Input Tariffs and Duty Drawbacks in the Design of Tariff Reform

Arvind Panagariya

What is the combined effect on welfare of tariff reductions on final goods, small tariffs on inputs, and duty drawbacks on exports? What is the effect of a duty drawback in the presence of input tariffs?
In recent years, many developing countries have lowered tariffs on final goods to promote economic efficiency. This change produces a revenue loss. In countries with undeveloped domestic tax bases, the search for more revenue invariably leads to an increased tariff on inputs. As the initial tariffs on inputs tend to be low, this increase, complemented by duty drawbacks, is expected to improve welfare.

Panagariya systematically analyzes the welfare effects of tariffs on inputs combined with duty drawbacks. He concludes that:

- Tariffs on inputs, if unaccompanied by duty drawbacks on exports, have an ambiguous effect on welfare.

- In a two-good model, a tariff on inputs combined with a duty drawback on exports improves welfare. In a multi-good model, a small tariff on inputs, combined with a duty drawback on exports, improves welfare provided excess demand for imports is substitutable for exports that use the inputs.

- The effect of a large tariff on the input, combined with a duty drawback on exports, is ambiguous in a multi-good model but a case can be made for improved welfare. (The last two results are reinforced if tax revenue is held fixed.)

- Given tariffs on both inputs and final imports, introducing a small duty drawback improves welfare provided the final import is substitutable for the export good using the input.
Input Tariffs and Duty Drawbacks in the Design of Tariff Reform

by
Arvind Panagariya*

Table of Contents

1. A Simple Model with a Revenue Constraint 3
2. A Model with Two Exports 13
3. Two Final Imports 17
4. Domestic Production of the Input 18
5. Concluding Remarks 20
References 22

* I am grateful to Ramon Lopez and Vinod Thomas for helpful discussions and to Bela Balassa for useful comments.
Intermediate Inputs, Tariffs and Duty Drawbacks on Exports

by

Arvind Panagariya

In recent years, many developing countries have lowered tariffs on final goods to promote economic efficiency. These tariff reductions almost always lead to a loss of revenue. In countries where the domestic-tax base is well developed, the revenue loss can be offset by raising taxes on consumption, production or value added. But in countries where trade taxes are the major source of revenue and the domestic-tax base is not well developed, the search for additional revenue invariably points to increased tariffs on inputs. As the initial tariffs on inputs tend to be low, it is believed that an increase in them complemented by duty drawbacks on exports will be welfare improving.

A large body of literature exists now on the structure of optimal tariffs in the presence of a revenue constraint. We know from this literature that revenue-constrained optimal tariffs normally include tariffs/subsidies on inputs.\(^1\) But a detailed analysis of the effects of piecemeal, revenue-neutral changes in tariffs complemented by duty drawbacks on exports is still lacking.\(^2\) As this type of policy change is often recommended by the World Bank and adopted by many developing countries, a rigorous analysis of its effects on welfare is quite urgent.

---


\(^2\)The existing literature on piecemeal reforms does not consider the effects of changes in tariffs on inputs accompanied by duty drawbacks on exports. The seminal contributions on piecemeal tariff reforms are Bertrand and Vaneck (1971) and Bruno (1972).
In the present paper, I analyze systematically the welfare effects of raising tariffs on inputs, complemented by duty drawbacks on exports, in a small open economy. In Section 1, I begin with a simple model with two final goods and one imported input. The initial equilibrium is assumed to be characterized by a tariff on the final import but no other distortions. This model is extended successively in Sections 2-4 to allow for an additional exportable which does not use the input, an additional importable, and domestic production of the input. Throughout the paper, it is assumed that the imported input and value added (defined as a composite of primary factors of production) are used in fixed proportions. This assumption limits the scope of the validity of the results. Future work should generalize the analysis to allow for substitutability between value added and imported inputs.

The main findings of the paper may be summarized as follows. First, a tariff on the input unaccompanied by duty drawbacks on exports works like a production tax at different rates on goods using the input. The effect of such a tariff on welfare is ambiguous in general even if the tariffs on final imports are lowered so as to maintain a constant revenue. Second, a tariff on

---

3 I follow the trade theorists' tradition of assuming fixed factor endowments and do not consider the issues which arise from endogenous labor-leisure choice. The latter are central to the optimal taxation literature in public economics.

4 Introduction of substitutability between the two types of inputs complicates the analysis considerably.

5 If the input is produced domestically, the tariff also has the effect of a production subsidy to its producers.
the input accompanied by a duty drawback on exports is equivalent to a production tax on the final import and a consumption tax on the export using the input. A small change of this type improves welfare unambiguously provided the export and import goods using the input are substitutes in both production and consumption. This result holds even if the policy change leads to a contraction of exportables not using the input. Finally, the effect of a large tariff on the input accompanied by a duty drawback on exports is ambiguous in general but a presumption can be established in favor of a favorable effect. The last two results are reinforced by the presence of a revenue constraint.

