# Transfer pricing policies under tariff barriers

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*Abstract.* When international trade occurs between affiliates of a multinational enterprise (MNE), customs authorities have two tools at their disposal – tariff rates and the customs valuation method – to achieve the goals of tariff policy: discouraging imports, protecting domestic industry, and raising revenue. The particular method used by the authorities constrains the transfer pricing policy of the MNE with predictable effects on primary and secondary intrafirm trade, output, and tariff revenues. These effects can either accentuate, weaken, or even reverse the standard trade effects of a tariff change. Using a partial equilibrium model of a horizontally and vertically integrated MNE, the paper predicts that the upcoming shift by Canadian tariff authorities from the fair market value to the GATT transfer value method will accentuate the effects of the current drop in Canadian tariff rates on import-competing secondary MNE affiliates in Canada. That is, the change in valuation method will generate larger expansions in intrafirm primary and secondary imports and, assuming positive net protection to import-competing secondary industry from the Canadian tariff structure, larger declines in output.

*Politiques de prix de cession interne dans un monde où des barrières tarifaires existent.* Face au commerce international entre filiales d'une firme multinationale (FMN), l'administration des douanes a deux outils pour réaliser les objectifs d'une politique tarifaire (décourager les importations, protéger l'industrie domestique, et augmenter les revenus du gouvernement): les droits de douane et la méthode d'évaluation par les douaniers. Un outillage particulier d'évaluation utilisé par les autorités va imposer des contraintes à la politique de prix de cession interne de la FMN et avoir des effets prévisibles sur le volume du commerce intra-firme primaire et secondaire, sur le niveau de production et sur le niveau de revenus gouvernementaux engendré par la barrière tarifaire. Les effets traditionnels d'un changement dans un droit de douane peuvent être accentués, atténués ou même entièrement renversés par ce genre de phénomène.

A partir d'un modèle d'équilibre partiel d'une FMN intégrée verticalement et horizontalement, ce mémoire prédit que le changement prochain dans la méthode d'évaluation par les autorités canadiennes (de la valeur transactionnelle à l'utilisation de la méthode proposée par le Code du GATT) va accentuer les effets de la réduction des droits de douane par le Canada sur les filiales de FMN dans le secteur des biens manufacturés qui concurrencent les importations. Le changement dans la méthode d'évaluation va engendrer une forte croissance des importations

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intra-firme primaires et secondaires et – si la structure tarifaire canadienne donne une protection nette positive à l'industrie secondaire canadienne en concurrence avec les importations – des chutes importantes de production.

## INTRODUCTION

When international trade occurs between affiliates of a multinational enterprise (MNE), the price negotiated between these related firms is called the transfer price.[1] Assuming the goal of the MNE is to maximize global profits net of tax and tariff costs, the optimal policy for the MNE is to maximize (minimize) the transfer price whenever the tax differential between the two trading countries is greater (less) than the tariff rate on intrafirm trade (Horst, 1971). The optimal value for the transfer price is therefore determined by the relationship between the tax differential and tariff rate and is independent of the volume of trade. Although this result is well-known in the literature, it implies the MNE has the freedom to choose this price independent of customs and tax regulations. However, the transfer price is closely constrained by legislation in most OECD countries (see Mathewson and Quirin, 1979, Chap. 3). The purpose of this paper is to discuss the effects of tariff regulations constraining the transfer price on the resource allocation decisions of a horizontally and vertically integrated MNE. We find that customs valuation methods do force the price to be related to the volume of trade with predictable effects on MNE output, sales, and trade flows.

Assuming the goals of tariff policy are to curtail imports, protect domestic import-competing industries, and raise revenue, the paper then discusses how effective tariffs levied on MNE trade can be under different customs valuation methods. In Canada the traditional method of valuing intrafirm imports is the fair market value method, which is based on the price the exporting firm charges unrelated customers in its domestic market. As part of the Tokyo Round, Canada is to replace this method in January 1985, with the GATT Customs Valuation Code based on the transfer value principle.[2] This principle basically accepts the price actually paid for the imports as the customs valuation. For MNE affiliates in Canada we predict the partial equilibrium effects of this change in customs valuation method to be expansions in both primary and secondary trade and in Canadian tariff revenues.

1 The MNE literature distinguishes between two types of transfer prices: the internal or shadow price based on marginal cost of the exporting firm, and the external or money price used for outside purposes such as tax-tariff declarations. This external price may be unconstrained so that the MNE is free to choose an optimal value given tax and tariff rates, or constrained by customs or tax valuation methods. In this paper transfer prices are constrained external prices that must be used both for tariff purposes and for internal resource allocation decisions; that is, the MNE keeps only one set of books. (See also Bond, 1980; Eden, 1978; and Horst, 1971). If the multinational could keep two sets of books, it first uses shadow transfer prices to maximize global pre-tax profits and then chooses external transfer prices to minimize tax costs. This logical dichotomy between financial and resource allocation decisions breaks down, however, when tariffs are levied on intrafirm trade. With tariffs the external and internal transfer prices must be the same, so that financial and resource allocation decisions must be solved simultaneously, as we do here. (See also Copithorne, 1976).

2 See chapter 5 in Grey (1981) for a discussion of the GATT customs valuation negotiations and their probable effects on Canada.

Assuming the Canadian tariff structure provides positive net protection to secondary import-competing affiliates, we also predict that the shift in valuation, holding tariff rates constant, will cause secondary production to contract.

In addition to changing the customs valuation method, Canada is also reducing its tariff rates as part of the 1979 GATT Agreement. The paper predicts that the expansion in trade and, assuming positive net protection, the contraction in secondary output as tariff rates decline will be reinforced by the shift to the transfer value method. The decline in tariff revenues, however, will be smaller than if the customs valuation method had not changed. Since Mathewson and Quirin (1979, 140) have estimated that 87 per cent of Canada's imports in 1974 were bought in markets where multinationals were important and 42 per cent in markets where scope for manipulating transfer prices existed, the change in the valuation method as tariff rates are falling should significantly lessen the effectiveness of the Canadian tariff structure as a trade barrier.

