# WELFARE AND MARKET ACCESS EFFECTS OF PIECEMEAL TARIFF REFORM

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## ABSTRACT

In a situation where tariff reforms are being negotiated between two parties, one of which aims to raise its exports and the other aims to raise its welfare, tariff cuts must be in the interest of at least one party. It is possible for the interests of the two sides to conflict. Conflict is certain if the excess demand for exported goods does not respond to changes in the prices of imported goods. In this case, any policy which raises imports must also reduce welfare.

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# 1 Introduction

In recent years, much of the world has abandoned basically autarchic, anti-market policies and is now actively trying to join the multilateral trading system. At the same time, countries like the U.S., faced with large and persistent balance of trade deficits, are looking for ways to improve their market access and increase their exports. A basic requirement for joining the World Trade Organization or for membership in regional trading arrangements is likely to be significant tariff reductions. These tariff reductions are the end result of bilateral or multilateral negotiations with trading partners. For example, in negotiating China's entry into the World Trade Organization ($WTO$) the Economist reported[1]:

*"American and European negotiators had hoped the Chinese would present long awaited plans for opening their service industries to foreign competition. No such offer was made. Though the Chinese agreed months ago that foreigners should be able to sell their goods directly to Chinese customers, they have not yet guaranteed that importers will be allowed to set up distribution networks to get their wares to market."*

It is often the case that on one side of such negotiations, namely for the country making the tariff reforms, the goal is to make the reforms in a way that increases its welfare; on the other side of the negotiations, the goal is to improve market access. One object of this paper is to understand the extent to which the two objectives of raising welfare and raising imports are complementary when reforms which reduce tariffs are undertaken. If raising imports as a consequence of trade liberalization *must* reduce welfare, then one would expect considerable resistance by countries to open their markets. On the other hand, if liberalization which raises welfare also raises imports, there might be considerable scope for successful negotiations of the kind described above. This link between trade volume, welfare and liberalization has not, to our knowledge, been studied to date.

In a many good world, an obvious measure of market access is the value of imports at world prices. Another purpose of this paper is a better understanding of the effect of tariff reductions on the value of imports. This has

[1]See the article in The Economist titled "Stand Off" on August 16th 1997, page 56, column 1.

not been the focus of much previous work. In contrast, the welfare effect of tariff reductions has been studied for decades. J. Meade (1955), T. Bertrand and J. Vanek (1971), T. Hatta (1977), and P. LIoyd (1974) provide the early contributions.

In this paper we restrict ourselves to the small country case throughout. In this scenario, we have a number of new results to offer. First, we show that if tariff reductions are uniformly proportional to a *modified* domestic price, denoted by $\overline{P}$, then the value of imports must increase. Second, we show that if all goods are substitutes, then a reduction of the *lowest* ad-valorem tariff increases the value of imports. Third, we show that if welfare falls due to a reduction in tariffs, then the value of imports must increase; if the value of imports falls due to a reduction in tariffs, then welfare must increase. Lastly, we show that if excess demand for exportable goods is completely unresponsive to price changes of importable goods, then welfare improves due to tariff reductions *if and only if* the value of imports is reduced. In this case, attempts to open markets are likely to be resisted.

The paper is organized as follows. In Section 2, we provide some intuition about welfare and market access effects of trade reform in a many commodity world. We show how these effects differ when goods are substitutes and when they are complements and focus on the linkage effects across markets. We use a partial equilibrium setup to build some intuition to begin with. In Section 3, we develop the general equilibrium version and study the market access effects of tariff reductions as well as the relationship between welfare effects and market access effects. Section 4 contains some concluding remarks.

# 2 Partial Equilibrium Intuition

In this section we develop a simple partial equilibrium model where markets are linked so that reform in one market impacts on all other markets. This helps build intuition about the linkages in the background which drive the results in this area. We look at final and intermediate good linkages as the intuition behind our results is most transparent in this framework.

Assume that there are three goods. A final good $x$ and an intermediate good $z$ in addition to a numeraire consumption good. The pattern of trade is such that the country imports the final and intermediate goods. Of course, the numeraire good is exported by it so that trade balances. We make the small country assumption so that world prices are given. The world price

for $j \in \{x, z\}$ is denoted by $p_j^w$. The country has tariffs on $x$ and $z$. These are assumed to be ad valorem tariffs for concreteness. The tariffs on $x$ and $z$ prior to reform are denoted by $t^{i0}$ for $i \in \{x, z\}$. Hence, the domestic price of $i$ before the reform, $p^{i0}$, is given by $p^{i0} = p^{iw}(1+ t^{i0})$ .