1. A Simple Model with a Revenue Constraint

Consider a small open economy producing two final goods, 1 and 2. Both goods use an intermediate input which is not produced at home. The production functions are similar to those frequently employed in the effective-protection literature. Thus, primary factors are first combined to produce value added which is, in turn, combined with the imported input to produce the final good. Formally, we have

\[ (1) \, V^i = F_i(k^i) \quad i = 1, 2 \]

\[ (2) \, X_i = \min.(V_i, M_i/a_i) \]

where \( V^i \) is value added, \( k^i \) is the vector of inputs, \( X_i \) is final output and \( M_i \) is the quantity of imported input in sector \( i \). Coefficient \( a_i \) denotes the input-output ratio in sector \( i \). \( F_i(.) \) is linear homogeneous in its arguments.

As noted earlier, our analysis will be restricted to a small country. Therefore, by appropriate choice of units, we can fix foreign prices of traded goods at unity. We also choose the units of value added in such a way that, as shown in equation (2), it takes 1 unit of \( V^i \) to produce 1 unit of \( X_i \). Under free trade, the zero-profit condition will imply
where $p_1^*$ denotes the price of value added under free trade.\(^6\)

Letting the ad valorem tariff on good 1 be $t$ and that on the imported input be $t_M$, domestic prices of the two goods may be written $1+t$ and $1+t_M$, respectively. The zero-profit conditions in the presence of tariffs imply

\[(4a) \quad p_{v1} = 1+t - (1+t_M)a_1\]
\[(4b) \quad p_{v2} = 1 - (1+t_M)a_2\]

where $p_{v1}$ stands for the price of value added in sector 1 ($i = 1, 2$) in the presence of tariffs.

From equations (3) and (4), it is easy to see that the effective rates of protection, as conventionally derived, may be written

\[(5a) \quad \tau_1 = \frac{p_{v1} - p_{v1}^*}{p_{v1}^*} = \frac{t - t_M a_1}{1 - a_1}\]
\[(5b) \quad \tau_2 = \frac{p_{v2} - p_{v2}^*}{p_{v2}^*} = \frac{t a_2}{1 - a_2}\]

An important general-equilibrium property of effective rates of protection (ERPs) emerges immediately from these equations. If the tariff on the input is sufficiently high to make $t - t_M a_1$ negative, both ERPs will be negative. But we know that effective protection cannot be negative on all goods. Thus, it is immediately clear that what matters is the relative effective protection as shown in equation (6) below.

\[\] \(^6\)Observe that the price of value added is influenced by the choice of units. Thus, if we choose units in such a way that it takes $v_i$ units of $V_i$ to produce 1 unit of good $i$, $p_{v_i}^*$ will equal $(1-a_i)/v_i$. None of the conclusions depend on the choice of units, however.
Good 1 will enjoy a positive effective protection provided $r_1 - r_2 > 0$.

Let us now proceed to a consideration of the equilibrium in the economy.

On the supply side, the economy's problem is to maximize GDP as given by

$$\text{GDP} = (l + t)X_1 + X_2 - a_1(l + t_m)X_1 + a_2(l + t_m)X_2$$

$$= [(l + t) - a_1(l + t_m)]F_1(k) + [1 - a_2(l + t_m)]F_2(k^2)$$

$$= p_{v1}F(k^1) + p_{v2}F(k^2)$$

In writing the second equality, I have made use of the fact that efficiency implies $X_i = V_i = F_i(k_i^1)$. Maximization of (7), given the full employment condition, yields GDP or revenue function

$$\text{GDP} = R(p_{v1}, p_{v2}) = R\left(1 + t - (l + t_m)a_1, 1 - (l + t_m)a_2\right)$$

where I have suppressed the factor-endowments vector for convenience. The partial derivative of $R(\cdot)$ with respect to $p_{v1}$ gives $V_i$ as a function of the prices of value added. As $X_i = F_i = V_i$, the partial derivatives also give equilibrium values of outputs of the two goods. $R(\cdot)$ has all the properties of a standard revenue function.

Demand side of the economy can be summarized in a standard expenditure function $E(l + t, l + t_m, u)$ where $u$ represents (social) utility. As usual, the partial derivatives of $E(\cdot)$ with respect to prices yield demands while that
with respect to $u$ gives the reciprocal of the marginal utility of income. In equilibrium, we have

$$ (9) \ E(1+t, 1; u) = R \left[ 1+t-a_1(1+tM), 1-a_2(1+tM) \right] + T $$

where $T$ is the tax revenue redistributed by the government. I assume that the government redistributes the entire tax revenue. Thus, we have

$$ (10) \ T = t(E_1 - R_1) + t_m(a_{11}R_1 + a_{12}R_2) $$

where $E_1$ is the first partial of $E(.)$ with respect to the first argument and represents the demand for good 1. Analogously, $R_i$ is the first partial of $R(.)$ with respect to the $i$th argument and represents the supply of good $i$.