## THE IMPACT OF TARIFF BARRIERS ON INTRAFIRM TRADE

In this section we outline a long-run partial equilibrium model of a three-firm MNE similar to Eden (1978). Firm 1, the U.S. parent firm, is a secondary manufacturer, as is firm 2, its Canadian subsidiary. Both firms produce identical products for final sale in their domestic markets. We assume demand curves slope downwards, price elasticities are determinate and different, and price discrimination between these markets is possible. Firm 1 also exports its surplus production over domestic sales to firm 2. Firm 3, the primary firm located in a third country (transport costs are ignored), extracts raw materials for sale to the secondary firms. No outside sales by firm 3 nor outside purchases by the secondary firms are possible.[3] For convenience we assume one unit of primary output is required to produce one unit of secondary output. We use the following symbols throughout the analysis (where $i, j = 1, 2, 3$, and $i \neq j$):

$Q_i$ = volume of output produced by firm $i$
$Y_i$ = volume of domestic sales by firm $i$
$X_{ij}$ = volume of intrafirm exports from firm $i$ to firm $j$
$C_i(Q_i)$ = total cost of $Q_i$, where $\partial C_i/\partial Q_i = \text{MC}_i > 0$, $\partial^2 C_i/\partial Q_i^2 = \text{MC}_i' \gtrless 0$, $C_i/Q_i = \text{AC}_i > 0$, and $\partial \text{AC}_i/\partial Q_i = \text{AC}_i' \gtrless 0$[4]
$R_i(Y_i)$ = total revenue from $Y_i$, where $\partial R_i/\partial Y_i = \text{MR}_i$, $\partial^2 R_i/\partial Y_i^2 = \text{MR}_i' < 0$, $R_i/Y_i = \text{AR}_i > 0$, and $\partial \text{AR}_i/\partial Y_i = \text{AR}_i' < 0$

3 We could incorporate an entrepôt division that buys and sells externally as in models by Bond (1980) and Copithorne (1976). The major impact would be to constrain the upper / lower bounds of the transfer prices by market prices net of costs of transacting in the outside market.

4 The second-order conditions for a global profit maximum are satisfied if $a_{11} < 0$, $a_{22} < 0$, $a_{33} < 0$, and $D < 0$ (see equation (10)). Decreasing marginal costs are therefore possible as long as these signs hold. As a result, our conclusions encompass both economies and diseconomies of scale in secondary production. Note, however, that the cofactors and equations of change are signed assuming $-\text{MC}_3' \leqslant 0$; that is, the primary firm faces constant or increasing marginal costs.

$P_{ij}(X_{ij})$ = transfer price firm $i$ charges firm $j$ per unit of $X_{ij}$, where $\partial P_{ij}/\partial X_{ij} = P_{ij}' \gtrless 0$, depending on the customs valuation method enforced by tariff authorities (as explained in the following section)

$r_{ij}$ = ad valorem tariff rate levied by country $j$ on $X_{ij}$

$\pi_i$ = profit earned by firm $i$ net of tariff costs.

The three profit functions of the MNE are

$$\pi_1 = R_1(Y_1) - C_1(Q_1) - (1 + r_{31})P_{31}(X_{31})X_{31} + P_{12}(X_{12})X_{12}, \tag{1}$$

where $X_{31} = Q_1$ and $Y_1 = Q_1 - X_{12}$,

$$\pi_2 = R_2(Y_2) - C_2(Q_2) - (1 + r_{32})P_{32}(X_{32})X_{32} - (1 + r_{12})P_{12}(X_{12})X_{12}, \tag{2}$$

where $X_{32} = Q_2$ and $Y_2 = Q_2 + X_{12}$,

$$\pi_3 = P_{31}(X_{31})X_{31} + P_{32}(X_{32})X_{32} - C_3(Q_3), \tag{3}$$

where $X_{31} + X_{32} = Y_3 = Q_3$.

We assume the goal of the MNE is to maximize $\pi_1 + \pi_2 + \pi_3$ or, substituting in the assumed relationships, to maximize

$$\begin{aligned}\pi = {} & R_1(Q_1 - X_{12}) - C_1(Q_1) + R_2(Q_2 + X_{12}) - C_2(Q_2) - C_3(Q_1 + Q_2) \\ & - r_{31}P_{31}(Q_1)Q_1 - r_{32}P_{32}(Q_2)Q_2 - r_{12}P_{12}(X_{12})X_{12},\end{aligned} \tag{4}$$

As a heuristic example, we assume the U.S. secondary division (firm 1) imports $X_{31}$ units of oil from a Mexican primary division (firm 3) in order to produce $Q_1$ units of plastic. The U.S. division then sells $Y_1$ units of plastic to its U.S. customers and $X_{12}$ units to the Canadian secondary division (firm 2). The Canadian division imports $X_{32}$ units of oil from the Mexican division and produces $Q_2$ units of plastic. It sells $Y_2$ units of plastic to its Canadian customers, of which $Q_2$ units are produced domestically and $X_{12}$ units imported from the U.S. division. Canadian customs authorities levy tariffs on both primary imports of oil from Mexico at rate $r_{32}$ and on secondary imports of plastic from the United States at rate $r_{12}$, while the U.S. authorities levy a primary tariff at rate $r_{31}$ on oil imports from Mexico. The goal of the MNE is to maximize global profits net of tariff costs, where the transfer prices of oil and plastic imports are constrained by Canadian and U.S. customs valuation rules.

If the MNE is free to manipulate transfer prices, it should set them as low as possible to minimize tariff costs, since there are no corporate taxes in this model. Differentiating (4) with respect to $P_{ij}$ and holding $P_{ij} = P_{ij}^0$, we have

$$\partial\pi/\partial P_{ij}|_{P_{ij}=P_{ij}^0} = -r_{ij}X_{ij}^0 < 0. \tag{5}$$

The optimal lower bound for $P_{ij}$ is therefore zero (assuming negative transfer prices are impossible). However, the effective lower bound on import prices in practice is the (positive) minimum valuation acceptable to customs officials. Therefore, even in the absence of any customs valuation method constraining transfer prices, the MNE still chooses positive (albeit as low as possible) transfer prices for intrafirm trade.

When customs valuation methods are introduced, the MNE no longer has the freedom to manipulate transfer prices and therefore cannot optimize (4) with respect to $P_{ij}$. The MNE, however, can choose optimal values for $X_{ij}$. Differentiating (4) with respect to $Q_1$, $Q_2$, and $X_{12}$, we have the first-order conditions for a global profit maximum:

$$\partial\pi/\partial Q_1 = \text{MR}_1 - \text{MC}_1 - \text{MC}_3 - r_{31}(P_{31} + Q_1P_{31}') = 0 \tag{6}$$

$$\partial\pi/\partial Q_2 = \text{MR}_2 - \text{MC}_2 - \text{MC}_3 - r_{32}(P_{32} + Q_2P_{32}') = 0 \tag{7}$$

$$\partial\pi/\partial X_{12} = \text{MR}_2 - \text{MR}_1 - r_{12}(P_{12} + X_{12}P_{12}') = 0. \tag{8}$$

