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IMPORT TARIFFS, DOMESTIC DISTORTIONS AND "MARKET LINKAGES" ¹

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¹ From Feenstra (1986)

INTRODUCTION

The traditional optimal tariff argument in a two-good model with perfect competition indicates that a large country, imposing an import tariff, will change the terms of trade in its favour and improve its welfare.

Graaf (1949) however first observed that when there are more than two goods, subsidies to some trade flows may be welfare enhancing. Similar results have been obtained by Kemp (1966, 1969), Jones (1967) and Das (1983) in models where goods and factors are mobile. More recently, some studies identify the conditions under which an export subsidy is welfare improving for the active country, even with perfect competition (Feenstra, 1986, using a three-good model and Itoh and Kiyono, 1987, in the case of a continuum of goods). In a similar vein, Bond (1990), dealing with the optimal tariff structure of a large country in a n -good model, demonstrates that some import tariffs can be negative while some export subsidies may be positive.

For all these authors, welfare improving trade subsidies arise because a terms of trade loss due to a subsidy on one market is offset by a terms of trade gain in another market. In other words, interactions between the various goods² lead to the imposition of trade policy instruments that would not be used in the classical two-good model.

However, despite this enlargement from the two-good case to higher dimension models, all the authors cited above assume an initial free trade equilibrium. So their theoretical predictions have a rather limited role for trade policy when dealing with markets in which the initial equilibrium is distorted.

In this paper, the two-country, perfect competition and several goods assumptions are retained. However, it is supposed that there are policy distortions (caused by tariffs) on some markets in the active country. Thus, the initial free trade equilibrium assumption is dropped. Hence, the objective of this paper is to determine the conditions under which an import tariff becomes welfare decreasing for the active country.

² the pattern of substitution and complementarity across goods or "market linkages" (Feenstra, 1986).

It will be shown that, even in the presence of domestic distortions, the pattern of substitution and complementarity across goods, at home and abroad, remains the central point of the analysis. But, taking into account existing distortions makes an import tariff more likely to be welfare decreasing when some involved goods are complements in the active country. More precisely, in a three-good model, starting from a free trade equilibrium, a necessary condition for an import tariff to damage the national welfare is that the taxed import be a stronger complement (a weaker substitute) with an export good in the home country than abroad. Starting from a distorted equilibrium position, this condition does not remain necessary. Indeed, we will demonstrate that as soon as the import and export goods are complements at home (even if lesser than abroad), an import tariff can induce a welfare loss for the active country.

To illustrate this point, the analysis here is applied to the European Commission's proposition of rebalancing its external protection between grains and cereal substitutes. This application will allow us to highlight the implications of the theoretical results in the context of a real trade policy problem, which is one point of disagreement between the EC and the US in the current GATT³ Uruguay Round negotiations.

The paper is organised as follows: the basic features of the three-good trade model and some of its properties are presented in section 1. In section 2, the general expression for change in social welfare will be derived and the conditions under which an import tariff is welfare decreasing for the active country are discussed. Section 3 deals with the application of the analysis to the case of the EC trade policy for grains and cereal substitutes.

³ General Agreement on Tariffs and Trade.

1. A TWO-COUNTRY THREE-GOOD GENERAL EQUILIBRIUM MODEL

It is assumed that the home country imports good 1 and exports goods 2 and 3. The net export supply function for good i is :

$$x_i(p, u) = \theta_i(p) - d_i(p, u)$$

where $p = (p_1, p_2)$ ⁴ are the respective domestic prices of goods 1 and 2, with good 3 chosen as the numeraire. u is the home utility level. $\theta_i(p)$ and $d_i(p, u)$ denote respectively the domestic supply and the representative consumer's compensated demand of good i . The net export x_i is positive when good i is an export ($i=2,3$) while it is negative if i is an import ($i=1$).

The foreign country imports goods 2 and 3 and exports good 1. The net export supply function of good i is :

$$x_i^*(p^*, u^*) = \theta_i^*(p^*) - d_i^*(p^*, u^*)$$

where foreign variables, denoted with an asterisk, correspond to the home country's variables definitions. Note that p^* is the world prices vector of goods 1 and 2 and that x_i^* is positive only for good 1.

In the next paragraphs, the properties of the net export supply functions are first examined, followed by studying the equilibrium conditions and lastly, the stability conditions of the model are determined.

1.1. PROPERTIES OF THE NET EXPORT SUPPLY FUNCTIONS

Let $x_{ij}(x_{ij}^*)$ denote the partial derivative $\partial x_i / \partial p_j$ ($\partial x_i^* / \partial p_j^*$) and $x_{iu}(x_{iu}^*)$ denote the partial derivative $\partial x_i / \partial u$ ($\partial x_i^* / \partial u^*$). Thus, $x_p(x_p^*)$ is the 2x2 matrix of partial

⁴ We will denote vector $p=(p_1, p_2)$ with all vectors treated as columns unless using a prime.

derivatives with respect to prices and $x_u(x_u^*)$ is the vector of partial derivatives with respect to the utility.