The first term in equation (10) is the revenue raised from final-good imports and the second term is the revenue raised from input imports. (Recall that $E_1$ is the demand for good 1 and $R_i$ is the supply of good $i$.)

Equations (9) and (10) summarize the equilibrium in our economy. These equations have two endogenous variables: $u$ and one of $t, t_m$ and $T$. Initially, we will treat $t$ and $t_m$ as exogenous variables and study the effects of changes in $t_m$ on $u$ at constant $t$ (but changing $T$). Later we will fix $T$ and study the effects of changes in $t_m$ on $u$ (and implicitly $t$) at constant revenue.

Differentiating (9) and (10) totally, we obtain

$$ (11) \ E_1 dt + E du = R \ dt - (a_{11}R_1 + a_{12}R_2) dt_m + dT $$

$$ (12) \ dT = (E_1 - R_1) dt + t \left[ E_1 du + (E_{11} - R_{11}) dt + (a_{11}R_1 + a_{12}R_2) dt_m \right] $$

$$+ (a_1R_1 + a_2R_2) dt_m + t_m \left[ \left( a_{11}R_1 + a_{12}R_2 \right) (dt - a_1 dt_m) + a_2 (a_{11}R_1 + a_{12}R_2) dt_m \right] $$

We are first interested in looking at the effect of a change in $t_m$ on welfare, holding $t$ constant. Therefore, we set $dt = 0$ and solve (11) and (12) for
We have

\[ (13) \quad (E_u - tE_{1u}) \frac{du}{dt} = (t - a_1 \tau_1)(a_1 R_{11} + a_2 R_{12}) - a_2 R_{12} (a_1 R_{21} + a_2 R_{22}) \]

Making use of (3), (4) and (5) and the fact that the \( R_i(.) \) are homogeneous of degree 0 in the \( p_{vi} \), we can rewrite (13) as

\[ (13') \quad (E_u - tE_{1u}) \frac{du}{dt} = - \frac{p^*_{v1} p^*_{v2}}{p_{v1} p_{v2}} \left[ a_1 - a_2 (1 + t) \right] \left( \tau_1 - \tau_2 \right) R_{12} \]

The term in parentheses on the left side is necessarily positive due to linear homogeneity of \( E_u \) in prices. Moreover, \( R_{12} \) is the effect of an increase in the relative price of good 2 on the supply of good 1 and is negative. Therefore, we can derive the following conclusion.

**Proposition 1:** Assuming that the effect of the initial tariff structure is to protect good 1 (\( \tau_1 - \tau_2 > 0 \)), a small increase in the tariff on the intermediate input, holding the tariff on the final good constant, will improve welfare if and only if

\[ a_1/(1 + t) > a_2. \]

Intuitively given \( \tau_1 - \tau_2 > 0 \), output of good 1 is below the optimum. Any change which reduces the output of good 1 without generating a t. product distortion will be welfare improving. A tariff on the input is equivalent to a production tax (at different rates) on goods using that input. Therefore,

---

8 Considerable manipulation is required before transforming (13) into (13').

9 It may be noted that given our fixed coefficients technology, positive protection on value added as measured by \( \tau_1 - \tau_2 \) also implies positive protection to final output. This result will not hold in general when substitution is allowed between primary and imported inputs.
welfare will improve or worsen as the increase in the tariff implies a higher or lower ad valorem production tax on good 1 than on good 2. Letting $\Delta t_ M$ be the increase in the tariff rate, the increase in the ad valorem production tax on good 1 will be $a_1 . \Delta t_ M/(1+t)$ and that on good 2 will be $a_2 . \Delta t_ M$\(^{10}\). The implicit production tax on good 1 will rise or fall as $a_1/(1+t)$ is higher or lower than $a_2$.

In general, the effect of the introduction of a tariff on the final good, holding the tariff on the final import constant, will be ambiguous. The important issue, however, is whether one can get an unambiguous improvement by reducing the tariff on the final good in such a way that the revenue stays constant. This is the issue I turn to next.

In order to obtain the effect of an increase in $t_ M$ at constant revenue, we set $dT = 0$ but let $t$ change endogenously in (11) and (12). After a number of manipulations, we can obtain

\[
(14) \quad [E'_u + \frac{tE_1 u}{\partial T/u}] \frac{du}{dt_ M} = \frac{1}{\partial T/\partial t} \left[ (R_{11} - E_{11}) ight.