In the absence of all tariffs ($r_{ij} = 0$) conditions (6, 7, 8) reduce to one simple first-order condition:

$$\text{MR}_1 = \text{MC}_1 + \text{MC}_3 = \text{MR}_2 = \text{MC}_2 + \text{MC}_3. \tag{9}$$

Comparing (9) with (6, 7, 8), note that transfer prices have no effect on global MNE profits when tariffs are zero. Since positive tariffs do affect global profits, the MNE must therefore simultaneously determine optimal transfer pricing policies and resource allocation decisions (see fn. 1). Now comparing (6) with (9) we see that the primary tariff $r_{31}$ drives a wedge equal to the marginal tariff costs assessed in intrafirm trade, $r_{31}(P_{31} + Q_1P_{31}')$, between $\text{MR}_1$ and $\text{MC}_1 + \text{MC}_3$. Assuming the tariff wedge is positive, the marginal cost of primary imports is increased causing $X_{31}$ to contract. Similarly $r_{32}$ drives a wedge between $\text{MR}_2$ and $\text{MC}_2 + \text{MC}_3$, causing $X_{32}$ to fall. And lastly, the secondary tariff $r_{12}$ drives a wedge between $\text{MR}_2$ and $\text{MR}_1$ (or between $\text{MC}_2 + \text{MC}_3$ and $\text{MC}_1 + \text{MC}_3$), causing $X_{12}$ to contract. All three tariff wedges therefore restrict intrafirm trade.

To analyse the comparative static effects of tariff changes on output, sales, and trade flows we totally differentiate (6, 7, 8). Setting the results in matrix form we have

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} dQ_1 \\ dQ_2 \\ dX_{12} \end{bmatrix} = \begin{bmatrix} (P_{31} + Q_1P_{31}')dr_{31} \\ (P_{32} + Q_2P_{32}')dr_{32} \\ (P_{12} + X_{12}P_{12}')dr_{12} \end{bmatrix}, \tag{10}$$

where

$$a_{ii} = \text{MR}_i' - \text{MC}_i' - \text{MC}_3' - r_{3i}(2P_{3i}' + Q_iP_{3i}'') < 0 \quad (i = 1, 2),$$

$$a_{33} = \text{MR}_1' + \text{MR}_2' - r_{12}(2P_{12}' + X_{12}P_{12}'') < 0,$$

$$a_{12} = a_{21} = -\text{MC}_3' \leq 0,$$

$$a_{13} = a_{31} = -\text{MR}_1' > 0,$$

$$a_{23} = a_{32} = \text{MR}_2' < 0,$$

and the determinant $D < 0$. Using Cramer's Rule, assuming positive tariff wedges, we reach the following conclusions:

PROPOSITION 1. $dQ_1/dr_{12} < 0,\ dQ_2/dr_{12} > 0,\ dX_{12}/dr_{12} < 0.$

A tariff on secondary imports contracts trade and protects domestic import-competing MNE subsidiaries while causing declines in foreign secondary production. Following Williams (1978), we call this the direct protection effect of the Canadian tariff structure.

PROPOSITION 2. $dQ_1/dr_{32} > 0,\ dQ_2/dr_{32} < 0,\ dX_{12}/dr_{32} > 0.$

A primary tariff levied on the secondary importer's inputs causes its output to contract while secondary imports and the output of its foreign competitor expand. This result implies that Canadian primary tariffs are anti-protective to Canadian secondary industry, while offering indirect protection to U.S. industry. A similar conclusion is reached by Williams (1978, 21) who argues that the output of Canadian import-competing primary firms is more expensive for secondary firms, owing to the Canadian primary tariff. As in Williams, we call this the antiprotective effect of the Canadian tariff structure.[5]

PROPOSITION 3. $dQ_1/dr_{31} < 0,\ dQ_2/dr_{31} > 0,\ dX_{12}/dr_{31} < 0.$

This is the reverse of proposition 2, that is, U.S. primary tariffs are anti-protective to U.S. secondary firms, while offering indirect protection to Canadian secondary competitors. Williams (1978, 21) also argues that U.S. primary tariffs provide protection to Canadian secondary firms but for a different reason. In his model the U.S. tariff lowers the price of Canadian primary exports to the United States (since U.S. prices are assumed fixed), so that purchases of primary goods by Canadian secondary firms tend to be cheaper by the amount of the U.S. tariff. In our model the U.S. primary tariff raises the price of U.S. secondary exports to Canada, causing MNEs to reduce intrafirm trade and substitute Canadian production. For both reasons the U.S. primary tariff has an indirect protection effect on Canadian secondary industry.

In summary, primary tariffs cause intrafirm primary trade to decline, while secondary trade declines (expands) if the primary importer is also a secondary exporter (importer). Secondary tariffs cause secondary trade to contract. Because the Canadian primary tariff causes domestic secondary production to fall ($dQ_2/dr_{32} < 0$), while the Canadian secondary tariff has the opposite effect ($dQ_2/dr_{12} > 0$), it would be useful to determine under what circumstances the direct protection effect dominates the anti-protection effect. We define net protection as the net impact on $Q_2$ of equal percentage changes in $r_{32}$ and $r_{12}$. Using a dot above a variable to indicate

5 For this reason, most countries allow raw materials to be imported free. However, because manufacturing proceeds through several stages, and there are tariffs at various stages, substantial antiprotection can exist for industries using imports or import-competing products as inputs. Therefore, primary tariffs should not be dismissed as irrelevant in countries where raw imports are duty free but should be treated as tariffs applying to earlier stages of manufacturing. (See Williams, 1978 for empirical estimates of antiprotection to Canadian industry.)

percentage change, net protection to import-competing secondary MNE affiliates in Canada is positive (zero, negative) as

$$\dot{Q}_2/\dot{r}_{12} \gtrless |\dot{Q}_2/\dot{r}_{32}|. \tag{11}$$

Multiplying the left-hand side of (11) by $\dot{X}_{12}/\dot{X}_{12}$ and the right-hand side by $\dot{X}_{32}/\dot{X}_{32}$ and rearranging, we have

$$(\dot{X}_{12}/\dot{r}_{12})(\dot{Q}_2/\dot{X}_{12}) \gtrless |(\dot{X}_{32}/\dot{r}_{32})(\dot{Q}_2/\dot{X}_{32})|. \tag{12}$$

From (12) we reach proposition 4.

