the transfer price in the opposite direction in the next

²⁷ A monetary reward scheme may work as well, but the profit-maximizing top management chooses the non-monetary reward because it has a lower marginal cost.

²⁸ The non-monetary reward, once received, may be subject to an income tax.

round. A trial-and-error process ensues, and the transfer price converges on the arm's-length boundary.

The non-monetary reward scheme starts the cooperation in the first round, or in any subsequent round, only if the non-monetary reward provides enough utility gain to the weaker division general management to offset its expected compensation loss. If the non-monetary reward is not high enough, will top management raise the non-monetary reward to promote cooperation? Top management raises the non-monetary reward to the point where the expected marginal gain in Π_N from cooperation is equal to the expected marginal loss in Π_N from increasing the non-monetary reward. In sum, a cooperative solution is possible under imperfect information, and is more likely when top management either provides information to division general managements, uses a non-monetary reward scheme, or division general managements discover by themselves that the negotiation is positive-sum.

IV. Results under the Possibility of Non-Compliance

Throughout our analysis in Section III, we assume that the transfer pricing regulations are perfectly effective, so multinational corporations comply with them.²⁹ The centralized and decentralized multinational corporations manipulate the transfer price within the arm's-length range to lawfully minimize their global tax burden. In this section, we relax this assumption and consider the results under a weaker or less than perfectly effective arm's-length constraint. This weaker arm's-length constraint means that the centralized and decentralized multinational corporations might choose, either knowingly or

²⁹ The arm's-length constraint is effective when it successfully restricts the transfer price. The arm's-length constraint may be effective but not binding for an individual multinational corporation. For example, a decentralized multinational corporation may choose a transfer price within the arm's-length range due to internal constraints; the arm's-length constraint is effective but not binding.

unknowingly, a transfer price that lies outside the arm's-length boundary, which reflects non-compliance.

The centralized multinational corporation chooses the transfer price at the highest or lowest allowable transfer price. Under tax compliance or an effective arm's-length constraint, the transfer price equals either the upper or lower arm's-length boundary. With the possibility of non-compliance, the centralized multinational corporation's transfer price is indeterminate. If it chooses non-compliance, how far outside the arm's-length boundary does it set the transfer price? Kant's (1988) analysis suggests a determinate solution under non-compliance. His analysis assumes that the multinational corporation believes that there is a certain and direct relationship between how far the transfer price is set outside the arm's-length range and the likelihood of being caught by the tax authorities and a penalty being imposed. It also assumes that the dollar value of the penalty is known. The transfer price is determinate and chosen outside the arm's-length boundary when the multinational corporation is not prohibitively risk averse. When the multinational corporation is unwilling to take the risk of being caught (or prefers to comply), it complies and sets the transfer price at the upper or lower arm's-length boundary.

Under an effective arm's-length constraint, the decentralized multinational corporation might choose a transfer price within the arm's-length range rather than on the arm's-length boundary, since it faces an internal constraint (if the arm's-length range is narrow and binding, it chooses the transfer price on the arm's-length boundary). Under the possibility of non-compliance, the decentralized multinational may choose a transfer price within, on, or outside the arm's-length boundary, depending on the slope of its internal demand and supply curves and the position of the arm's-length boundary. Refer to Figure 3, which illustrates a non-compliant transfer price when the slope of the

demand (supply) curve is very steep and a compliant transfer price when the slope of the demand (supply) curve is relatively flat.

By comparing the transfer price for the centralized versus the decentralized multinational corporation under the possibility of non-compliance, it is shown that the decentralized multinational is more likely to comply. This reflects the fact that the decentralized multinational corporation faces an internal constraint while the centralized multinational does not. Consider the case where both the centralized and the decentralized multinational corporation are identical in every way, except for the difference in decision-making structure. The centralized multinational that prefers not to comply chooses a transfer price that lies outside the arm's-length boundary, while the decentralized multinational that prefers not to comply faces an internal constraint that leads to a transfer price that is closer to the arm's-length boundary than the centralized multinational's transfer price (see Figure 4) (except when the internal supply and demand curves are vertical). Therefore, under a less than perfectly effective arm's-length constraint, non-compliance is less probable for the decentralized multinational corporation than for the centralized multinational corporation, *ceteris paribus*, given that it faces an internal constraint.