\left. - R_{12} [a_1 - a_2 (1+t)] \left( \frac{t_ M}{p_{v_1}} + \frac{p^*_v p^*_v}{p_{v_1} p_{v_2}} (r_1 - r_2) \right) \right]
\]

where $\partial T/\partial t$ represents the effect of a change in $t$ on $T$, holding $t_ M$ and $u$ constant. Assuming that the initial tax rate is not in the Laffer range, this partial derivative will be positive. The first term in square brackets yields the effect of the reduction in the tariff on final imports and is

\[^{10}\text{Note that the price of good 1 facing producers in the domestic market is } 1+t.\]

Therefore, the per-unit increase in the production tax of $a_1 . \Delta t_ M$ translates into an ad valorem increase of $a_1 . \Delta t_ M/(1+t)$.
The second term captures the effect of an increase in the tariff on input and is ambiguous in general. As we have already seen, the direction of this effect depends on whether the implicit tax on good 1 is higher or lower than that on good 2. Thus, constancy of revenue weakens the condition for welfare improvement but does not guarantee the latter. We have

**Proposition 2.** At constant revenue, the effect of an increase in tariff on input will be ambiguous in general. A sufficient but not necessary condition for welfare to improve is that the implicit ad valorem production tax on the protected good be higher than that on the other good.

Finally, let us introduce a duty drawback on exports. The duty drawback by itself works like an export subsidy and raises the domestic price of the good above the world price. Like an export subsidy, the drawback creates an incentive to sell abroad rather than at home and puts pressure on the domestic price. In equilibrium, the domestic price must equal the subsidy inclusive world price; otherwise, the entire domestic output will be sold abroad.

Sometimes it is argued that since the exportable can be imported at the world price, the introduction of a duty drawback cannot lead to an increase in the domestic price. The problem with the argument is that if the exportable is imported freely at the world price, all domestic output of the good will be sold abroad and all domestically consumed quantity will be imported. As this makes the analysis meaningless, the standard practice in analyzing export subsidies is to assume that there are transport costs or import tariffs in the background which rule out the arbitrage between the world and domestic prices.

Formally, since the duty drawback is $a_t$ per unit of exports, the price

\[ E_{11} - R_{11} \]

represents the increase in imports due to a reduction in the tariff on good 1.
of exportables facing domestic consumers becomes \(1 + a_2 t_M\). The expenditure function is written \(E(l + t, 1 + a_2 t_M; u)\). On the production side, the zero-profit condition requires that the price of value added in exportables satisfy

\[ p v_2 + a_2 (l + t_M) = 1 + a_2 t_M \]

or

\[ p v_2 = 1 - a_2. \]

The revenue function is then written as \(R\left[l + t \cdot a_1 (l + t_M), 1 - a_2, 1\right]\).

In equilibrium, we have

\[
(15) \ E(l + t, 1 + a_2 t_M; u) = R\left[l + t \cdot a_1 (l + t_M), 1 - a_2\right] + T
\]

where \(T\) is net revenue given by

\[
(16) \ T = t(E_1 - R_1) + t_M (a R_1 + a_2 R_2) - a_2 t_M (R_2 - E_2)
\]

\[ = t(E_1 - R_1) + t_M (a R_1 + a_2 E_2) \]

Note that the last term in the first equality represents the duty drawback.

It is useful to note that the combined effect of a tariff on input and drawback on exports is equivalent to a production tax on the final import and a consumption tax on exportables. In equation (16), this fact is represented by the second term in the second equality. Thus, in addition to the revenue raised on final imports, \(T\) consists of a production tax on good 1 and a consumption tax on good 2 at rates \(a_1 t_M\) and \(a_2 t_M\) per-unit, respectively.\(^{12}\)

---

\(^{12}\) Intuitively, the tariff on the input implies a production tax of \(a_1 t_M\) per unit on good 1 and \(a_2 t_M\) per unit on good 2. The drawback is an export subsidy at rate \(a_2 t_M\) per unit on good 2 which raises the domestic price of that good to \(1 + a_2 t_M\). The two changes together (i.e., the duty drawback and the tariff on
Starting from an equilibrium characterized by a tariff on final imports only, we know that good 1 is overproduced and good 2 is overconsumed relative to the Pareto efficient outcome. As just noted, the combined effect of a tariff on input and a duty drawback on exports is equivalent to that of a production tax on good 1 and consumption tax on good 2. Both of these changes drive the economy towards the Pareto efficient equilibrium. Therefore, we can state

**Proposition 3:** Assuming that initial tariff structure is such that relative prices of the import good facing producers and consumers exceed the corresponding prices under free trade, an increase in tariff on input combined with duty drawback on exports is unambiguously welfare improving. This result is valid in the presence as well as absence of a revenue constraint.