PROPOSITION 4. *The Canadian tariff structure offers positive net protection to secondary import-competing MNE affiliates in Canada if*

1. $r_{12}/r_{32}$ *is large, so the direct protection effect dominates the anti-protection effect and* $|\dot{X}_{12}/\dot{r}_{12}| > |\dot{X}_{32}/\dot{r}_{32}|$;
2. *secondary imports are more responsive to changes in tariff rates than are primary imports so* $|\dot{X}_{12}/\dot{r}_{12}| > |\dot{X}_{32}/\dot{r}_{32}|$; *and*
3. *domestic output is more responsive to changes in secondary imports than in primary imports so* $|\dot{Q}_2/\dot{X}_{12}| > \dot{Q}_2/\dot{X}_{32}$.

Proposition 4 is intuitively appealing. Primary tariffs raise the marginal cost of primary imports, causing $Q_2$ to fall, while secondary tariffs raise the marginal cost of secondary imports, inducing $Q_2$ to rise. The higher is $r_{12}$ relative to $r_{32}$, the more likely is the net effect on $Q_2$ to be positive. For $\dot{r}_{12} = \dot{r}_{32} > 0$, the more elastic are secondary imports relative to primary imports, the more likely is $Q_2$ to expand. And similarly, for $\dot{X}_{12} = \dot{X}_{32} < 0$, the more responsive is $Q_2$ to direct changes in secondary imports relative to primary imports, the more likely is $Q_2$ to expand. In terms of our MNE model, (1) and (2) are satisfied while (3) is not, because we have assumed a unit of $X_{32}$ is required to produce a unit of $Q_2$. Since, in reality, some substitution between $X_{32}$ and other factors used in the production of $Q_2$ probably exists, we argue that, in a partial equilibrium sense, the Canadian tariff structure provides positive net protection to import-competing secondary MNE affiliates in Canada.[6]

In summary, each tariff drives a wedge equal to the marginal tariff costs assessed on intrafirm trade, $r_{ij}(P_{ij} + X_{ij}P_{ij}')$, which causes that trade to contract. In the next three sections we address the question: by how much? If the MNE can manipulate

6 Note that Williams's definition of net protection differs from ours. Using a general equilibrium linear programming approach, he compares Canadian industry output levels in 1961 with hypothetical output levels under a free trade simulation (i.e., where all taxes and tariffs are zero). An industry receives positive (negative) net protection, in a general equilibrium sense, if its output level contracts (expands) under free trade. Williams finds substantial negative net protection exists for most Canadian industries except textiles, chemicals, food and agriculture (1978, 34); that is, most industries would expand under free trade. Then using discriminate analysis he finds that industries characterized as receiving negative net protection tend to receive little direct protection from the Canadian tariff, face high levels of antiprotection, and make large purchases from the import-competing sector (1978, 26). These results provide empirical support for proposition 4.

transfer prices, the optimal $P_{ij}$ is set by the lower bound acceptable to tariff authorities according to (5). Since this optimal transfer price is fixed and independent of changes in $X_{ij}$, $P_{ij}' = 0$ and the relevant tariff wedge is $r_{ij}P_{ij}$ (Eden, 1978, 537–8). However, in the following section we show that customs regulations do constrain the transfer price and force $P_{ij}' \gtrless 0$. The corresponding tariff wedge is therefore larger or smaller, and since the tariff wedge affects the optimal volume of $X_{ij}$, output and trade levels are also larger or smaller than those chosen by the MNE in the absence of customs valuations. The fourth section compares the optimal values of trade as customs valuations change, holding tariff rates constant, while the fifth section allows the rates to vary.

## CUSTOMS VALUATION METHODS AND THE TARIFF WEDGES

Let us drop the subscripts and use a more general formulation of the tariff wedge, $W = r(P + XP')$, or transfer pricing function. This wedge is based on the valuation method imposed by tariff authorities on the MNE. We assume the transfer price $P$ is a continuous function of the volume of $X$ being transferred between divisions. The slope of the transfer pricing function, $P + XP'$, is determined by the importing country's customs valuation procedure. The intercept of this function is set by the minimum acceptable $P$ to the tariff authorities in the absence of a valuation method according to (5). When $P' = 0$ the marginal tariff cost, $r(P + XP')$, and the average tariff cost, $rP$, are equal. The transfer pricing function is therefore fixed at the acceptable lower bound, $rP$, regardless of $X$. When $P' > 0$, $r(P + XP') > rP$, so the marginal tariff cost exceeds the per unit cost and the transfer pricing function slopes up from $rP$ as $X$ rises. Similarly, if $P' < 0$ the marginal cost lies below the average cost and the transfer pricing function slopes down from $rP$ as $X$ rises.

Let us examine particular valuation methods in terms of the model in the preceding section. Canadian tariff authorities currently value imports according to their fair market value (FMV), which is defined in the Customs and Excise Act (sections 36–44) as the price at which 'like goods are freely sold for home consumption in the domestic market of the exporter, in similar quantities and to customers at the same trade level as the Canadian importer.' If similar but not like goods are freely sold, the Act allows customs value to be based on a cost plus method.

Since there are no outside sales of primary imports, FMV can be applied only to secondary imports of $X_{12}$. In terms of our example in the preceding section, the transfer price of Canadian plastic imports from the United States is based on $AR_1$, the price the U.S. division charges its domestic customers. Let us define FMV as $P = f(AR_1)$ and $P' = \partial f(AR_1)/\partial X_{12}$. Therefore $P' = \partial f(AR_1)/\partial Y_1 \cdot dY_1/dX_{12} > 0$ and FMV can be classified as a $P' > 0$ transfer pricing policy.[7] That is, the larger the volume of

7 We can write $dY_1/dX_{12}$ as $dQ_1/dX_{12} \cdot dY_1/dQ_1$. First, to find $dQ_1/dX_{12}$ we eliminate (8) by in effect assuming $X_{12}$ is constrained to some level $\bar{X}_{12}$. Differentiating (6) and (7) with respect to $Q_1$, $Q_2$, and $\bar{X}_{12}$, setting the results in $2 \times 2$ matrix form and using Cramer's Rule, we find $dQ_1/dX_{12} > 0$ and $dQ_2/dX_{12} < 0$. (See Adler and Stevens, 1974, 66 for a similar procedure.) Second, totally differentiating (6) with respect to $Q_1$ and $Y_1$ we find $dY_1/dQ_1 \gtrless 0$ as $MC_1' + MC_3' + r_{31}(2P_{31}' + Q_1P_{31}'') \lesseqgtr 0$. Since we assume the sum of the slopes of the cost curves is positive, $dY_1/dQ_1 < 0$. Therefore $dY_1/dX_{12} < 0$.

Canadian plastic imports from the U.S. division, the smaller the amount available for U.S. customers, ceteris paribus, and the higher the U.S. price and the transfer price. The tariff wedge is therefore a rising function of Canada's plastic imports.