When the arm's-length constraint is less than perfectly effective, non-compliance with the transfer pricing regulations is possible. *Ceteris paribus*, an industry that consists of both decentralized and centralized multinational corporations is more likely to comply, in general, than an industry that is comprised entirely of centralized multinational corporations. Therefore, the existence of decentralized multinational corporations in a particular industry leads to a higher average compliance rate than the industry that consists only of centralized multinational corporations.

The decentralized decision-making model predicts that the range over which the profit-maximizing vertically integrated multinational corporation adjusts the transfer price

to shift profit is likely to be smaller than the centralized multinational corporation's range. Thus, a country's tax authorities may have less concern with the effect of international tax differentials on the profit-shifting behavior of decentralized multinational corporations than centralized multinational corporations. The decentralized vertically integrated multinational corporation has less room to maneuver the transfer price than the centralized multinational corporation, so the degree of compliance with the transfer pricing regulations is higher than predicted by Horst's (1971) analysis. With greater compliance with the transfer pricing regulations and, in turn, a truer reported corporate profit, a country's tax authorities collect more of the tax revenue that is legally due.

This conclusion may not hold under negotiated transfer pricing, however, since the decentralized multinational corporation is more likely to choose the (perceived) highest or lowest allowable transfer price, the centralized decision-making result, rather than an interior solution. Therefore, a multinational industry that includes centralized multinational corporations, decentralized multinational corporations that practice centralized transfer pricing, and decentralized multinational corporations that practice negotiated transfer pricing, should have an intermediate compliance rate.

V. Summary and Conclusions

This paper considers how the multinational corporation's transfer price responds to changes in international tax rates. The centralized decision-making model produces a boundary solution for the transfer price, either at the upper or lower arm's-length price, when the arm's length constraint is perfectly effective. The decentralized decision-making model may produce an interior solution not on the arm's-length boundary, since the decentralized decision-making assumption specifies the quantity of intra-firm trade as a function of the transfer price.

We first extend Bond's (1980) model by completing the comparative static analysis. The results confirm our intuition that the profit-maximizing multinational

corporation uses the transfer price to shift profit to the relatively lower-tax country in order to maximize its global after-tax profit, all else equal. Also, the results apply to a wide range of relative tax rates.

Under decentralized decision-making, the transfer price may lie within the arm's-length boundary, since the multinational corporation's adjustment of the transfer price affects division output. Thus, since the decentralized multinational corporation may choose an interior transfer price, the degree of non-compliance by multinational corporations is less than that predicted by the centralized Horst (1971) model. In addition, the decentralized decision-making analysis shows that centralized decision-making dominates decentralized decision-making when tax rates differ, but centralized decision-making is not generally applicable to the multinational corporation.

We then extend the decentralized model by assuming negotiated transfer pricing. Bond (1980) assumes centralized transfer pricing, where top management chooses the transfer price and division general managements choose the quantity of intra-firm trade. Under negotiated transfer pricing, division general managements choose both the transfer price and the quantity of intra-firm trade. With perfect information, profit-maximizing division general managements negotiate and choose both the firm-wide optimal output and transfer price. This result is consistent with Horst (1971), where the transfer price is a boundary solution. In contrast to Halperin and Srinidhi (1991), profit-maximizing division general managements do not use the transfer price to divide the joint gain from cooperation. They must use alternative accounting to communicate their negotiated allocation of the profit gain to top management for compensation purposes. When division general managements have less than perfect information, top management first must persuade them to cooperate by telling them the negotiation is positive-sum or through a non-monetary reward scheme. As long as the relatively weaker bargaining division general management believes that the non-monetary reward

provides at least as much gain as its loss in management compensation, cooperation occurs. Through a trial-and-error process, division general managements eventually choose the firm-wide optimum transfer price, *ceteris paribus*.