Although the logic behind this result is quite clear, it is useful to derive a formal expression relating the change in utility to change in the tariff on input and duty drawback. This exercise is also helpful in setting up the stage for our analysis in the next section where we allow for an additional export good which does not use the imported input. As before, we differentiate totally equations (15) and (16). We have

\[(17) \ E_1 \frac{dt}{1} + a \ E_2 \frac{dt}{2} + E_2 \frac{du}{u} = R_1 (dt - a \ dt_1) + dT\]

\[(18) \ dT = \frac{\partial T}{\partial t_1} dt_1 + \frac{\partial T}{\partial t_2} dt_2 + \frac{\partial T}{\partial u} du\]

where

input facing producers of good 2) are equivalent to consumers paying the price $1+a_2 t_2 M$ and producers receiving 1 for the good.
(19a) \( \frac{\partial T}{\partial t} = E_1 + tE_{11} - R_1 - (t - a_1 M)R_{11} + a_2 t E_{21} \)

(19b) \( \frac{\partial T}{\partial t_M} = tE_{12} a_2 + a_1 R_1 + (t - a_1 M)R_{11} a_1 + a_2 E_2 + a_2 t E_{22} a_2 \)

(19c) \( \frac{\partial T}{\partial u} = tE_{1u} + a_2 t E_{2u} \)

Setting \( dt = 0 \), we can solve (17)-(19) for \( du/dt_M \). After a series of simplifications, we have

(20) \[ \left[ \frac{E_u - (tE_{1u} + a_2 t E_{2u})}{dt_M} \right] = a_2 \left[ (tE_{12} + a_2 t E_{22}) + a_1 (t - a_1 M)R_{11} \right] \]

This is our key equation for analyzing the welfare effect of a tariff on input combined with a duty drawback. The equation will be useful both here and in the next section where we introduce a second export good.

Remembering that the \( E_i(.) \) are homogeneous of degree 0 in prices, we can simplify (20) further to

(20') \[ \left[ \frac{E_u - (tE_{1u} + a_2 t E_{2u})}{dt_M} \right] = \frac{a_2 E_{22}}{1 + t} (t - a_1 M) + a_1 (t - a_1 M)R_{11} \]

Let us assume that \( t-a_1 t_M, t-a_1 t_1 > 0 \) at the initial equilibrium. The first of these inequalities implies that at the initial equilibrium, the relative price of good 1 facing consumers is higher than that under free trade.\(^{13} \)

Analogously, the second inequality implies that at the initial equilibrium the relative price of value added in sector 1 is higher than that under free trade. In equation (20'), the first term on the right-hand side captures the welfare effect due to a change in the allocation of consumer expenditure. Similarly, the second term captures the effect due to reallocation of resources in production. Given \( t-a_1 t_M, t-a_1 t_1 > 0 \) initially, both effects are positive and welfare must improve.

\(^{13} \)The two relative prices are \((1+t)/(1+a_2 t_M)\) and 1, respectively.
This result is strengthened if we introduce the revenue constraint. The reason is that ceteris paribus, an increase in $t_M$ is accompanied by an increase in revenue. Therefore, we can lower the tariff on the final import as we raise $t_M$. This reduction in the tariff will confer further gains on the economy. Thus, Proposition 3 is shown to be valid.

2. A Model with Two Exports

So far, it has been assumed that the country under consideration produces only two goods. This assumption makes the analysis simple due to the fact policies which expand exports also reduce imports. If there are more goods, however, this direct link is weakened in that expansion of exports of one commodity may come at the expense of exports of the other commodity. For instance, it is sometimes feared that the introduction of duty drawbacks on exports may lead to an expansion of export industries using imported inputs at the expense of other export industries which do not use these inputs. Under such circumstances, do the results derived in the previous section remain valid?

In order to answer this question, let us introduce another export good, good 3, which does not use the imported input. We will continue to assume that the imported input is used in fixed proportions in goods 1 and 2. We

---

14 Given our substitutability assumption, the increase in $t_M$ leads to a contraction of output and expansion of consumption of the importable. Both changes increase imports and hence revenue at the initial level of $t$.

15 For example, this is a concern expressed in the context of Chile. It is feared that a duty drawback there will benefit manufactures and may lead to a contraction of agricultural exports.
already know that the welfare effect of a tariff on the input is ambiguous. Therefore, henceforth, we will consider the effects of such a tariff only in conjunction with a duty drawback on exports. We will also consider the effects of duty drawbacks on exports in isolation assuming that a tariff on the input already exists.

For simplicity, I will assume that there are no taxes or subsidies on good 3. Continuing to let \( t \) and \( t_M \) denote the ad valorem tariff rates on good 1 and the imported input, the expenditure function may be written \( E(l+t, 1+a_2 t_M, 1; u) \), where the third argument represents the price of good 3 which is exported. Analogously, the revenue functions can be written as \( R\left(l+t-a_1(l+t_M), 1-a_2, 1\right) \). In equilibrium, we have

\[
E(l+t, 1+a_2 t_M, 1; u) = R\left(l+t-a_1(l+t_M), 1-a_2, 1\right) + T
\]

where \( T \) continues to be given by (16). Observe that except for an additional argument in \( E(.) \) and \( R(.) \), (21) is the same as (15).

The reader may verify that the welfare effect of an increase in \( t_M \) continues to be given by (20). The main difference is that (20') no longer follows from (20). The \( E_i(.) \) and \( R_i(.) \) have an additional argument now which invalidate the transformation (20').