The cost plus method bases $P$ on $AC_1$, the average cost of plastic produced by the U.S. division. Let us define $P = g(AC_1)$ and $P' = \partial g(AC_1)/\partial X_{12}$. Therefore $P' = \partial g(AC_1)/\partial Q_1 \cdot dQ_1/dX_{12} \gtrless 0$ as $AC_1' \gtrless 0$. That is, the larger the volume of Canadian plastic imports from the U.S. division, the larger is total output of the U.S. division, ceteris paribus, and the higher (lower) is the average U.S. production cost and transfer price of plastic, assuming increasing (decreasing) U.S. costs. The tariff wedge is therefore an increasing (decreasing) function of plastic imports as average U.S. costs rise (fall). Similarly, if the cost plus method is applied to primary oil imports by the Canadian division from the Mexican division, $P = h(AC_3)$ and $P' = \partial h(AC_3)/\partial X_{32}$, so that $P' = \partial h(AC_3)/\partial Q_3 \cdot dQ_3/dX_{32} \gtrless 0$ as $AC_3' \gtrless 0$.

The GATT code defines the transfer value principle (TV) in article 1.1 as 'the price actually paid or payable for goods, when sold for export to the country of importation,' provided the relationship between the trading parties does not affect the price. If customs authorities believe the transfer price was affected by the relationship, two of the four possible test values that can be used to justify the transfer price apply to our model:

1. the resale value method (RV), the price at which the imports after processing are sold to unrelated buyers in the importing country net of value added, transport and tariff costs; and
2. the computed value method, the sum of the exporter's production costs, profits and expenses on the intrafirm trade.

The GATT Code specifically prohibits the use of FMV, because it is based on the price of goods in the exporter's domestic market and relies on data from the exporting country. Since TV is defined as the actual price paid for imports, this valuation method does not force the transfer price for either primary or secondary imports to be related to either $Q_i$ or $Y_i$. Thus $P' = 0$ and TV can be considered as fixed transfer pricing policy.

When TV is not available, the MNE can use the resale value method which bases $P$ on the price the Canadian division charges its customers for plastic, $AR_2$. We define as $P = (1 - \alpha)AR_2 - rP$ where $\alpha$ represents the mark-up for value added and non-tariff costs. Therefore, for secondary imports of $X_{12}$, $P = (1 - \alpha/1 + r)AR_2$ or $P = k(AR_2)$ and $P' = \partial k(AR_2)/\partial X_{12}$. Thus, $P' = \partial k(AR_2)/\partial Y_2 \cdot dY_2/dX_{12} < 0$. That is, the larger the volume of plastic imported from the U.S. division, the larger are Canadian sales of plastic, ceteris paribus, and the lower are the Canadian consumer price and the transfer price. Therefore the RV method forces the tariff wedge to fall as plastic imports increase. Similarly for primary imports of $X_{32}$ the resale value formula is again based on $AR_2$, but $P'$ becomes $\partial k(AR_2)/\partial Y_2 \cdot dY_2/dQ_2 < 0$. The resale value method for primary and secondary imports can therefore be classified as a $P' < 0$ policy.[8] And lastly, the third method – the computed value method – bases valuation

8 The United States also had a special tariff regulation causing $P' < 0$ which has been eliminated under the new GATT procedures. This was the American Selling Price basis of valuation for certain chemical imports where the basis for tariff valuation was the price prevailing in the U.S. market (which was

on $AC_1$ for secondary imports and on $AC_3$ for primary imports and generates $P' \gtrless 0$ as $AC_1' \gtrless 0$ $(i = 1, 3)$.

In summary, there are three general valuation methods for both primary and secondary imports:

1. $P' > 0$ (FMV and cost plus or computed value for $AC_i' > 0$),
2. $P' = 0$ (TV and cost plus or computed value for $AC_i' = 0$), and
3. $P' < 0$ (RV and cost plus or computed value for $AC_i' < 0$).

We can use this classification to predict the effects of changing tariff barriers on MNE trade, output, and tariff costs. Although actual customs valuations will never vary perfectly with changes in $X_{ij}$, a comparison of fixed transfer prices with smoothly continuous price changes may yield some useful insights into how valuation methods differ. We can then assess the effectiveness of the current and new GATT tariff regulations in each case. Let us now turn to a discussion of MNE behaviour under tariffs to see how this behaviour is affected by the customs valuation method. In the following section the impact of substituting one method for another under given tariff rates is discussed, while the fifth section explains the effects on trade of changing tariff rates for different methods.

## CHANGING THE CUSTOMS VALUATION METHOD

In this section we address the question: for given tariff rates what is the effect on intrafirm trade of substituting one valuation method for another? Since different methods yield different values for $P'$ the tariff wedges and the resulting trade flows will also differ. Let us first compare TV ($P' = 0$) with FMV ($P' > 0$) and then with RV ($P' < 0$). Let us call the TV wedge, $W^T = rP^T$, and the corresponding volume of trade, $X^T$. Let the FMV wedge be $W^F = r(P^F + XP')$ and its volume of trade, $X^F$, and similarly define $W^R = r(P^R + XP')$ and $X^R$.[9]

In terms of secondary trade in $X_{12}$, $W_{12} = r_{12}(P_{12} + X_{12}P_{12}')$ and $dW_{12}/dX_{12} = MR_1' + MR_2' < 0$ by totally differentiating (8).[10] We could therefore plot a downward sloping curve in $W_{12} - X_{12}$ space along which (8) was satisfied. This curve, the

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generally higher than the price the exporters charged and therefore afforded more protection to U.S. chemical industry). The ASP method would mean $P = k(AR_2)$ and $P' < 0$.

9 Since the cost plus and computed value methods yield $P' \gtrless 0$ as $AC_i' \gtrless 0$, we do not explicitly discuss their effects in the rest of the paper. The results, however, are easily determined, since FMV also represents the increasing cost case, as TV represents constant costs and RV decreasing costs.