A comparison of centralized transfer pricing and negotiated transfer pricing reveals that the decentralized multinational corporation's transfer price depends on who chooses it as well as the difference in international corporate tax rates (and other factors). Under both assumptions, the qualitative relationship between the transfer price and tax rates is the same – the multinational corporation uses it to shift profit to the low-tax country. An interior solution is more likely under centralized transfer pricing, however, while the Horst (1971) solution – a boundary solution – is more likely under negotiated transfer pricing. In addition, the profit potential under negotiated transfer pricing is greater. Therefore, in the context of decentralized decision-making and different tax rates, top management weakly prefers negotiated transfer pricing to centralized transfer pricing.

When the arm's length constraint is less than perfectly effective, non-compliance is possible. In that case, the centralized multinational corporation's transfer price is indeterminate. By including Kant's (1988) assumptions, the centralized multinational corporation's transfer price is determinate. The decentralized multinational corporation's transfer price may lie outside the arm's-length range, but it is likely to be closer to the arm's-length boundary than the centralized multinational corporation's transfer price, *ceteris paribus*. Therefore, the compliance rate in an industry with a higher proportion of decentralized multinational corporations should be higher.

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Appendices

Appendix 1: Derivation of Results

The total differential of top management's first-order condition is:

$$-[AA]dt_1 - [BB]dt_2 + [CC]dP_{12} = 0,$$

where $AA = [(P_{12} - C_1')X_{12}' + X_{12}]$, $BB = [(\bar{P}_2 - \gamma_2' - P_{12})X_{12}' - X_{12}]$, and

$$CC = \left[(1-t_1) \left\{ 2X_{12}' - (X_{12}')^2 C_1'' + (P_{12} - C_1')X_{12}'' \right\} + (1-t_2) \left\{ -2X_{12}' - (X_{12}')^2 \gamma_2'' + (\bar{P}_2 - \gamma_2' - P_{12})X_{12}'' \right\} \right]$$

Assuming that the multinational corporation has linear marginal cost curves ($X_{12}^{s''} = X_{12}^{d''} = X_{12}'' = 0$), $CC = D_1 = [2X_{12}'(t_2 - t_1) + C_1''(X_{12}')^2(t_1 - 1) + \gamma_2''(X_{12}')^2(t_2 - 1)]$. From the first-order condition, the comparative static results are:

$$\frac{dP_{12}^*}{dt_1} = \frac{AA}{D_1} \quad \text{and} \quad \frac{dP_{12}^*}{dt_2} = \frac{BB}{D_1}.$$

Appendix 2: Signing the Results

Refer to the multinational corporation's internal market (Figure 1). When top management sets the transfer price above (below) the equilibrium price, $P_{12} > P_{12}^0$ ($P_{12} < P_{12}^0$), and the multinational corporation is along the subsidiary's demand (parent's supply) curve and the relevant quantity is the quantity demanded (supplied) by the subsidiary (parent), $X_{12} = X_{12}^d$ ($X_{12} = X_{12}^s$). When the multinational corporation is along the demand (supply) curve, the subsidiary's (parent's) first-order condition holds, $\bar{P}_2 - \gamma_2' - P_{12} = 0$ ($P_{12} - C_1' = 0$), while the parent's (subsidiary's) first-order condition is positive, $P_{12} - C_1' > 0$ ($\bar{P}_2 - \gamma_2' - P_{12} > 0$). Therefore, along the demand curve

$$\left. \frac{dP_{12}^*}{dt_1} \right|_{X_{12}^d} = \frac{(P_{12} - C_1')X_{12}^{d'} + X_{12}^d}{D_1} < 0 \quad \text{and} \quad (7d)$$

$$\left. \frac{dP_{12}^*}{dt_2} \right|_{X_{12}^d} = \frac{-X_{12}^d}{D_1} > 0, \quad (8d)$$

and along the supply curve

$$\left. \frac{dP_{12}^*}{dt_1} \right|_{X_{12}^s} = \frac{X_{12}^s}{D_1} < 0 \quad \text{and} \quad (7s)$$

$$\left. \frac{dP_{12}^*}{dt_2} \right|_{X_{12}^s} = \frac{(\overline{P_2} - \gamma_2' - P_{12})X_{12}^{s'} - X_{12}^s}{D_1} > 0, \quad (8s)$$

where $D_1 < 0$ by the assumption that top management maximizes the multinational corporation's global after-tax profit and thus the second-order condition for profit maximization holds.³⁰