It is assumed that economy's revenue and expenditure functions are well-behaved at home and in the foreign country. So, each net export supply function is increasing with its own price (x_{ii} and x_{ii}^* are positive), decreasing with utility if the good is not inferior (x_{iu} and x_{iu}^* are negative) and the matrix x_p and x_p^* are positive semi-definite ⁵.

We say that goods i and j are net substitutes if $x_{ij}(x_{ij}^*)$ is negative. They are net complements if $x_{ij}(x_{ij}^*)$ is positive.

1.2. EQUILIBRIUM CONDITIONS

The prices in the home country differ from the world prices by a vector of specific tariffs $t = (t_1, t_2)$ levied on net exports. Thus :

$$p = p^* + t$$

At the initial equilibrium, the tariff on good 1 is equal to zero. On the other hand, there is an export subsidy on good 2. So, t_2 is positive.

The equilibrium conditions for the world economy are given by :

$$p = p^* + t \tag{1}$$

$$x(p, u) + x^*(p^*, u^*) = 0 \tag{2}$$

$$p'x(p, u) + x_3(p, u) = t'x(p, u) \tag{3}$$

$$p^*x^*(p^*, u^*) + x_3^*(p^*, u^*) = 0 \tag{4}$$

Where x and x^* are respectively the vectors of home and foreign countries net exports of goods 1 and 2.

⁵ For a derivation of net export supply functions from the economy's revenue and expenditure functions, see Dixit and Norman (1980) and Woodland (1982).

The two equations in (2) ensure that world markets for goods 1 and 2 are equilibrated. The market clearing condition for good 3 has been omitted in view of Walras' law. Equations (3) and (4) are trade balanced conditions for the home and the foreign country respectively.

Substituting (1) in the other equations gives four equations to solve for the world equilibrium price vector p^* and the utility levels u and u^* .

1.3. STABILITY CONDITIONS

In this paper attention is focused upon tariff reform in the home country. The changes in these policy instruments will cause adjustments in the world price vector and the utility levels in both countries. Dynamic adjustment of endogeneous variables consistent with the re-establishment of a competitive equilibrium is obtained by computing the differential comparative static system for the model.

Equations (1) to (4) are differentiated at the initial equilibrium to yield :

$$dp = dp^* + dt \quad (1')$$

$$x_p dp + x_u du + x_p^* \cdot dp^* + x_u^* \cdot du^* = 0 \quad (2')$$

$$p' x + p' x_p dp + p' x_u du + x'_{3p} dp + x_{3u} du = dt' x + t' x_p dp + t' x_u du \quad (3')$$

$$dp^* ' x^* + p^* ' x_p^* \cdot dp^* + p^* ' x_u^* \cdot du^* + x^* '_{3p} \cdot dp^* + x^*_{3u} \cdot du^* = 0 \quad (4')$$

Where x_{3p} and x^*_{3p} are the vectors of the partial derivatives of respectively home and foreign net export supply functions of good 3 with respect to prices.

By the homogeneity condition , we have :

$$p' x_p + x'_{3p} = 0$$

$$p^* ' x_p^* + x^* '_{3p} = 0$$

Then, adopting the normalization :

$$p'x_u + x_{3u} = -1$$

$$p'^*x_u^* + x_{3u}^* = -1$$

and substituting (1') in other equations obtains :

$$[x_p + x_p^*]dp^* + x_u du + x_u^* du^* + x_p dt = 0 \quad (2'')$$

$$(1 + t'x_u)du = (x' - t'x_p)dp^* - t'x_p dt \quad (3'')$$

$$du^* = x'^* dp^* \quad (4'')$$

Substituting equations (3'') and (4'') in market clearing conditions yields :

$$[Z]dp^* + [S]dt = 0 \quad (5)$$

where the 2x2 matrix Z and S are defined by :

$$[Z] = \begin{bmatrix} x_p + x_p^* + \frac{x_u}{1 + t'x_u} (x' - t'x_p) - x_u^* x' \\ x_p + \frac{x_u}{1 + t'x_u} t'x_p \end{bmatrix}$$

$$[S] = \begin{bmatrix} x_p + \frac{x_u}{1 + t'x_u} t'x_p \end{bmatrix}$$

The dynamic adjustment mechanism is of walrasian type, namely :

$$\dot{dp}^* = [k][Z]dp^*; \quad [k] = \begin{bmatrix} k_1 & 0 \\ 0 & k_2 \end{bmatrix}; \quad k_1 < 0, k_2 < 0 \quad (6)$$

where the dot denotes a time derivative.

The equations in (6) infer that when there is excess supply (demand) on the world market of good i, its price decreases (increases).

Necessary and sufficient conditions for local stability about an equilibrium solution are that the trace and the determinant of Z be positives ⁶.

⁶ This assumes that k_1 and k_2 are taken to be minus unity. For a statement of the Ruth-Hurwitz necessary and sufficient conditions for local stability see Sargent (1979) and Murata (1983).