In order to explain the effect of a rise in \( t_M \) in the present case, observe that the second term on the right-hand side of (20) is unambiguously positive as long as the initial structure of tariffs and duty drawbacks is such that the relative price of value added in sector 1 is higher than that under free trade. The first term on the right-hand side of (20) is ambiguous, however. Therefore, the effect of an increase in \( t_M \) on welfare is ambiguous in general although as shown below, a strong presumption in favor of improvement can be established.

Consider first the case when \( t_M = 0 \) initially. In this case, the term in
square brackets reduces to $t_{E_{21}}$ and, assuming that goods 1 and 2 are substitutes, the right-hand side becomes unambiguously positive. Thus, as long as goods 1 and 2 are substitutes, the introduction of a small tariff on inputs complemented by a duty drawback on exports is unambiguously welfare improving. Intuitively, with $t_m = 0$ initially, the only distortion in the economy is the tariff on good 1. The effect of this distortion is to cause good 1 to be overproduced and underconsumed relative to the Pareto efficient level. Substitutability between goods 1 and 2 ensures that the introduction of the tariff with duty drawback leads to a rise in the consumption and decline in the output of good 1. Both of these changes are welfare improving.

Now suppose that the initial equilibrium is characterized by a positive tariff on the input and a duty drawback. On the production side, the effect of a positive $t_m$ is to correct the distortion caused by the tariff on good 1 without a by product distortion. Therefore, a further increase in $t_m$ has a favorable effect as far as the production side of the economy is concerned (the second term in (20)). On the consumption side, the effect of the tariff on the input accompanied by a duty drawback is to create a wedge of $a t_m$ between the domestic and world price of good 2. In addition, the tariff on good 1 implies a wedge of $t$ between the domestic and world price of good 1. Assuming that goods 1 and 2 are substitutes, a further increase in $t_m$ will lower the consumption of good 2 and raise that of good 1. Given the initial distortions as just described, this change will confer a gain of $t$ per-unit expansion of consumption of good 1 and a loss of $t_m$ per-unit contraction of consumption of good 2. The net effect on the consumption side is positive or negative as $t_{E_{12}} + t M_{22}$ is positive or negative. In cases when the substitution effect is strong or the initial $t_m$ is small, the positive effect dominates.

We can now state
Proposition 4: Let there be two exportables of which only one uses the imported input. Assume that the final import good is subject to a tariff initially. In this setting, the introduction of a small tariff on the input accompanied by a duty drawback on exports is necessarily welfare improving. If the tariff on the input and duty drawback exist in the initial equilibrium, a small increase in them has an ambiguous effect in general but the presumption is in favor of a positive effect. These conclusions are strengthened by the presence of a revenue constraint.

A final issue to consider in the present section concerns the effect of a duty drawback on exports on welfare given that a tariff on the input already exists without a drawback. Letting $s$ denote the ad valorem rate of the drawback, our equilibrium condition in this case is written

$$(22) \quad E(l+t, 1+a_1 s, 1; u) = R(l+a_1 (1+t_m), l+a_2 (1+t_m-s), 1) + T$$

Observe that if $t_m = s$, this equation reduces to (21). But since we are assuming that the drawback is absent initially, we have $t_m > s = 0$. Equation (16) defining $T$ modifies to

$$(23) \quad T = t(E_{11} - R_1) + t_m (a_{11} R_1 + a_{22} R_2) - a_{2} s (R_2 - E_2)$$

As before, we can differentiate (22) and (23) with respect to $s$ and solve for $\frac{du}{ds}$. The final result is given by

$$(24) \quad \left[ E_u - (tE_{11} + a_2 sE_{22}) \right] \frac{du}{ds} = a_2 \left[ tE_{12} + a_2 sE_{22} \right] + a_2 \left[ a_{22} (t_m - s) \right] - (t - a_{12} t_m R_{12})$$

Assuming that goods 1 and 2 are substitutes in production and consumption (i.e., $R_{12} < 0$ and $E_{12} > 0$), this equation implies that the introduction of a
small duty drawback is unambiguously welfare improving. The drawback raises
the price of good 2 facing consumers which, in turn, increases the consumption
of good 1. As good 1 is subject to a tariff, this change is beneficial. On
the supply side, the drawback raises the output of good 2 and reduces that of
good 1. As good 2 is subject to a production tax \( t_M > 0 \) and good 1 is
protected \( t - a t_M > 0 \) initially, both of these changes are beneficial.