Demand for the final good in the country arises from utility maximization of a representative consumer. The representative consumer has a utility function given by:

$$U(x) + n. \tag{1}$$

He maximizes utility subject to the budget constraint:

$$p_x x + n = L + \Pi_x + \Pi_z + t_x p_x^w M_x + t_z p_z^w M_z \tag{2}$$

where $\Pi_x$ and $\Pi_z$ denote profits made in the final and intermediate good industries respectively, and $t_x p_x^w M_x$ and $t_z p_z^w M_z$ give tariff revenue. $L$ denotes any other lump sum income and is set at zero from here on. As usual, the representative consumer obtains the surplus of the government and profits of the firms in the country as lump sum income.

The inverse demand for the final good is defined by:

$$U'(x) = p_x. \tag{3}$$

Let the corresponding demand for $x$ be denoted by $D_x(p_x)$. The production function for $x$ is given by:

$$F(z, k) = x \tag{4}$$

where $F$ is a constant returns to scale production function and $k$ is a fixed factor of production. Let $z(p_x,\ p_z)$ be the solution to the maximization problem:

$$\underset{z}{Max}\ \Pi_x(z) = p_x F(z, k) - p_z z. \tag{5}$$

and let $R(p_x, p_z)$ be the value function for this problem[2]. Note that $z(p_x,\ p_z)$ is the derived demand for the input. Thus, it equates the marginal value product of $z$ to its price. As such $z(\cdot)$ is increasing in $p_x$ and decreasing in $p_z$. $F(z(p_x, p_z), k) = x(p_x, p_z)$ is the supply of the final good. Finally, define $S_z(p_z)$ to be the domestic supply of $z$. Imports of $z$, $M_z(p_x, p_z)$, and those of $x$, $M_x(p_x, p_z)$, are given by:

$$M_z(p_x, p_z) = z(p_x, p_z) - S_z(p_z). \tag{6}$$

[2]Note that R(.) is HD1 and convex in its arguments. All the usual duality and homogeniety results associated with such problems are used below. Let the subscripts on $R(\cdot)$ denote partial derivatives.

and

$$M_x(p_x, p_z) = D_x(p_x) - x(p_x, p_z). \tag{7}$$

Now we are in a position to illustrate the effects of trade reform and how the linkages between markets operate[3]. Panel $A$ of Figure 1 depicts the effects of a reduction in the tariff on the final good, so that its domestic price falls from $p_x^{A0}$ to $p_x^{A1}$. Panel $B$ on the left side of Figure 1 depicts the effect of a reduction in the intermediate good tariff so that the domestic price of the intermediate good falls from $p_z^{B0}$ to $p_z^{B1}$. The upper set of figures depict the situation in the final good market, while the lower ones depict that in the intermediate good market.

In Figure $1A$ the effect of reducing the tariff on $x$ is twofold. First, the fall in the price of $x$ from $p_x^{A0}$ to $p_x^{B0}$ reduces quantity supplied and increases quantity demanded, *raising imports.* This is what we call the *trade creation effect.* Second, the reduction in supply caused by the fall in the price of $x$ shifts the derived demand for $z$ inwards as shown in the lower left panel. This we call the *derived demand effect* and it *reduces imports* of $z$.

In Figure $1B$ the reduction in the domestic price of the intermediate good causes two effects. First there is the *trade creation effect* in the intermediate good market as the price has fallen to $p_z^{B1}$. Quantity supplied falls and quantity demanded rises, and imports of $z$ rise. In addition, the fall in the input price shifts out the supply of the final good as depicted in the upper right hand figure. Thus *imports fall* due to this *input price effect*[4]. Note that the trade creation effects raise imports, while the derived demand and input price effects reduce them[5]. The net effect is ambiguous in general. However, we show below that reducing all tariffs in a particular manner, or reducing the lowest tariff when the good with the lowest tariff is a net substitute for all other goods, both raise the value of imports.

We turn next to the welfare effects of trade reform. Substituting (2) into (1) gives the welfare of country $i$ to be:

$$W(p_x, p_z) \;=\; CS_x(p_x) + R(p_x, p_z) + \Pi_z(p_z)$$

[3]For an algebraic demonstration of the results outlined in this section see Ju and Krishna (1996).

[4]Similar results also go through with many final goods, each using an intermediate input, in an obvious manner.