From (5) we suppose that the income effects in the foreign country are negligible. Since x_H and x_H^* are both positive, the trace of Z is positive if :

$$1 + t'x_u > 0 \quad (6.1)$$

$$x'_u(x - x'_p t) > 0 \quad (6.2)$$

where the first sufficient condition may be referred to as the "Hatta normality condition" ⁷, while the second one measures the direct income effect in the home country.

Since x_p and x_p^* are both positive semi-definite, the determinant of Z is positive if :

$$(x' - t'x_p)[x_p + x_p^*]^{-1}x_u > 0 \quad (6.3)$$

At the initial equilibrium, tariff on good 1 equals zero. Thus, condition (6.3) may be expressed as :

$$(x_{22} + x_{22}^*)x_{1u}(x_1 - t_2x_{21}) + (x_{11} + x_{11}^*)x_{2u}(x_2 - t_2x_{22}) > (x_{12} + x_{12}^*)x_{2u}(x_1 - t_2x_{21}) \\ + (x_{21} + x_{21}^*)x_{1u}(x_2 - t_2x_{22})$$

So condition (6.3) holds if direct income effects on world prices are stronger than cross income effects.

⁷ See Hatta (1977a), Hatta (1977b), and Turnuren-Red and Woodland (1991).

2. IMPORT TARIFF AND THE HOME COUNTRY'S WELFARE CHANGE

In this section, the effects on the home country's welfare of a change in the import tariff on good 1, around the initial equilibrium are examined. Initially, the general condition for the import tariff to be welfare decreasing is derived, assuming first, the case of an initial free trade equilibrium and second, an initial distorted equilibrium, which makes easier the interpretation of this general condition.

2.1. CONDITION FOR A WELFARE DECREASING IMPORT TARIFF

Differentiating equilibrium conditions given by equations (1) to (4) leads to equations (2'') to (3'') of section 1. Substituting equation (2'') for dp^* in equations (3'') and (4'') and assuming that income effects in the foreign country are negligible, obtains the following expression for the change in the home country's welfare :

$$du = \frac{-(x' - t' x_p)[x_p + x_{p^*}]^{-1} x_p - t' x_p) dt}{I + t' x_u + (x' - t' x_p)[x_p + x_{p^*}]^{-1} x_u} \quad (7)$$

where dt is the vector of the tariff changes $(dt_1, 0)$.

From the stability conditions, the denominator of (7) is positive (see conditions 6.1 and 6.3), thus the sign of the welfare change is the sign of the numerator of (7).

This numerator, evaluated at the initial equilibrium, can be expressed as :

$$(x_1 K_1^* + x_2 K_2^* - t_2 x_{22} K_2^* - t_2 x_{21} K_1) dt_1 \quad (8)$$

where :

$$K_i^* = -\frac{I}{\det[x_p + x_{p^*}]} ((x_{22} + x_{22}^*) x_{11} - (x_{12} + x_{12}^*) x_{21})$$

$$K_1 = \frac{1}{\det[x_p + x_p^*]} ((x_{22} + x_{22}^*)x_{11}^* - (x_{12} + x_{12}^*)x_{21}^*)$$

$$K_2^* = -\frac{1}{\det[x_p + x_p^*]} (x_{21}x_{11}^* - x_{21}^*x_{11})$$

Note that if the income effects in the home country are very low, we may write :

$$K_1^* = dp_1^*$$

$$K_1 = dp_1$$

$$K_2^* = dp_2^*$$

So neglecting the home country's income effects, K_1^* and K_1 measure respectively world and domestic prices changes of good 1, while K_2^* is the change of the world price of good 2.

In this case, the two first terms in (8) measure the impact of the terms of trade changes on the home country's welfare. The second and third terms in (8) are the welfare effects of the import tariff on the existing export subsidy on good 2, through the impact of world prices changes on the exported quantity.

The sign of each term in (8) is ambiguous but, if direct price effects are stronger than cross price effects, at home and abroad, K_1^* is negative while K_1 is positive. This is what is observed in the two-good case : an import tariff increases the domestic price ($K_1 > 0$) and decreases the world price ($K_1^* < 0$) of the imported good ⁸.

Thus, assuming that direct price effects are greater than cross price effects the first term of (8) is positive, implies that the terms of trade change on good 1's market is welfare improving for the home country. But even with this hypothesis ⁹, the signs of the three other terms remain ambiguous.

⁸ Assuming here that the income effects in the home country are negligible.

⁹ It is shown later that this hypothesis does not affect the following results.

For small movements around the initial equilibrium, an import tariff is welfare decreasing for the home country if and only if :

$$x_2 K_2^* - t_2 x_{22} K_2^* - t_2 x_{21} K_1 < -x_1 K_1^* \quad (9)$$

Condition (9) stipulates that the sum of the terms of trade change and of the import tariff effects on the existing distortion on good 2's market must be less than the terms of trade change on the market of good 1. Note that condition (9) holds if either the world price of good 1 decreases or increases (in this last case, condition (9) even becomes easier to satisfy because the import tariff induces a welfare terms of trade loss on good 1). In other words, a terms of trade gain on market of good 1 must be offset by a loss on market of good 2 (or a terms of trade loss in good 1 must be greater than a possible welfare gain on the market of good 2).