10 Totally differentiating (8) with respect to $X_{12}$ and $r_{12}$, we have

$$[MR_1' + MR_2' - r_{12}\partial(P_{12} + X_{12}P_{12}')/\partial X_{12}]dX_{12} - [P_{12} + X_{12}P_{12}']dr_{12} = 0,$$

or, rearranging,

$$MR_1' + MR_2' = (P_{12} + X_{12}P_{12}')dr_{12}/dX_{12} + r_{12}\partial(P_{12} + X_{12}P_{12}')/\partial X_{12}.$$

But

$$dW_{12}/dX_{12} = (P_{12} + X_{12}P_{12}')\partial r_{12}/\partial X_{12} + r_{12}\partial(P_{12} + X_{12}P_{12}')/\partial X_{12}.$$

Therefore $dW_{12}/dX_{12} = MR_1' + MR_2' < 0$. Using a similar procedure we can prove

$$dW_{3i}/dX_{3i} = MR_i' - MC_i' - MC_3' < 0 \quad (i = 1, 2).$$

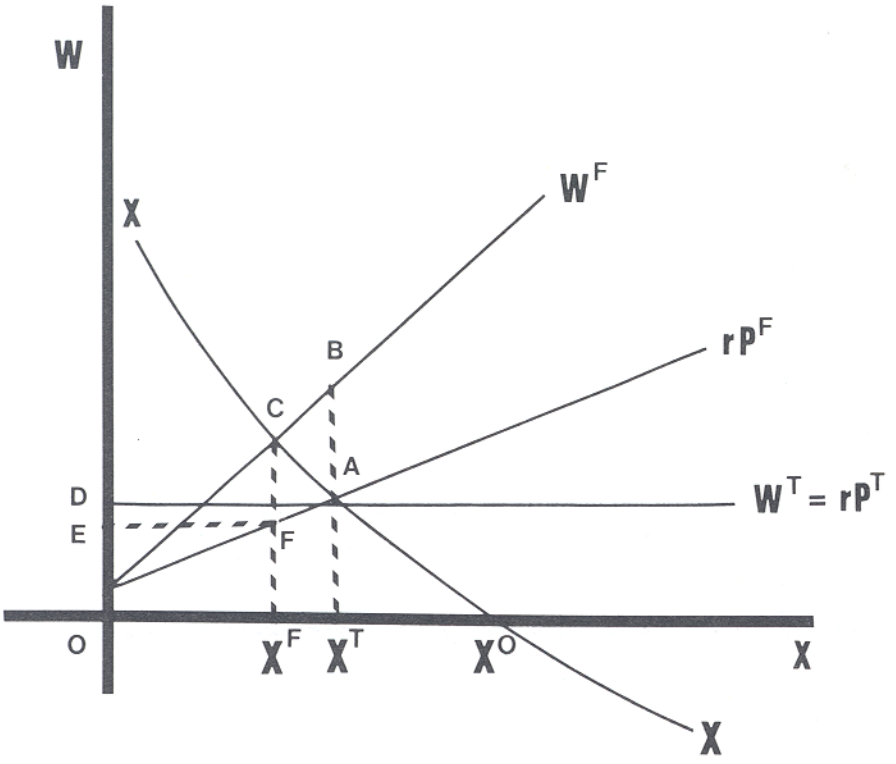


FIGURE 1 Comparison of TV and FMV for a given tariff rate

$X_{12}X_{12}$ curve, would show the equilibrium level of $X_{12}$ corresponding to each $W_{12}$. Where $W_{12} = 0$, the curve would cross the horizontal axis at the free-trade level of imports $X_{12}{}^0$. Where $W_{12} > 0$, $X_{12} < X_{12}{}^0$ and where $W_{12} < 0$, $X_{12} > X_{12}{}^0$. Points to the left (right) of the $X_{12}X_{12}$ curve would be disequilibrium points, because the MNE could expand profits by increasing (decreasing) $X_{12}$ for a given $W_{12}$ so as to satisfy (8).

In terms of primary trade in $X_{31}$, $W_{31} = r_{31}(P_{31} + X_{31}P_{31}')$ and $dW_{31}/dX_{31} < 0$ by totally differentiating (6). We could therefore construct a downward sloping market equilibrium curve in $W_{31} - X_{31}$ space along which (6) was satisfied, which would have similar properties to the $X_{12}X_{12}$ curve. And lastly, trade in $X_{32}$ would also generate a downward sloping $W_{32} - X_{32}$ curve along which (7) was satisfied, since $dW_{32}/dX_{32} < 0$, totally differentiating (7). That is, for both primary and secondary trade $dW/dX < 0$. Let us therefore construct a downward sloping $XX$ curve in general $W - X$ space along which equilibrium in the $X$ market is satisfied. The analysis in this section and in the next is therefore based on the general $W - X$ relationship and applies to both primary and secondary trade flows.

Figure 1 plots a market equilibrium $XX$ curve in $W - X$ space. Crossing it at point $A$ is the $W^T$ curve, which shows the average (and marginal) transfer value initially

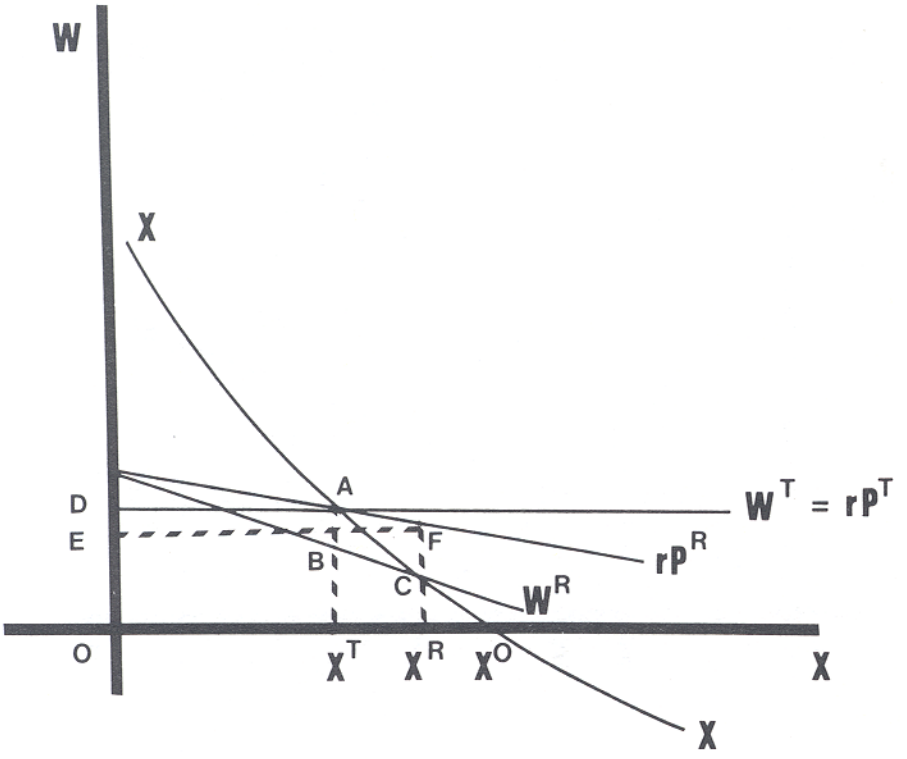


FIGURE 2 Comparison of TV and RV for a given tariff rate

acceptable to tariff authorities for each level of $X$. Given $W^T$, the MNE will maximize profits at point $A$ where the $W^T$ and $XX$ curves intersect. Now assume FMV is substituted for TV, holding tariff rates constant. Since $P' > 0$ the $rP^F$ and the $W^F$ curves slope upward and $W^F$ lies above $rP^F$. Initially we assume equal average valuations so $rP^T = rP^F$ at $X^T$. However, $W^F > W^T$ and $X$ therefore begins to fall. The new equilibrium occurs at point $C$ where the $W^F$ and $XX$ curves intersect. The FMV wedge is therefore larger, the volume of trade smaller ($X^F < X^T$) and total tariff revenues less ($OEFX^F < ODAX^T$).