[5]Similar linkage effects occur between final goods. If final goods are complements, a reduction in the price of one good shifts out the demand for the other and raises imports in the linked market. If goods are substitutes, the opposite occurs and imports in the linked market fall.

$$+t_x p_x^w M_x(p_x, p_z) + t_z p_z^w M_z(p_x, p_z) \tag{8}$$

where $CS_x(p_x)$ stands for consumer surplus from good $x$. Consider the effect on welfare of a reduction in the tariff on the final good. In Figure 1, ($IA$ and $IIA$) the change in consumer surplus from this reform is given by the area $\{p_x^{A0} f p_x^{A1} e\}$, while the change in profits in the final good industry is given by $\{-p_x^{A0} c p_x^{A1} h\}$ as profits in the final good industry fall, while the change in tariff revenue from the final goods market is given by $\{hage - cbfd\}$. The sum of these areas gives the welfare improvement due to the trade creation effect and equals the area $\{hcab + fedg\}$. In addition, there is a fall in tariff revenue from the intermediate good market due to the derived demand effect and this is given by the area $\{-jkvl\}$. The *net* effect on welfare is the sum of these areas. Hence the net welfare consequences of the tariff cut are given by the area $\{hcab + fedg - juvl\}$. Note that *the trade creation effect, area* $hcab + fedg$*, results in a welfare improvement, while the derived demand effect, area* $\{-juvl\}$*, reduces welfare.*

Similarly, consider the effect of liberalization in the intermediate good market. The area $\{PRp_z^{B0} p_z^{B1}\}$ is the change in profits in the final goods market due to liberalization in the intermediate good market[6]. The change in profits in the $z$ market is $\{-p_z^{B0} p_z^{B1} LM\}$, the area between the price and the supply curve gives profits. In addition, the change in tariff revenue in the $z$ market is given by $MRSU - LPVT = MNSV + QRTU - LPNQ$.[7] Simplifying these terms shows that the area $\{PRp_z^{B0} p_z^{B1}\} - \{p_z^{B0} p_z^{B1} LM\} + \{MNSV + QRTU - LPNQ\} = SVLM + TURP$. Hence the *trade creation effect results in a welfare improvement.*

In addition, as the input price effect shifts out the supply of the final good, tariff revenue from the final goods markets falls by the area $\{ABCD - EFBD\} = -EAFC$. Hence, *the input price effect reduces welfare.* Once

[6]Recall that $R_2(p_x, p_z) = -z(p_x, p_z)$, so that the change in profit equals

$$\int_{p_z^0}^{p_z^1} R_2(p_x, p_z) dp_z = \int_{p_z^1}^{p_z^0} z(p_x, p_z) dp_z$$

which is the area $PRp_z^0 p_z^1$. In other words, the value of output of $x$ equals the area under the demand for $z$ since this is just the marginal value product of $z$ in making $x$. This makes the change in profit in the $x$ market, revenue less cost of inputs, equal $PRp_z^{B0} p_z^{B1}$.

[7]Hence, the profits in the $x$ market show up as if they were consumer surplus in the $z$ market. Thus, the analysis here parallels that above where a final goods tariff was reduced.

again, the net effect on welfare is ambiguous. However, three insights can be derived from the analysis so far. First, if goods are substitutes in excess demand, as they are in this example, and the high tariff is reduced while the linked market has a low tariff, the negative welfare effect from the reduction of tariff revenue in the linked market is likely to be smaller than the welfare gain from trade creation so that such reforms are likely to raise welfare. This is of course the well understood intuition behind the famous concertina result. Second, if goods are net complements, the effect via the linked market on tariff revenue is positive[8]. Thus, reducing tariffs on goods which are complementary with the goods which have high tariffs and substitutable with the goods with the low tariffs is likely to raise welfare. Finally, reducing the tariff in linked markets will tend to reduce the tariff revenue loss from linkage effects while resulting in positive welfare effects via trade creation. For this reason proportional reductions in tariffs across the board would tend to raise welfare. This is, of course, the well known intuition behind the uniform proportional cuts ($UPC$) rule.

What about the relationship between the change in welfare and import value? This it turns out, is not ambiguous. We show below that if trade liberalization is undertaken, then the sum of the welfare and import value *must* rise. As a consequence, if the value of a country's imports falls when evaluated at world prices, then its welfare must rise. If its welfare falls, then the value of imports when evaluated at world prices must rise.