2.2. STARTING FROM A FREE TRADE EQUILIBRIUM

If at the initial equilibrium, there is no policy distortion on the domestic market of good 2, condition (9) becomes :

$$x_2 K_2^* < -x_1 K_1^*$$

This means that if the terms of trade change in good 1 is welfare improving for the home country ($-x_1 K_1^* < 0$), the terms of trade change in good 2 must be welfare decreasing ($x_2 K_2^* < 0$) and this loss must more than offset the gain obtained in good 1 ¹⁰.

The import tariff will induce a loss in good 2 for the home country if K_2^* is negative (that is to say if the world price of the exported good decreases ¹¹).

PROPOSITION 1 : For small movements around the free trade equilibrium, an import tariff on good 1 is welfare decreasing if and only if :

¹⁰ If the tariff leads to a terms of trade loss in good 1, the terms of trade change in good 2 can be either welfare decreasing or improving, but in this last case, the gain must be lesser than the loss in good 1.

¹¹ Neglecting the home income effects.

$$\frac{x_{2I} - \dot{x}_{2I}}{x_{1I} - \dot{x}_{1I}} > \frac{x_I}{x_2} K_I \frac{\det[x_p + x^* p^*]}{x_{1I} \dot{x}_{1I}} \quad (10)$$

Recalling that own-price derivatives are positive, this condition essentially says that goods 1 and 2 are weaker net substitutes (stronger net complements) at home than abroad ¹².

Intuitively, following the imposition of the import tariff, the world price of good 1 is expected to decrease. Thus, if goods 1 and 2 are net substitutes in the foreign country, imports of good 2 should decrease. On the other hand, domestic price of good 1 is expected to rise leading, if both goods are net substitutes, to a reduction of the home exports of good 2. Moreover, if the degree of substitution between goods 1 and 2 is greater abroad than at home, the decrease of the import demand of good 2 will be stronger than the decrease of the export supply, resulting in a decrease of the world price of good 2. If this terms of trade loss more than offsets the terms of trade gain in good 1, overall home welfare decreases due to these market interactions.

Suppose now that a terms of trade loss is assumed for good 1 (remember from condition (8) that this is the case when cross price effects are stronger than direct price effects in both countries). Thus, the right-hand side of (10) becomes positive and proposition 1 still holds but does not remain necessary. The import tariff is welfare decreasing for the home country as long as it leads to a terms of trade loss in good 2 or a gain which does not exceed the loss in good 1.

To conclude, proposition 1 is similar to the condition stated by Feenstra (1986) for an export subsidy to be welfare improving for the active country.

¹² Note that if goods 1 and 2 are substitutes at home and complements abroad, a tariff on good 1 is necessarily welfare improving for the home country.

2.3. STARTING FROM A DISTORTED EQUILIBRIUM

It is now pertinent to return to condition (9) :

$$x_2 K_2^* - t_2 x_{22} K_2^* - t_2 x_{21} K_1 < -x_1 K_1^*$$

The hypothesis is now adopted among which the import tariff makes the world price of good 1 to decrease and its domestic price to increase ¹³ ($x_1 K_1^*$ and K_1 are both positive). In this case, an import tariff on good 1 will be welfare decreasing if, and only if, the sum of the terms of trade change in good 2 ($x_2 K_2^*$) and the tariff effects on the existing policy distortion ($-t_2 x_{22} K_2^* - t_2 x_{21} K_1$) ¹⁴ leads to a loss for the home country which more than offsets the welfare gain in good 1. There are now two cases to study.

a) Goods 1 and 2 are net substitutes at home.

When goods 1 and 2 are net substitutes at home, the third term of the left-hand side of condition (9) is positive ($-t_2 x_{21} K_1 > 0$). It means that the rise of the domestic price of 1 leads to a decrease of the exported quantity of 2. As a result, the welfare loss due to the home export subsidy is reduced.

Following this proposition, an import tariff on good 1 will be welfare decreasing if, and only if, the sum of the two first terms of the left-hand side of (9) is negative. But recalling that the own-price derivatives are positive, these two terms have opposite signs. Intuitively, if the import tariff induces a terms of trade loss in good 2 at home ($K_2^* < 0$) the quantity exported of good 2 will be reduced leading to a welfare gain for the home country via the partial correction of the existing domestic distortion ($t_2 x_{22} K_2^* > 0$).

So proposition 2 can be expressed as follows :

PROPOSITION 2 : For small movements around the initial equilibrium, if goods 1 and 2 are net substitutes at home, an import tariff is welfare decreasing if and only if :

¹³ In fact it is the most usual case and moreover it does not change the following results.