Assuming that a partial duty drawback exists initially \( t_M > s > 0 \), the
effect of an increase in the drawback is ambiguous in general. But since the
production effect is favorable and consumption effect is partially so if goods
1 and 2 are substitutes in production and consumption, the presumption is is
in favor of an improvement. We have

**Proposition 5:** Given tariffs on the final and intermediate
imports, the introduction of a small duty drawback on exports
is welfare improving as long as the good receiving the
drawback and the import are substitutes in consumption as well
as production. If a partial drawback exists in the initial
equilibrium, the effect of an increase in it on welfare is
ambiguous in general but the presumption is in favor of an
improvement. These results hold true when there are two
exportables of which only one uses the imported input.

### 3. Two Final Imports

Let us consider briefly the case when there are two final imports and one
export. Assume that goods 1 and 2 are imported while good 3 is exported. Ad
valorem tariffs on the two goods are denoted \( t_1 \) and \( t_2 \). The effect of an
increase in the tariff on the input accompanied by a duty drawback on exports
can be derived as before. In order to economize on space, I present here the
final result.

\[
\left[ \frac{\partial}{\partial t} - (t E_{1u} + t E_{2u} + a_3 t E_{3u}) \right] du = \frac{a_3}{l + a} \left[ (t_1 - a_3 t M) E_{31} + (t_2 - a_3 t M) E_{32} \right] \\
+ (t - a M) \left[ a R_{11} + a R_{12} \right] + (t - a M) \left[ a R_{21} + a R_{22} \right]
\]

Let us assume that the prices of goods 1 and 2 facing consumers at the initial equilibrium are higher than those prevailing in the world market \((t_i - a_3 t M > 0, i = 1, 2)\). Also assume that the prices of value added in the two sectors are higher at the initial equilibrium than those prevailing under free trade \((t_i - a_i t > 0, i = 1, 2)\). Given the first assumption, the first term on the right hand side will be positive provided the two goods are net substitutes with respect to the exportable. Given the second assumption, the second and third terms will also be positive provided the increase in \(t\) reduces value added in sectors 1 and 2, respectively. As both sets of conditions are plausible, we expect the increase in \(t\) to be welfare improving.

4. Domestic Production of the Input

In this section, I will demonstrate that the results derived in section 2 remain valid in the presence of domestic production of the input. To economize on space, I will consider only the case when the tariff on input is accompanied by a duty drawback on exports. The case when only the duty drawback is changed (with the tariff on the input given) can be handled similarly. Presence of domestic production of the input affects only the

\[\frac{\partial R_i}{\partial t} = -(a R_{11} + a R_{12}).\] The effect will be negative if and only if the term in parentheses is positive.
revenue function of the model. The equilibrium condition is given by

\begin{equation}
(26) \ E(1+t, 1+a_2 t_m, 1; u) = R\left(1+t-a_1(1+t_m), 1-a_2, 1, 1+t_m\right) + T
\end{equation}

where the first partial of R(.) with respect to the last argument gives the domestic output of the input. The revenue T is given by

\begin{equation}
(27) \ T = t(E_1 - R_1) + t_m(a_2 R_1 + a_2 R_2 - R_4) - a_2 t_m(R_2 - E_2)
\end{equation}

Differentiating (26) and (27) with respect to t_m and simplifying, we can obtain

\begin{equation}
(28) \ \left[E_u - (tE_{1u} + a_2 t M_{2u})\right] \frac{du}{dt_m} = a_2 \left[tE_{12} + a_2 t M_{22}\right] + a_1(t - a_1 t_m)R_{11}
\end{equation}

\begin{equation}
- \left(t - a_1 t_m\right)R_{14} + t_m(a R_{41} - R_{44})
\end{equation}

The right-hand side of this equation is the same as that of (20) except that it has two extra terms. The third term captures the indirect effect on the output of good 1 resulting from the change in the tariff on input. The fourth and last term represents the effect on welfare due to a change in the output of good 4, both directly because the price of the input rises and indirectly because the price of value added in sector 1 falls.

Setting t_m = 0 initially, we can see that welfare will rise as long as the goods are substitutes in both production and consumption. Intuitively,

\[17\] This indirect effect is in addition to the direct effect which results from the decline in the price of value added in sector 1 which is, in turn, induced by the rise in the tariff on the input.
the only initial distortion in this case is the tariff on the final import. Given the substitutability assumption just mentioned, the introduction of a small tariff on the input with duty drawback leads to a contraction of output and an expansion of consumption in sector 1. Both changes are welfare improving.

Given a positive $t_M$ initially, the effect of a rise in $t_M$ is ambiguous in general. The explanation of the result is similar to that of Proposition 4 except that we must now take into account the implications of input production as captured by the third and fourth terms in equation (27). Initially, the input price is above the world price. Therefore, a further increase in the tariff adds to this distortion as shown by the last term in (27). At the same time, to the extent that expansion of the input sector causes sector 1 to contract, there is a positive effect on welfare as shown by the third term in (27). Once again, unless the initial level of $t_M$ is already high, the presumption is that welfare will rise. Thus, we can state

**Proposition 6:** Proposition 4 remains valid in the presence of domestic production of the imported input except when the initial level of $t_M$ is high.