It is possible to see this diagrammatically. Note that the area $S_x^{A1}S_x^{A0}ch$ in Figure 1, (I-A) equals the area $D_z^{A0}D_z^{A1}vl$ in Figure 1, (II-A). $S_x^{A1}S_x^{A0}ch$ is the area under the marginal cost or supply curve and so it equals the change in total cost when the price of x changes from $p_x^{A0}$ to $p_x^{A1}$. As $z$ is the only variable input, this also equals the change in the value of demand for $z$ when price of $x$ changes from $p_x^{A0}$ to $p_x^{A1}$ which is given by the area $D_z^{A0}D_z^{A1}vl$ . Decomposing these two areas into their constituent parts gives us $abch + abS_x^{A1}S_x^{A0} = D_z^{A0}D_z^{A1}jk + jkvl$. Thus $abch - jkvl = -\{p_x^w(\ S_x^{A0} - S_x^{A1}) - p_z^w(D_z^{A0} - D_z^{A1})\}$. The right hand side term inside the brackets of course equals the change in the value of imports at world prices, ($\Delta V^*$) and the left hand side term equals the change in welfare, ($\Delta W$) if the demand for the final good is inelastic so that the area $dgef$ vanishes. Thus, $\Delta W = -\Delta V^*$.

Thus, there seems to be reason to expect that the sign of the change in

[8]Of course, not all goods can be complements for each other as excess demand is homogeneous of degree zero in prices and own price effects are negative.

welfare and that of the change in import value are related and that with inelastic demand, may actually be opposite in sign. This is what we turn to next. In what follows, we show that this result continues to hold in a general equilibrium setting. We also look at the effects of trade reform on import value.

# 3 A General Equilibrium Model

We now turn to general equilibrium analysis. Suppose there are $N$ goods in total[9]. Let $P^w = (p^{w1}, p^{w2}, \cdots p^{wN})$ and $P = (p^1, p^2, \cdots p^N)$ denote the world and domestic price vectors, respectively. The specific tariffs are denoted by the vector $T = (T^1, T^2, \cdots T^N)$. The equivalent ad valorem tariffs are given by the vector $t = (t^1, t^2, \cdots t^N)$. We treat all vectors as column vectors and denote transposes by a " $'$ ". Let $I_t$ denote the diagonal matrix with the element of $t$ along the diagonal. Hence:

$$P = P^w + T = P^w + I_t P^w. \tag{9}$$

## 3.1 The Model

Assuming that tariff revenue is redistributed among consumers in a lump-sum fashion, the budget constraint for the country can be written as:

$$E(P, U) = R(P, V) + T'M \tag{10}$$

where $E(.)$ is the standard expenditure function, $R(.)$ is the revenue function, $U$ is the utility level, $V$ is the fixed factor endowments vector. As usual $E(.)$ and $R(.)$ have all the standard properties. $E_p(.)$ and $R_p(.)$ are column vectors which represent the first partial derivatives of the expenditure and revenue functions with respect to domestic prices. Thus, $E_p(P, U) = C(P, U)$ is the demand vector, and $R_p(P, V) = X(P, V)$ is the supply vector. $M(.) = E_p(.) - R_p(.)$ is the net trade vector.

Let $I = (1, 2, \cdots, h)$ denote the set of imported goods and $J = (h + 1, \cdots, N)$ denote the set of exported goods. All goods are assumed to be traded for simplicity. The tariffs on exported goods are assumed to be zero.

[9]These could be final or intermediate goods. Intermediate goods enter the output vector as negative elements and pure intermediate goods enter the demand vector as zeros.

We will index a component or set of components in a vector by the use of a superscript. So the value of imports is

$$V = (P^{wI})' M^I. \tag{11}$$

The welfare and market access effects due to tariff reform can now be studied by examining $\frac{dW}{dT}$ and $\frac{dV}{dT}$ respectively[10].

### 3.1.1 Welfare

Totally differentiating the budget constraint (10), gives us:

$$\begin{aligned} E_p(.)'dP + E_u(.)dU &= R_p(.)'dP + M(.)'dT \\ &\quad + T'\left[E_{pp}(.)dP + E_{pu}(.)dU - R_{pp}dP\right] \end{aligned} \tag{12}$$

so that:

$$\left[E_u(.) - T'E_{pu}(.)\right] dU = -M(.)'dP^w + T'M_p(.)dP \tag{13}$$

where $M_p(.) = E_{pp}(.) - R_{pp}(.)$ is the first derivative matrix of $M(.)$. $E_u(.)$ is homogeneous of degree one in prices. This, together with the assumption that all goods are normal yields the result:

$$E_u(.) - T' E_{pu}(.) = P^{w'} E_{pu}(.) \geq 0$$

This result, along with the small country assumption and the assumption that there are no taxes or subsidies on exports allows us to rewrite (13) as:

$$\begin{aligned} P^{w'} E_{pu}(.)dU &= T'M_p(.)dP \\ &= T'M_p(.)dT. \end{aligned} \tag{14}$$