¹⁴ Neglecting the home income effects.

$$(x_2 - t_2 x_{22}) \left(\frac{x_{21}}{x_{11}} - \frac{x_{21}^*}{x_{11}^*} \right) > (x_1 K_1^* - t_2 x_{21} K_1) \frac{\det[x_p + x_p^*]}{x_{11} x_{11}^*} \quad (11)$$

Condition (11) essentially says that if the terms of trade change in good 2 is stronger than the direct price tariff effect on the existing distortion ($x_2 - t_2 x_{22} > 0$) goods 1 and 2 must be weaker net substitutes at home than abroad. In the contrary case goods 1 and 2 must be stronger net substitutes at home than abroad.

Two main ideas can be derived from the above proposition. First, in the most usual case, $x_2 - t_2 x_{22}$ can be expected to be positive. So, in general, if goods 1 and 2 are net substitutes at home, the condition for a welfare decreasing import tariff is similar starting either from a free trade or a distorted equilibrium. The only difference introduced by taking into account domestic policy distortions is that the condition required on market linkages for an import tariff to become welfare decreasing is more difficult to satisfy. Indeed, we see that the right-hand side of condition (11) is greater in absolute value than the right-hand side of condition (10). Thus, the gap between x_{21}/x_{11} and x_{21}^*/x_{11}^* must be wider now than in the no distortion case. In other words, when goods 1 and 2 are net substitutes at home, existing domestic distortion on good 2 makes the import tariff more likely to be welfare improving due to its corrective effect on this distortion. But, and it is the second point, suppose that the exported quantity of good 2 is very small (x_2 near zero) while the export subsidy is high, which would be the case if for example, industry of good 2 in the home country is "young" and is just taking off, the export subsidy being aimed to strengthen this home sector. In this example policy makers must be aware of imposing an import tariff on good 1 because the existing export subsidy reverses the substitution relationship across import and export goods that is usually required to avoid a possible decreasing home welfare change.

b) Goods 1 and 2 are net complements at home.

The third term of the left-hand side of condition (9) is negative ($-t_2 x_{21} K_1 < 0$). The rise of the domestic price of 1 leads to an increase of the exported quantity of good 2, and the welfare loss due to the domestic export subsidy increases. So in this case an import tariff on good 1 may be welfare decreasing although it leads to a terms of trade gain in good 2.

PROPOSITION 3 : For small movements around the initial equilibrium, if goods 1 and 2 are net complements at home, an import tariff is welfare decreasing if and only if:

$$(x_2 - t_2 x_{22}) \left(\frac{x_{21}}{x_{11}} - \frac{\dot{x}_{21}}{\dot{x}_{11}} \right) + t_2 x_{21} \frac{((x_{22} + x_{22}^*)x_{11}^* - (x_{12} + x_{12}^*)x_{21}^*)}{x_{11}x_{11}^*} > x_1 K_1^* \frac{\det[x_p + x_p^*]}{x_{11}x_{11}^*} \quad (12)$$

Consider the most usual case where $x_2 - t_2 x_{22}$ is positive. Thus, condition (12) essentially says that the more the goods 1 and 2 are complements at home, the more likely the import tariff will be welfare decreasing¹⁵. And even if the two goods are weaker net complements at home than abroad (the first term of the left-hand side in (12) is negative) the import tariff can remain welfare decreasing for the home country.

So, starting from a distorted equilibrium when goods 1 and 2 are net complements at home, makes the condition required for an import tariff to become welfare decreasing easier to satisfy. In other words, an import tariff is less likely to improve the home country's welfare when import and export goods are net complements at home, especially if a domestic distortion exists on the internal market for the export good.

In sections 1 and 2 it was shown that in a three-good model the effects of an import tariff on home country's welfare may be in sharp contrast to the conventional wisdom from two-good or partial equilibrium models. Market linkages across goods at home and abroad can indeed lead to an import subsidy to be the optimal policy. Furthermore, a welfare improving import subsidy can easily appear when import and export goods are net complements at home especially in the case where a domestic distortion does initially exist on the market for an export good.

This last result is interesting because it can be related and illustrate a current trade policy concern in the EC agricultural sector : the so-called rebalancing proposition which remains one point of disagreement between the EC and the US in the current GATT negotiations.

3. APPLICATION TO THE EC REBALANCING PROPOSITION

¹⁵ Note that the import tariff is more easily welfare decreasing for the home country if goods 1 and 2 are stronger complements at home than abroad or complements at home and substitutes abroad, although in contrast with the previous cases this condition is not necessary here.

What is concerned here is one of the main "disharmonies"¹⁶ created by the Common Agricultural Policy (CAP). The different trade regimes applied to grains and cereal substitutes¹⁷ in the EC has led to a case of distortion which, since the last 1970's, the Community has tried to confront by reforming its trade policy. But the EC and the US do not agree about how to implement this reform.