Similarly in figure 2 we compare TV and RV for given tariff rates. Since $P' < 0$ under RV, both the $rP^R$ and $W^R$ curves slope downward and $W^R$ lies below $rP^R$. Assuming $rP^T = rP^R$ initially at $X^T$, $W^R < W^T$ and $X$ begins to expand. The new equilibrium occurs where the $W^R$ and $XX$ curves intersect. The RV wedge is therefore smaller, the volume of trade larger ($X^R > X^T$), and greater tariff revenues are generated ($OEFX^R > ODAX^T$ since $W^R > 0$ in practice).[11]

11 If $P + XP' \leq 0$, $W \leq 0$ and $dX/dr \geq 0$. A negative tariff wedge therefore implies that higher tariff rates cause trade to expand, a reversal of the standard predictions of trade theory. Since we assume $P > 0$, a negative wedge can arise only if $P' < 0$, that is, from the RV method or cost plus / computed

In summary, holding rates constant and assuming initially equal average valuations ($P^F = P^T = P^R$), we predict that $W^F > W^T > W^R$ and that the MNE therefore maximizes profits by choosing $X^F < X^T < X^R$. As a result, RV yields the largest tariff revenues while FMV yields the least.

## CHANGING THE TARIFF RATE

In this section we analyse a different question: what is the effect on intrafirm trade as the tariff rate changes assuming transfer prices are constrained by the customs valuation method; that is, what is the sign and size of $dX/dr$ for different methods?[12] In order to concentrate on the effects of changing $r$, we assume that marginal transfer prices are initially equal so that both policies yield the same $W$ and $X$ before $r$ is changed. Let us compare TV and FMV first and then TV and RV.

Suppose $W^T = W^F$ initially at some initial equilibrium level of trade $X^*$ (which is smaller than the free-trade level $X^0$, since $r > 0$). If $r$ increases, both tariff wedge curves shift upwards and the equilibrium level of $X$ (determined by the intersection of the $W$ and $XX$ curves) falls. In the TV case that is the end of the matter; under FMV, however, since $P' > 0$, as $X$ falls so does $P + XP'$. This dampens the decline in $X$ and in the new equilibrium $X^T < X^F < X^*$. Since now $rP^F < W^F < rP^T$, it is unclear which valuation method generates the larger tariff revenues. It is probably realistic to assume the percentage difference between the two per unit tariff costs exceeds the percentage difference in the trade volumes, since tariff costs are only one variable among many affecting trade flows. That is, assuming $E_r = \%\triangle X/\%\triangle rP < 1$, FMV yields smaller tariff revenues than TV as $r$ rises.[13] If $r$ falls instead of rises, one can similarly show that $X^T > X^F > X^*$. Since $rP^T > rP^F$ in the new equilibrium tariff revenues are larger under the TV principle.

Now let us compare the effects on $X$ of a rise in $r$ under TV and RV. Assume $W^T = W^R$ initially at $X^*$. As $r$ increases, both $W$ curves shift upwards and the equilibrium level of $X$ falls. However, as $X$ falls in the $P' < 0$ case, the marginal transfer price rises, causing a larger contraction in $X$. As a result, $X^R < X^T < X^*$. Since $rP^R > rP^T$, assuming $E_r < 1$, RV yields larger tariff revenues. If $r$ falls, in the new equilibrium $X^R > X^T > X^*$. Since $rP^R > rP^T$, RV again generates larger revenues.

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value method where $AC_i' < 0$. For intrafirm trade between oligopolistic MNE affiliates we can prove $W > 0$ under the RV method; however, we cannot rule out the $W \leq 0$ possibility in the other case. The proof is as follows for the RV method. If $P + XP' \leq 0$, then $-XP'/P \geq 1$. But $-XP'/P = -X/\partial X \cdot \partial Y_2/Y_2 \cdot Y_2/\partial Y_2 \cdot \partial P/P = E_{Y_2,X}/E_{Y_2,P}$. Since $E_{Y_2,P} = E_{Y_2,AR_2} > 1$ for profit-maximizing oligopolistic affiliates, and $0 \leq E_{Y_2,X} \leq 1$ then $0 < -XP'/P < 1$ and $P + XP' > 0$. In the limiting case where $Q_2 = 0$, $E_{Y_2,X} = 1$ so $-XP'/P = 1/E_{Y_2,AR_2}$, and $P + XP' = P(1 - 1/E_{Y_2,AR_2})$. Tariff revenues for $Q_2 = 0$ are therefore maximized when $E_{Y_2,AR_2} = 1$. (See also Katrak, 1977.)

12 The results in this section were derived assuming $P = f(X)$. Identical results can also be derived for each customs valuation method separately by adding a Lagrangian profit function where $\lambda_i(\cdot)$ has four variations: (1) TV method $\lambda_1(P - P^T)$, FMV method $\lambda_2[P - f(AR_1)]$, cost plus method $\lambda_3[P - g(AC_1)]$, and RV method $\lambda_4[P - h(AR_2)]$. Solving for the first-order conditions, totally differentiating and using Cramer's Rule we reach the same conclusions as those assuming $P = f(X)$. These proofs are available from the author on request.

13 Note that $E_r$ differs from $E_X$, the elasticity of the $XX$ curve which is $\%\triangle W/\%\triangle X$. As $r$ rises, total tariff revenues rise or fall as $E_X \lesseqgtr 1$.

In summary, assuming initially equal tariff wedges ($W^F = W^T = W^R$) at $X^*$, as $r$ rises, $X$ falls, since $dX/dr < 0$. In the new equilibrium $X^R < X^T < X^F < X^*$. As $r$ falls, trade expands and $X^R > X^T > X^F > X^*$. The movements in $X$ in response to a change in $r$ therefore are dampened under FMV because $P' > 0$, while the RV method accentuates these changes, since $P' < 0$. However, RV yields the largest revenues while FMV yields the smallest, whether $r$ rises or falls, assuming $E_r < 1$.