We now use the model to re-derive two basic theorems in piecemeal policy reform. We do so for the sake of being able to compare these results with

[10]Note however, that by separating the goods into imported goods and exported goods we are assuming that our policies will not cause a good to switch from one category to the other. For small changes and a discrete number of goods this is not a restrictive assumption as long as all imports and exports are strictly non negative and excess demand functions are continuous.

those on the effects of trade liberalization on import value. Let the matrix $M_p(.) = E_{pp}(.) - R_{pp}(.)$ have as its $ij$th element $m_j^i$, which is the derivative of the $i$th excess demand with respect to the $j$th price. Of course, $M_p(.)$ is symmetric. Let $M_p(.)$ be partitioned as follows.

$$\begin{aligned} M_p(.) &= \begin{bmatrix} m_1^1 & m_2^1 & \dots & m_h^1 & m_{h+1}^1 & \dots & m_n^1 \\ m_1^2 & m_2^2 & \dots & m_h^2 & m_{h+1}^2 & \dots & m_n^2 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ m_1^h & m_2^h & \dots & m_h^h & m_{h+1}^h & \dots & m_n^h \\ m_1^{h+1} & m_2^{h+1} & \dots & m_h^{h+1} & m_{h+1}^{h+1} & \dots & m_n^{h+1} \\ \vdots & \vdots & \dots & \vdots & \vdots & \vdots & \vdots \\ m_1^N & m_2^N & \dots & m_h^N & m_{h+1}^N & \dots & m_N^N \end{bmatrix} \\ &= \begin{bmatrix} M_p^{II} & M_p^{IJ} \\ M_p^{JI} & M_p^{JJ} \end{bmatrix} \\ &= \begin{bmatrix} M_p^I \\ M_p^J \end{bmatrix} \end{aligned}$$

where $M_p^{II}$ consists of the first $h$ rows and columns of $M_p(.)$ and $M_p^I$ consists of the first $h$ rows and all $N$ columns of $M_p(.)$. The corresponding vector $T^I$ and matrix $(\frac{dT}{T})^{II}$ are analogously defined. $(\frac{dT}{T})^{II}$ represents a $h \times h$ diagonal matrix with the $i^{th}$ component in the diagonal equal to $\frac{dt^i}{t^i}$ while $T^I$ denotes the $h \times 1$ vector of specific tariffs on imported goods.

Now when there are no taxes on exports as assumed here (14) can be rewritten as:

$$P^{w'} E_{pu}(.) dU = (T^I)' \left[M_p^{II}(.)\right] \left(\frac{dT}{T}\right)^{II} T^I \tag{15}$$

where $\left[M_p^{II}(.)\right]$ defined above is negative definite since $M_p(.)$ is negative definite. Thus, if $\frac{dt^i}{t^i} = \alpha < 0$ for all $i$, so that uniform proportional cuts in tariff occur, then welfare must rise as $(T^I)' \left[M_p^{II}(.)\right] \left(\frac{dT}{T}\right)^{II} T^I \geq 0$. This is the $UPC$ result.

Now note that if only one tariff, say that on good 1 changes then:

$$T' M_p(.) dT = p^{w1} dt^1 \sum_{i=1}^{N} t^i p^{wi} m_1^i \tag{16}$$

$$= p^{w1}dt^1 \sum_{i=1}^{N} t^i p^{wi} m_i^1 \tag{17}$$

$$= p^{w1}dt^1 \sum_{i=1}^{N} \frac{t^i}{1+t^i} p^i m_i^1 \tag{18}$$

where $m_i^1$ is the derivative of the imports of the first good with respect to the price of $i^{th}$ good. Because $m_i^1 = E_{i1}(.) - R_{i1}(.)$ is homogeneous of degree zero subject to prices, then $\sum_{i=1}^{N} p^i m_i^1 = 0$, which implies:

$$p^1 m_1^1 = -\sum_{i=2}^{N} p^i m_i^1 \tag{19}$$

Substituting (19) into (18) and recalling that $T = tP^w$ gives:

$$\begin{aligned} p^{w1}dt^1 \sum_{i=1}^{N} \frac{t^i}{1+t^i} p^i m_i^1 &= p^{w1}dt^1 \left[ \frac{t^1}{1+t^1} p^1 m_1^1 + \sum_{i=2}^{N} \frac{t^i}{1+t^i} p^i m_i^1 \right] \\ &= p^{w1}dt^1 \sum_{i=2}^{N} \left( \frac{t^i}{1+t^i} - \frac{t^1}{1+t^1} \right) p^i m_i^1 \\ &= p^{w1}dt^1 \sum_{i=2}^{N} \left( \frac{t^i - t^1}{(1+t^i)(1+t^1)} \right) p^i m_i^1. \end{aligned} \tag{20}$$