This section first relates the respective points of view of both countries. At this stage and recalling the above theoretical results it is interesting to see that one argument in the discussion between the EC and the US concerns the substitution-complementarity relationships across grains and two main cereal substitutes, namely, Corn Gluten Feed (CGF) and soyameal in the Community's feed demand. In a second stage, we analyse the changing effects of EC import tariffs on CGF or soyameal on the sign of the home welfare change when the relationships between grains and these two cereal substitutes in the EC net export supply vary from net substitutes to net complements. These calculations reveal the importance of taking into account existing domestic policy distortions in such an analysis. On the other hand they help to highlight the issues of the EC-US conflict.

3.1. THE EC CEREAL SUBSTITUTES PROBLEM : A NOW CLASSICAL CASE OF DISTORTION IN THE CAP

The EC grain market is highly protected, through both internal and external policy mechanisms. Internal regulation calls for the annual fixing of threshold, target and intervention prices for grains. The EC internal market price is not allowed to fall below the intervention price since the Community is required to purchase all grains offered at this price. In order to maintain the internal protection, external policies must isolate the domestic market from other countries. This is accomplished by applying a variable import levy (equal to the difference between the world and the threshold prices) to grain imports

¹⁶ CEC (1988).

¹⁷ In this paper the term cereal substitutes is used in the broadest sense, referring to those non grain feeds which are imported by the EC at low or null tariff rates, including all cereal substitutes as defined by the European Commission (mainly cassava, corn gluten feed and citrus pulp) and soyameal, even if this last one cannot be considered as a pure cereal substitute due to its high protein content (by opposition with grains which are energy-rich ingredients).

and a variable export subsidy or refund (equal to the difference between the world and the internal market prices) to grain exports.

But facing high grain prices, EC feed manufacturers have sought to use other less expensive feedstuffs which could act as substitutes for grains in feed rations. In particular, EC feed manufacturers use of so-called cereal substitutes has increased as most of these products enter the Community at very low or nill tariff rates which are bound under GATT.

Since the late 1970's, the inclusion of these substitutes in compound feeds has increased rapidly. At the same time, the growth in the EC's grain supply surpassed the domestic demand, leading to both a rise in intervention stocks and the increasing use of export subsidies to dispose of surpluses on world markets, with a consequent rise in EC budgetary expenditure to deal with these cereal surpluses.

In order to address this budgetary problem and remove the distortions effects on its grain market, EC has been attempting to restore the price competitiveness of grains in feed rations. Three policy options were possible in this situation : cutting the internal price of grains, increasing the domestic prices of cereal substitutes by imposing a tariff on imports, or adopting both of these changes simultaneously. The EC rebalancing proposition in the GATT negotiations and the so-called Mc Sharry CAP reform have chosen the third policy option.

The origin of the EC-US conflict lies in the possibility of imposing tariffs on the Community's cereal substitute imports.

3.2. THE EC-US CONFLICT

The EC has made several attempts to "harmonize" its external protection by imposing tariffs on cereal substitute imports ¹⁸. However, the US has always vigourously resisted these attempts and the Community only succeeded in negotiating a voluntary export restraint agreement with Thailand for cassava in 1984.

¹⁸ For more details see Schmidt and Gardiner (1988), Guyomard and Mahé (1992a and b) for the CAP reform proposal and EC's proposition to the GATT.

The US position is clear. First, high internal grain prices turned the EC to a net cereal exporting position in the early 1980's. So the major concerns of the US is to alleviate or reverse the consequences of the CAP principles on trade in grains. Secondly, with the exception of cassava, the main cereal substitutes imported by the EC are CGF and soyameal¹⁹ which are major US exports²⁰. Not surprisingly, the US is strongly opposed to EC import tariffs on these two feed ingredients.

These trade interests lead the US to argue that the only way for the EC to remove its budgetary problem and reduce its grain surplus is to cut the internal grain price and eliminate the variable levy-refund system. The US argument is that CGF and soyameal are protein-rich ingredients so they act as complements with grains (which are energy-rich ingredients) in EC feed rations. Hence, tariffs on CGF or soyameal imports aimed at increasing feed grain demand in the Community would not achieve this objective.

The EC however, does not accept the US position. Although CGF and soyameal are protein-rich commodities²¹, the high grain price in the EC has led to price ratios of CGF and soyameal to grains that has turned the "natural" complementary relationship to an "artificial" substitution link in the Community's feed rations. So increasing internal prices of CGF and soyameal by an import tariff would probably decrease the feed consumption of these cereal substitutes in favour of grains.

In fact, the substitution complementarity relationships between grains and both CGF and soyameal in the EC feed demand are not very well-established. Few studies have tried to estimate the feed demand cross-price elasticities between these ingredients in the Community, and when estimates have been made they are often conflicting because estimation procedures and data availability vary.