Top management's first-order condition is:

$$\begin{aligned} \frac{d\Pi_N}{dP_{12}} &= (1-t_1)[(P_{12} - C_1')X_{12}' + X_{12}] + (1-t_2)[(\overline{P_2} - \gamma_2' - P_{12})X_{12}' - X_{12}] = 0, \text{ or} \\ &-\frac{(P_{12} - C_1')X_{12}' + X_{12}}{(\overline{P_2} - \gamma_2' - P_{12})X_{12}' - X_{12}} = \frac{(1-t_2)}{(1-t_1)} > 0. \end{aligned}$$

The sign of the first-order condition in this form is positive, since $\frac{(1-t_2)}{(1-t_1)} > 0$.

When the firm is along the X_{12}^s -curve, $(P_{12} - C_1') = 0$ and $(\overline{P_2} - \gamma_2' - P_{12}) > 0$, and the first-order condition reduces to:

$$\frac{-X_{12}}{(\overline{P_2} - \gamma_2' - P_{12})X_{12}' - X_{12}} > 0.$$

Therefore, $[(\overline{P_2} - \gamma_2' - P_{12})X_{12}' - X_{12}] < 0$ in equation (8s).

When the firm is along the X_{12}^d -curve, $(\overline{P_2} - \gamma_2' - P_{12}) = 0$ and $(P_{12} - C_1') > 0$, and the first-order condition reduces to:

$$\frac{-[(P_{12} - C_1')X_{12}' + X_{12}]}{-X_{12}} > 0.$$

Therefore, $[(P_{12} - C_1')X_{12}' + X_{12}] > 0$ in equation (7d).

³⁰ In the linear supply and demand curves case, $D_1 < 0$ whether or not the second-order condition holds. $D_1 = \left[2X_{12}'(t_2 - t_1) + C_1''(X_{12}')^2(t_1 - 1) + \gamma_2''(X_{12}')^2(t_2 - 1) \right] < 0$, given increasing marginal costs ($\gamma_2'' > 0$, $C_1'' > 0$), positive national tax rates that are less than one ($0 < t_1 < 1$, $0 < t_2 < 1$), and $t_1 < t_2$ ($t_1 > t_2$) when the MNC is along the X_{12}^d (X_{12}^s) curve (see Appendix 3 for the derivation of these tax conditions).

Appendix 3: The Tax Conditions

In Appendix 2, we saw that when the multinational corporation is along its internal supply curve, top management's first-order condition is:

$$\frac{-X_{12}}{(\overline{P}_2 - \gamma'_2 - P_{12})X'_{12} - X_{12}} = \frac{(1-t_2)}{(1-t_1)} > 0,$$

where $\left[(\overline{P}_2 - \gamma'_2 - P_{12})X'_{12} - X_{12}\right] < 0$ and $(\overline{P}_2 - \gamma'_2 - P_{12}) > 0$. Therefore $\frac{(1-t_2)}{(1-t_1)} > 1$ and $t_1 > t_2$ when the multinational corporation is along the supply curve.

When the multinational corporation is along its internal demand curve, top management's first-order condition is:

$$\frac{-\left[(P_{12} - C'_1)X'_{12} + X_{12}\right]}{-X_{12}} = \frac{(1-t_2)}{(1-t_1)} > 0,$$

where $\left[(P_{12} - C'_1)X'_{12} + X_{12}\right] > 0$ and $(P_{12} - C'_1) > 0$. Therefore $\frac{(1-t_2)}{(1-t_1)} < 1$ and $t_1 < t_2$ when the multinational corporation is along the demand curve.

Appendix 4: The Critical Upper and Lower Transfer Prices

When the multinational corporation is along its internal demand curve, equations (7d) and (8d) are the comparative static results. By top management's first-order condition, since $BB = -X_{12}^d < 0$ in equation (8d), the profit-maximizing top management chooses a transfer price where $AA = \left[(P_{12} - C'_1)X_{12}^d + X_{12}^d\right] > 0$ in equation (7d). Therefore, the optimal transfer price lies below the transfer price that makes $AA = 0$, where the price that makes $AA = 0$ is the critical upper transfer price (P_{12}^{CU}) (see Figure 2). Since BB is always negative along the demand curve for the profit-maximizing multinational corporation, the multinational corporation is restricted to choosing a transfer price where AA is positive; the optimal transfer price is not at or above P_{12}^{CU} .