5. Concluding Remarks

The results of this paper have been summarized already in the various propositions. The general message of the paper is that given a tariff on final imports but no other distortions, introduction of tariffs on intermediate inputs complemented by duty drawbacks on exports is welfare improving. A sufficient but not necessary condition that guarantees this result is that the final import and the export good using the input be substitutes in consumption. The favorable effect is reinforced if the tariff on the input and drawback on exports are accompanied by a reduction in tariffs
on final imports in a way that revenue is held constant.

An important limitation of the present paper is that it is based on the simplifying assumption that the imported input and value added are used in fixed proportions. Realistically speaking, the two sets of inputs are likely to be substitutable. An important extension of the paper will be to incorporate this feature into the analysis.

In practice, we also need to pay attention to other distortions in the economy. For example, if the structure of distortions is such that the relative price of exportables using the imported input in the initial equilibrium is above that under free trade, duty drawbacks on exports can be harmful.

A final question of importance is that duty drawbacks on exports can be misused in practice. Thus, firms are likely to overstate the quantity of imported inputs used in exports and obtain more drawback than actually due. Although this problem deserves to be studied formally, my guess is that the qualitative results of this paper will not change in the presence of fake invoicing of input usage in exports. Moreover, fake usage can be policed by enforcement authorities.
References


Ramaswami, V. K. and T. N. Srinivasan, 1968, Optimal subsidies and taxes when some factors are traded, Journal of Political Economy 76, 569-582.
<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Date</th>
<th>Contact for paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection Facing Exports from Sub-Saharan Africa in the EEC, Japan, and the United States</td>
<td>Refik Erzan, Peter Svedberg</td>
<td>November 1989</td>
<td>G. Illogan 33732</td>
</tr>
<tr>
<td>Economic and Policy Determinants of Public Sector Deficits</td>
<td>Jorge Marshall, Klaus Schmidt-Hebbel</td>
<td>December 1989</td>
<td>S. Jonnakuty 37453</td>
</tr>
<tr>
<td>Earmarking Government Revenues: Does It Work?</td>
<td>William McCleary</td>
<td>December 1989</td>
<td>A. Bhalla 37699</td>
</tr>
<tr>
<td>Ethical Approaches to Family Planning in Africa</td>
<td>F. T. Sai, K. Newman</td>
<td>December 1989</td>
<td>S. Ainsworth 31091</td>
</tr>
<tr>
<td>Manufacturers' Responses to Infrastructure Deficiencies in Nigeria</td>
<td>Kyu Sik Lee, Alex Anas</td>
<td>December 1989</td>
<td>L. Victorio 31009</td>
</tr>
<tr>
<td>Do Exporters Gain from Voluntary Export Restraints?</td>
<td>Jaime de Melo, L. Alan Winters</td>
<td>January 1990</td>
<td>M. Ameal 37947</td>
</tr>
<tr>
<td>Effective Incentives in India's Agriculture: Cotton, Groundnuts, Wheat, and Rice</td>
<td>Ashok Gulati, with James Hanson and Garry Pursell</td>
<td>January 1990</td>
<td>G. Bayard 38004</td>
</tr>
<tr>
<td>Title</td>
<td>Author</td>
<td>Date</td>
<td>Contact for paper</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>WPS335 Macroeconomic Adjustment and the Labor Market in Four Latin American Countries</td>
<td>Ramon E. Lopez, Luis A. Riveros</td>
<td>December 1989</td>
<td>L. Riveros 37465</td>
</tr>
<tr>
<td>WPS336 Input Tariffs and Duty Drawbacks in the Design of Tariff Reform</td>
<td>Arvind Panagariya</td>
<td>May 1990</td>
<td>K. Cabana 37946</td>
</tr>
<tr>
<td>WPS337 Projecting Mortality for All Countries</td>
<td>Rodolfo A. Bulatao, Eduard Bos, Patience W. Stephens, My T. Vu</td>
<td>December 1989</td>
<td>S. Ainsworth 31091</td>
</tr>
<tr>
<td>WPS338 Bank Lending for Divestiture: A Review of Experience</td>
<td>Sunita Kikeri</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WPS341 Cost-of-Living Differences between Urban and Rural Areas of Indonesia</td>
<td>Martin Ravallion, Dominique van de Walle</td>
<td>December 1989</td>
<td>C. Spooner 30464</td>
</tr>
<tr>
<td>WPS342 Human Capital and Endogenous Growth in a Large Scale Life-Cycle Model</td>
<td>Patricio Arrau</td>
<td>December 1989</td>
<td>S. King-Watson 31047</td>
</tr>
<tr>
<td>WPS345 Private Transfers and Public Policy in Developing Countries: A Case Study for Peru</td>
<td>Donald Cox, Emmanuel Jimenez</td>
<td>December 1989</td>
<td>A. Bhalla 37699</td>
</tr>
</tbody>
</table>