Assume that all goods are substitutes, that is, $m_i^1 \geq 0$ for $i \geq 2$. Then it is easy to see that if good 1 has the lowest tariff, then reducing the tariff on it must reduce welfare. Of course, if good 1 has the highest tariff, then reducing the tariff on it must raise welfare, which is the well known concertina result.

## 3.2 Import Value

Now we turn to the effect of reform on the value of imports. Totally differentiating (11) gives:

$$\begin{aligned} dV &= M^I(.)' dP^{wI} + (P^{wI})' M_p^I(.) dP + (P^{wI})' M_u^I dU \\ &= (P^{wI})' M_p^I(.) dT + (P^{wI})' E_{pu}^I dU \end{aligned} \tag{21}$$

in the small country case. From (14), we have:

$$dU = \frac{T' M_p(.) dT}{P^{w'} E_{pu}(.)}. \tag{22}$$

Since the tariffs on the exportable goods are zero, $T'M_p(.)dT = (T^I)'M_p^I(.)dT$. Let $\beta = \frac{\left(p^{wI}\right)'E_{pu}^I}{(P^w)'E_{pu}}$ and note that $0 < \beta < 1$ for normal goods. Substituting (22) into (21) gives:

$$\begin{aligned} dV &= \left(P^{wI} + \beta T^I\right)' M_p^I(.)dT \\ &= (\overline{P}^I)' M_p^{II}(.)dT^I \\ &= (\overline{P}^I)' M_p^{II}(.) \left(\frac{dT}{\overline{P}}\right)^I \overline{P}^I \end{aligned} \tag{23}$$

where $\overline{P} = P^w + \beta T = P^w(1+\beta t)$, $(\frac{dT}{\overline{P}})^I$is a $h \times h$ diagonal matrix with its $ith$ element along the diagonal equal to$\frac{dT^i}{\overline{p}^i}$. If $\frac{dT^i}{\overline{p}^i} = r \leq 0$ for all $i = 1, 2, \cdots h$, then the right hand of above equality is positive. Thus we have the following proposition which is analogous to the $UPC$ result for welfare changes.

**Proposition 1** *For the small country case, if the tariff reduction is such that* $\frac{dT^i}{\overline{p}^i} = r \leq 0$ *for all imported goods, then the value of imports must increase.*

What if only one tariff changes? We turn to this next to get a result analogous to the concertina result for welfare. From the above equation we see that:

$$\begin{aligned} dV &= p^{w1}dt^1 \sum_{i=1}^{h} \overline{p}^i m_i^1 = p^{w1}dt^1 \sum_{i=1}^{h} \frac{\overline{p}^i}{p^i} p^i m_i^1 \\ &= p^{w1}dt^1 \sum_{i=1}^{h} \frac{1+\beta t^i}{1+t^i} p^i m_i^1 \\ &= p^{w1}dt^1 \left[ -\frac{1+\beta t^1}{1+t^1} \sum_{i=2}^{N} p^i m_i^1 + \sum_{i=2}^{h} \frac{1+\beta t^i}{1+t^i} p^i m_i^1 \right] \\ &= p^{w1}dt^1 \left[ \sum_{i=2}^{h} \left( \frac{1+\beta t^i}{1+t^i} - \frac{1+\beta t^1}{1+t^1} \right) p^i m_i^1 - \sum_{j=h+1}^{N} \frac{1+\beta t^1}{1+t^1} p^j m_j^1 \right] \\ &= p^{w1}dt^1 \left[ \sum_{i=2}^{h} \left( \frac{(1-\beta)(t^1 - t^i)}{(1+t^i)(1+t^1)} \right) p^i m_i^1 - \sum_{j=h+1}^{N} \frac{1+\beta t^1}{1+t^1} p^j m_j^1 \right] \end{aligned} \tag{24}$$

If $t^1 \leq t^i$, $dt^1 < 0$, all goods are substitutes for the good with the lowest tariff so that $m_i^1 > 0$, and $dt^i = 0$ for all $i > 1$, then $dV > 0$. This gives us:

**Proposition 2** *For a small country, if all goods are substitutes for the good with the lowest tariff, then, a reduction in the lowest ad-valorem tariff increases the value of imports.*

Note that from (20), we can easily see that the reduction of the lowest tariff reduces the welfare. Therefore, if the lowest tariff is reduced, the effects on welfare and on the value of imports are in exactly opposite directions. On the other hand, if the highest tariff, (as in the concertina rule), is reduced, the first term inside the bracket in the right hand side of last equality above is positive and the second term is negative, so that the value of imports may rise or fall, while welfare rises. If exportable goods are not sensitive to changes in the price of importable goods[11], then the second term is likely to be small so that tariff reform along the lines of the concertina rule is likely to reduce the value of imports. This suggests that there may be a general relationship between imports and welfare.