Surry and Moschini (1984) consider only three aggregates in Belgian and Dutch feed rations: grains, cereal substitutes (mainly cassava, and citrus pulp) and high protein feeds (soya, rapeseed, sunflower meals and CGF). They found that cereal substitutes and high protein feeds were complements and together substitutes with grains in Belgian and Dutch feed demand, although their estimates of cross-price elasticities were very low in

¹⁹ In the following, we shall refer to soyameal as meals and beans in meal equivalent.

²⁰ The US is the first CGF world exporter and a great exporter of soya together with Brazil and Argentina.

²¹ The CGF imported by the EC from the US contains about 22-24 % protein while soyameal are 44 % protein.

absolute value terms. Mc Kinzie, Paarlberg and Huerta (1986) estimated feed demand equations for sixteen ingredients, in the Netherland. Their results showed that grains were substitutes with CGF but complements with soyameal. On the other hand, estimated cross-price elasticities were much higher in absolute value terms than those from the Surry-Moschini study. For France only, Surry (1990) showed that wheat and corn are both substitutes with meals in feed rations. For the EC-12, Le Mouël (1991) found that wheat can be substitute to CGF and soyameal while coarse grains were complements with CGF and substitutes with soyameal. In Gardiner (1986) soyameal was found to be substitute with wheat but complement with corn in the EC feed demand. Finally Mahé and Munk (1987) concluded that CGF and soyameal were both substitutes with grains in the Community's feed sector.

This empirical studies suggest that neither the US nor the EC view is fully supported by the data. Indeed these studies intimate that both views can be correct. In this context, in the following paragraph, we consider that EC export supply cross price derivatives between grains and CGF or soyameal vary allowing net substitution or net complementarity relationships across these feed ingredients. Before addressing this issue, it is important to emphasize two points. First, as the market linkages between grains and CGF or soyameal are uncertain, the welfare effects of applying tariffs on these cereal substitute imports may be hazardous for the EC. Secondly, following the Mc Sharry CAP reform implementation, the EC domestic price of grains will decrease. Thus the final prices ratios of CGF or soyameal to grains should favour the re-emergence of the "natural" complementarity relationship between these ingredients in the EC feed demand. In view of the earlier theoretical discussion in this paper, tariffs on CGF or soyameal imports could become less attractive for the Community in terms of the expected resulting welfare gain.

3.3. TO WHAT EXTENT ARE TARIFFS ON CGF OR SOYAMEAL IMPORTS WELFARE IMPROVING FOR THE EC ?

Applying the three-good model of sections 1 and 2, the EC becomes the "home country" while the "foreign country" means the "rest of the world". Good 1 imported by the Community will be successively CGF and soyameal. Good 2 represents grains which are exported by the EC.

At this stage it should be noted that the export subsidy on good 2 cannot remain fixed as in the theoretical model. Indeed, in the EC the export subsidy t_2 is variable while the domestic price of grains p_2 is fixed.

Under these hypothesis condition (12) of section 2 becomes :

$$x_2 \left(\frac{x_{21}}{x_{11}} - \frac{\dot{x}_{21}}{\dot{x}_{11}} \right) + t_2 x_{21} \frac{(x_{22} \dot{x}_{11} - x_{12} \dot{x}_{21})}{x_{11} \dot{x}_{11}} > x_1 K_1 \frac{\det(x_p + x_p^*)}{x_{11} \dot{x}_{11}}$$

The parameters and data used and their sources are presented in appendix. Table 1 gives the sign of the EC welfare change following the imposition of tariffs either on CGF or soyameal imports when the derivative of grain export supply with respect to CGF or soyameal prices vary from -0.2 to 7.0 in the Community, taking into account or not the existing domestic distortion on good 2.

Table 1. EC welfare effects of import tariffs

EC export supply cross price derivative	Sign of the EC welfare change			
	Import tariff on CGF		Import tariff on soyameal	
	No distortion	With a distortion	No distortion	With a distortion
-0.2	+	+	+	+
-0.1	+	+	+	+
0.0	+	+	+	+
0.1	+	+	+	-
0.2	+	+	+	-
0.3	+	+	+	-
0.4	+	-	+	-
1.5	+	-	-	-
7.0	-	-	-	-

As expected, when grains and CGF (soyameal) are net substitutes in the EC the import tariff improves the Community's welfare.

Table 1 also illustrates the theoretical results of section 2. More precisely it is seen that when grains and CGF or soyameal are net complements in the EC, tariffs on both cereal substitutes are most likely to decrease welfare if the existing distortion on the

internal grain market is taken into account. When not considering this distortion the tariff on CGF (soyameal) remains welfare improving until the EC export supply cross price derivative reaches 7.0 (1.5). When the distortion is considered the magnitude of the cross price derivative consistent with an EC welfare improvement falls to 0.4 (0.1). This result shows the hazardous effects of import tariffs in presence of domestic policy distortions.

The third result and probably the most important for EC policy makers lies in the comparative effects of both import tariffs on the Community's welfare.