## THE GOALS OF TARIFF POLICY

When a government levies a tariff, it has three goals in mind: reducing imports, raising revenue, and protecting domestic industry. When tariffs are levied on intrafirm trade, the customs authorities can select the customs valuation method as well as the tariff rates. In this section we determine which method best achieves these goals for given tariff rates and as rates change. Summarizing the analysis in the fourth and fifth sections, we assert the following propositions concerning the first two goals (assuming $E_r < 1$ in all cases):

PROPOSITION 5: *For a given r, assuming initially equal average transfer prices, FMV generates the smallest volume of primary or secondary imports; however, it raises the least tariff revenues.*

PROPOSITION 6: *As r increases, assuming initially equal marginal transfer prices, RV offers the largest contraction in primary or secondary imports and also raises the most tariff revenues.*

PROPOSITION 7: *As r falls, assuming initially equal marginal transfer prices, FMV yields the smallest expansion in primary or secondary imports; however, it offers the least revenue.*

PROPOSITION 8: *Therefore the most effective valuation method in terms of reducing imports for a given r or as r is falling is FMV, followed by TV and RV in that order. RV is most effective when tariff rates are rising and also generates the largest revenues in all three cases.*

Since Canada is both lowering tariff rates and shifting from FMV to TV, we conclude that the expansion in imports will be larger than that predicted on the basis of the drop in rates alone. The probable contraction in tariff revenues will, however, be smaller. Therefore the joint policy changes of lowering rates and moving from FMV to TV have conflicting effects on the goals of Canadian tariff policy.[14] The effects on

14 The goals of Canadian tariff policy, however, may be at odds with overall trade policy. If the goals of Canadian trade policy are to reduce international trade barriers and expose Canadian industry to international competition, clearly an ineffective tariff policy is desirable. Lower tariff rates should be accompanied by a shift to TV or RV, since these generate larger trade expansions than FMV does as $r$ falls. We assume here that the Canadian government, although it must lower tariff rates under the GATT agreement, still wants an effective tariff barrier (see Grey, 1981, chapt. 5). Note that we also assume lower tariff rates are not simply replaced by higher non-tariff barriers to trade.

Canadian MNE subsidiaries engaged in intrafirm secondary trade are clear, however: intrafirm primary and secondary imports increase and tariff costs decline slowly, if at all, as tariff rates fall.

The third goal of tariff policy – protecting import-competing industry – in our model applies only to output of the secondary affiliate, firm 2, since all primary inputs are assumed to be imported. As we saw in the second section, the Canadian tariff structure is most likely to offer positive net protection to secondary import-competing MNE affiliates if tariff rates are higher on secondary imports than on primary imports, secondary imports are more responsive than primary imports to changes in tariff rates, and secondary output is more responsive to changes in secondary imports than primary imports. Assuming positive net protection does exist, the impact of the secondary tariff dominates that of the primary tariff on domestic output of $Q_2$. Therefore we assert:

PROPOSITION 9: *For given tariff rates or as rates fall* FMV *offers the greatest protection to domestic import-competing secondary* MNE *affiliates, followed by* TV *and* RV*, respectively. As tariff rates increase* RV *is most protective, followed by* TV *and* FMV*, respectively.*

## A QUALIFICATION

The above propositions are based on the assumption that the MNE has no freedom to manipulate transfer prices under any customs valuation method and that changes from one method to another do not allow any flexibility in determining $P$. However, in practice, TV is likely to allow the MNE more freedom to manipulate $P$ than the other methods would. Under TV the authorities must accept the actual price paid as the official customs valuation, unless they can show that the relationship between the trading firms did affect the transfer price. If the MNE can adjust $P^T$ independently, but not $P^F$ or $P^R$, our earlier conclusions need re-examination.

Let us continue to assume the MNE prefers to choose as low a value for $P$ as possible. When TV is substituted for FMV, assuming $r$ is constant, the MNE therefore chooses a new lower bound $P^T$ and increases $X^T$, further expanding the gap between $X^T$ and $X^F$. Since $P^T < P^F$ and $X^T > X^F$, assuming $E_r < 1$, FMV yields larger tariff revenues. If the MNE can manipulate $P^T$ but not $P^F$ or $P^R$ in this manner, our earlier conclusion that $X^T > X^F$ is now stronger, while our conclusion about revenues is reversed.

As $r$ is lowered, assuming the MNE still chooses to minimize $P$, the change from FMV to TV again permits the MNE to reduce $P$. We therefore reach the same conclusions as above: $X^T > X^F$ but FMV yields larger revenues. On the other hand, if tariffs no longer dominate the tax differential (which we have implicitly assumed is zero until now), the MNE chooses a maximum value for $P$ and our conclusions are reversed. As Canadian tariff rates decline, this case becomes more likely. For import-competing subsidiaries, where the MNE selects a maximum value for $P$, we predict $X^T < X^F$, $Q_2{}^T > Q_2{}^F$ and, assuming $E_r < 1$, larger tariff revenues under TV than FMV.

In summary, if the transfer value principle allows the MNE more freedom to manipulate transfer prices, assuming tariff rates dominate, the multinational will reduce the acceptable lower bound for $P$, imports will expand, domestic secondary production will contract, and tariff revenues will decline. This freedom therefore further weakens Canadian tariff policy as a trade barrier.

## CONCLUSIONS

When international trade occurs between related firms, customs authorities have two tools that can be used to achieve the goals of tariff policy: tariff rates and the customs valuation method. These methods force certain transfer pricing policies, which may or may not be indirectly tied to the volume of imports, on the MNE with predictable effects on intrafirm trade, output, and tariff revenues. When falling tariff rates are accompanied by a shift in the valuation method, the impact on import-competing MNE affiliates can be significant.

This paper predicts that the current shift from FMV to TV by Canadian tariff authorities will accentuate the partial equilibrium effects on intrafirm trade and output of secondary import-competing MNE affiliates of the concurrent drop in Canadian tariff rates. Assuming positive net protection from the Canadian tariff structure, the expansion in imports and the fall in domestic production will be larger than one would predict on the basis of the drop in tariff rates alone. The probable drop in tariff revenues, however, will be smaller. To the extent that the MNE can manipulate transfer under the GATT transfer value principle, we predict that, assuming the tariff rate continues to dominate the tax differential, the effects on imports and domestic production will be stronger and the drop in tariff revenues larger. Since 40 per cent or more of Canadian imports are bought in markets where scope for transfer price manipulation exists, the shift from FMV to TV at the same time as tariff rates are falling will therefore weaken the effectiveness of the Canadian tariff structure as a trade barrier.

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