## 3.3 Import Value and Welfare

We now turn to the general relationship between the welfare and market access effects. Note that given our small country assumption, equations (14) and (23) can be written as

$$P^{w'} E_{pu}(.)dU = (T^I)' M_p^I(.)dP \tag{25}$$

and

$$dV = (P^{wI})' M_p^I(.)dP + \beta (T^I)' M_p^I(.)dP. \tag{26}$$

Let

$$\begin{aligned} A &= (T^I)' M_p^I(.)dP + (P^{wI})' M_p^I(.)dP && (27)\\ &= (P^I)' M_p^I(.)dP && (28)\\ &= (P^I)' M_p^{II}(.)dP^I && (29)\\ &= \sum_{j=1}^{h} \sum_{i=1}^{h} p^j m_i^j dp^i \end{aligned}$$

[11] For many countries, importable goods and exportable goods belong to different industries. The cross price effects between them could be very small.

$$= \sum_{i=1}^{h} dp^i \sum_{j=1}^{h} p^j m_j^i$$
$$= \sum_{i=1}^{h} dT^i \sum_{j=h+1}^{N} \left(-p^j m_j^i\right),$$

where we have used the fact that $m^i$ is homogeneous of degree zero, and the small country assumption to get the last of the above equalities. If all goods are substitutes for each other, then $m_j^i \geq 0$ for $i \neq j$ so that $A \geq 0$ for any reform that reduces tariffs.

Substituting (27) into the equation (26), we have:

$$\begin{aligned} dV &= A - (1-\beta)(T^I)' M_p^I(.) dP \qquad (30) \\ &= A - \left[(1-\beta) P^{w'} E_{pu}(.)\right] dU \\ &= A - \left[P^{w'} E_{pu}(.) - P^{wI} E_{pu}^I(.)\right] dU. \end{aligned}$$

Note that when all goods are normal, $k = P^{w'} E_{pu}(.) - P^{wI} E_{pu}^I(.) > 0$. Thus:

$$dV + k dU = A > 0. \qquad (31)$$

From (31) it follows that if $dU \leq 0$, then $dV \geq 0$. If $dV \leq 0$, then $dU$ will be positive. If the exportable goods are perfect inelastic with respect to the prices of importable goods, then $A = 0$ so that $dV$ and $dU$ must have opposite signs. This gives:

**Proposition 3** *When all goods are normal, and are substitutes for each other in excess demand, and world prices are given, both welfare and the value of imports cannot fall in response to a reduction in tariffs. If welfare decreases due to such tariff reform, then the value of imports must increase; if the value of imports decreases due to such tariff reform, then welfare must increase. If the excess demand for exported goods does not respond to changes in the prices of imported goods, then the value of imports falls if and only if welfare rises due to such reform.*

# 4 Conclusion

Our results suggest that in a situation where tariff reforms are being negotiated between two parties, one of which aims to raise its exports and the

other aims to raise its welfare, tariff cuts must be in the interest of at least one party. The bad news is that it is possible for the interests of the two sides to be in conflict. Conflict is certain if the excess demand for the exported goods does not respond to changes in the prices of imported goods. In this case, any policy which raises imports will also reduce welfare.