When the multinational corporation is along its internal supply curve, equations (7s) and (8s) are the comparative static results. By the first-order condition, since $AA = X_{12}^s > 0$ in equation (7s), the profit-maximizing multinational corporation only chooses a transfer price on the supply curve where $BB = \left[(\overline{P}_2 - \gamma'_2 - P_{12})X_{12}^s - X_{12}^s\right] < 0$ in equation (8s). That is, the optimal transfer price is higher than a value that makes $BB \geq 0$. The critical lower transfer price (P_{12}^{CL}), then, is the transfer price that makes $(\overline{P}_2 - \gamma'_2 - P_{12})X_{12}^s = -X_{12}^s$, or $BB = 0$.

Figure 1: The Multinational Corporation's Internal Market

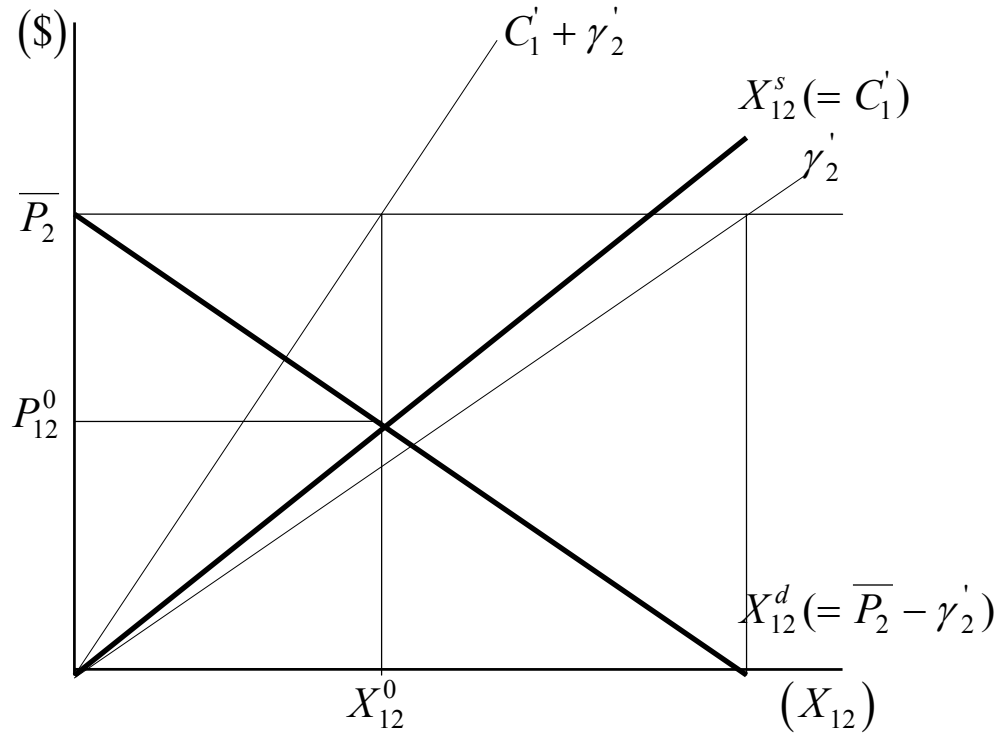


Figure 2: The Critical Upper and Lower Transfer Prices

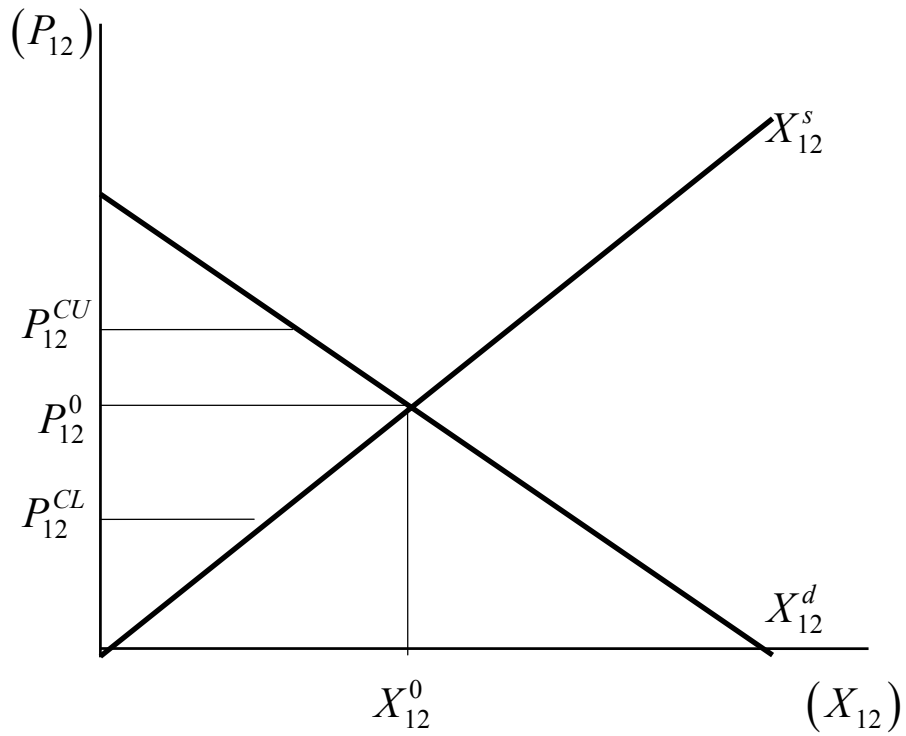


Figure 3: Decentralized Multinational Corporation Under The Possibility of Non-Compliance and Different Sloped Demand Curves

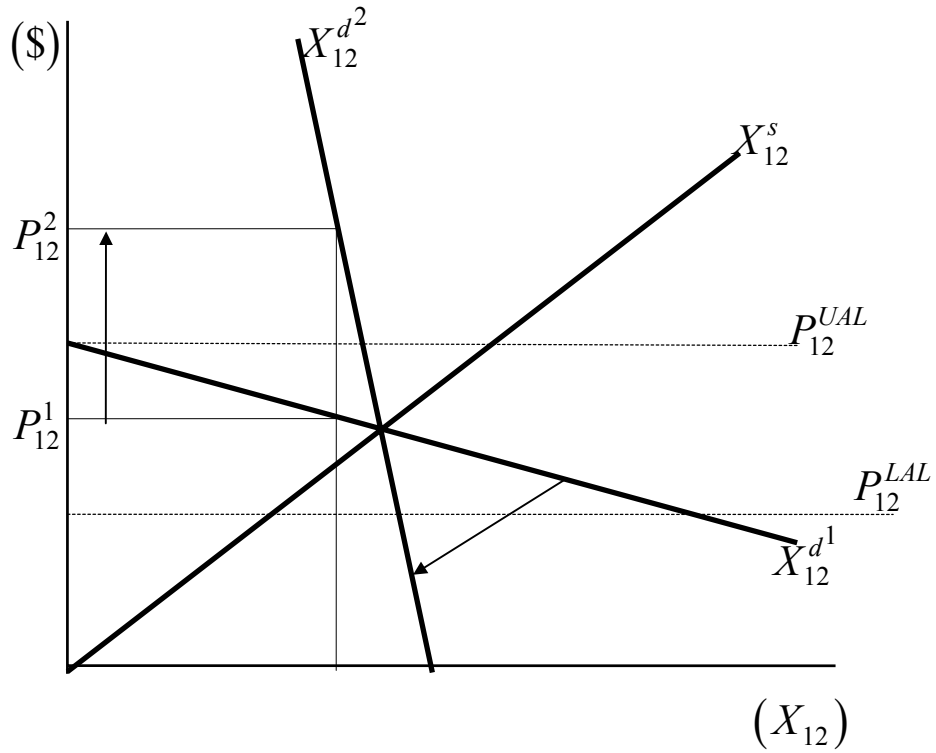


Figure 4: Centralized Versus Decentralized Multinational Corporation's Transfer Price Under Non-Compliance