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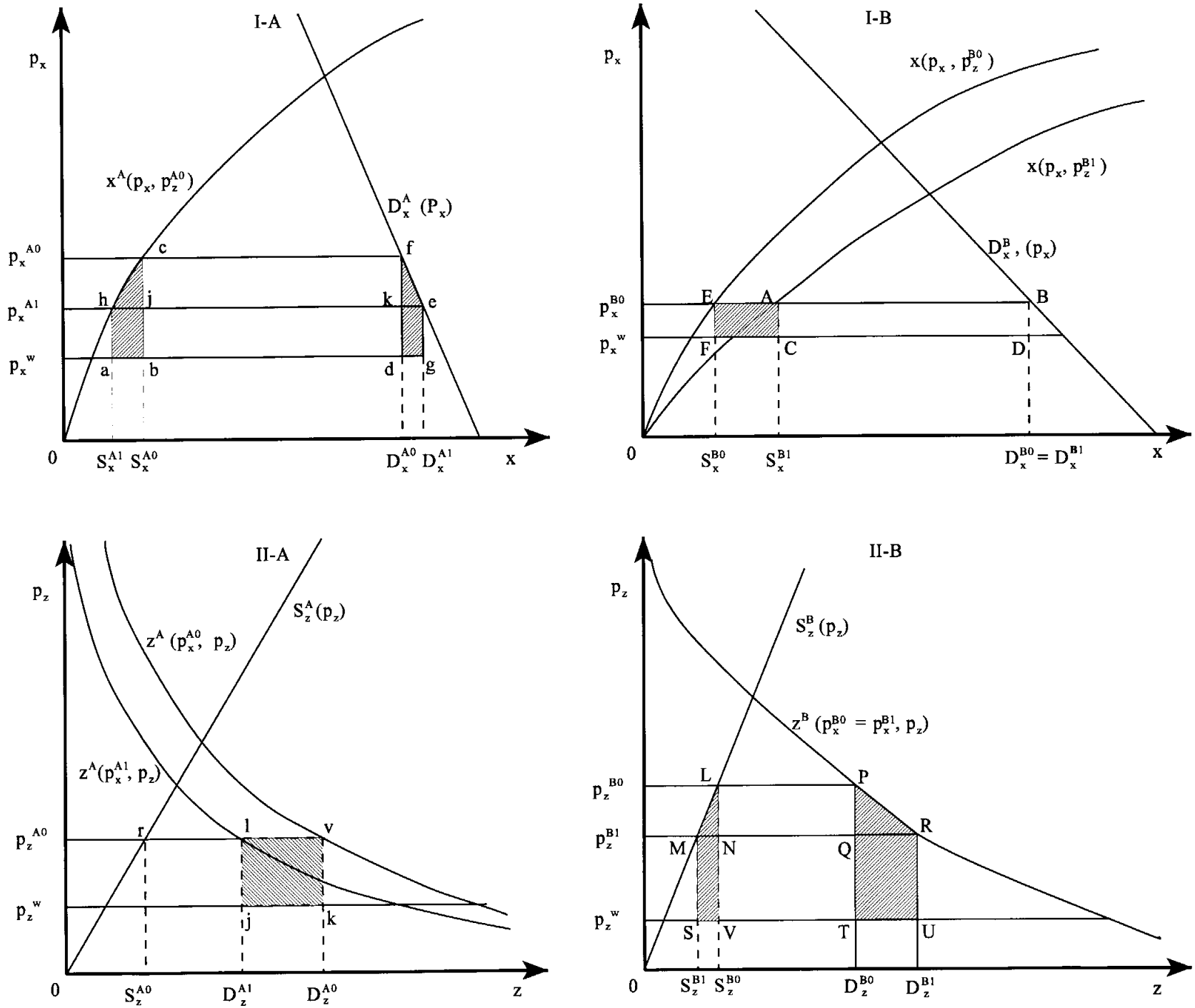
I-A
$p_x$
$x^A(p_x, p_z^{A0})$
$D_x^A(P_x)$
$p_x^{A0}$
$p_x^{A1}$
$p_x^w$
c
f
h
j
k
e
a
b
d
g
0
$S_x^{A1}$ $S_x^{A0}$
$D_x^{A0}$ $D_x^{A1}$
x
I-B
$p_x$
$x(p_x, p_z^{B0})$
$x(p_x, p_z^{B1})$
$D_x^B, (p_x)$
$p_x^{B0}$
$p_x^w$
E
A
B
F
C
D
0
$S_x^{B0}$
$S_x^{B1}$
$D_x^{B0} = D_x^{B1}$
x
II-A
$p_z$
$S_z^A(p_z)$
$z^A(p_x^{A0}, p_z)$
$z^A(p_x^{A1}, p_z)$
$p_z^{A0}$
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r
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0
$S_z^{A0}$
$D_z^{A1}$
$D_z^{A0}$
z
II-B
$p_z$
$S_z^B(p_z)$
$z^B(p_x^{B0} = p_x^{B1}, p_z)$
$p_z^{B0}$
$p_z^{B1}$
$p_z^w$
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P
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V
T
U
0
$S_z^{B1}$ $S_z^{B0}$
$D_z^{B0}$
$D_z^{B1}$
z

**Figure 1**