From table 1 it can be seen that even as argued by the US, grains and CGF are net complements in the EC an import tariff on this cereal substitute can remain welfare improving (until the complementarity relationship reaches a rather high degree of 0.4). In fact the market power of the EC for CGF is very strong²² and the tariff leads to a substantial terms of trade gain for the Community on this market. Then, the tariff on CGF remains welfare improving even if it induces a loss on the grain market. In other words grains and CGF must be strong complements for the loss on the grain market more than offset the terms of trade gain on the CGF market and the tariff become welfare decreasing.

Thus, it can be concluded from these calculations that a tariff on CGF should in any case be welfare enhancing for the EC due to its dominant market position.

On the contrary, the tariff on soyameal imports produces welfare effects which are far less favourable for the Community. Table 1 shows that as soon as grains and soyameal become net complements in the EC, the tariff acts to decrease welfare. This result is essentially due to the less prominent position of the Community in the world soya market²³. A tariff on soyameal leads to a welfare terms of trade gain on this world market which remains rather limited for the EC. Thus, even if grains and soyameal are weak net complements in the Community the welfare loss on the grain market easily offsets the gain on the soyameal market. So, it can be concluded that the Community should take care before imposing a tariff on its soyameal imports because the sign of the induced welfare

²²The own-price derivative of the export supply in the foreign country (that is to say the US) is very low (0.02) indicating strong market power for the EC. This is not so surprising: first CGF is a by-product, second the US is virtually the only world exporter, so CGF export supply in the foreign country reacts weakly to its own price, and third the EC is the single world importer.

²³ The own-price derivative of soyameal export supply in the foreign country is 0.6 indicating that the EC has weaker market power for soyameal than for CGF. This is due to the fact that soyameal cannot be considered as a by-product in the same way as CGF, that there are several large world exporters and that the EC is not the only world importer.

change is uncertain, especially if we assume that a GATT agreement between the EC and the US or the application of the Mc Sharry CAP reform should tend to confirm the complementarity relationship across grains and soyameal in the Community's feed demand ²⁴.

It is worth noting, in view of the previous discussion, that since the first Mc Sharry CAP reform proposals have been discussed within the EC the more recent rebalancing propositions from the Community do not involve soyameal anymore.

²⁴Keeping in mind that a GATT agreement and the CAP reform implies a cut in the EC domestic price of grains, then, in the final equilibrium, EC net exports of grains and net imports of CGF and soyameal would change. Moreover, the variable grain export subsidy t_2 should decrease, so the degree of net complementarity between grains and both cereal substitutes required in the EC for the tariffs become welfare decreasing would probably be higher than in the current situation. Nevertheless this does not question the gap between the tariffs on CGF and soyameal in terms of their respective effects on the sign of the EC welfare change.

CONCLUDING REMARKS

In this paper it is shown that an import tariff may be welfare decreasing for the active country even in the large country and perfect competition case. This result in contrast with the conventional outcomes of the two-good model is derived in a framework of several goods and is due to the pattern of substitution and complementarity across goods.

It is demonstrated that an import tariff is more likely to be welfare decreasing when import and export goods are net complements at home, especially in the presence of domestic distortions on internal markets for export goods.

The empirical application in the paper confirms these theoretical conclusions. Moreover, the empirical analysis gives emphasis to the fact of the welfare improving power of an EC import tariff on CGF, and also the hazardous welfare effects of an EC import tariff on soyameal.

This paper, both theoretically and empirically assumes, as in most of the literature, that facing an import tariff, the foreign country remains passive. It would be worthwhile to examine, in future research, how the home welfare change is affected under retaliation.

Another extension of this paper would be to consider more than three goods in the model. Thus, the analysis here could be related to other studies which deal with tariff reform in n -good models. Most of this literature provides theoretical results on the welfare effects of a tariff reform for a small open economy (Bertrand and Vanek 1971, Hatta 1977a and b, Fukushima 1979, Dixit and Norman 1980). Then, considering n goods in the model used here would permit the extension of these results to the large country case as first done by Dixit (1987).

APPENDIX :

1. Data and parameters used

Data used with their significations and sources are presented in table 2 below.

Table 2. Data used.

	Signification	Sources	Value
x_1	EC net exports of CGF (including corn gluten meal) 1990	Eurostat, Comext	-6.74 Million Tons
	EC net exports of soya in meal equivalent 1990	Eurostat Comext	-25.64 Million Tons
x_2	EC net exports of grains (including all grains except durum wheat and rice) 1990	Eurostat Comext	26.80 Million Tons
p_2	EC domestic price of grains (Weighted average of intervention prices of wheat, maize, barley and oat) 1990	Eurostat	184.19 Ecu/Ton
p_2^*	World price of grains (Weighted average of world prices of wheat, maize and barley) 1990	World grains situation and outlook report USDA ERS	106.22 Ecu/Ton
t_2	EC per unit export subsidy on grains 1990	Calculation	77.97 Ecu/Ton

Parameters used are derived from Le Mouël (1991). They are reproduced in table 3.

Table 3. Parameters used

	$x_{11}(x_{11}^*)$		$x_{12}(x_{12}^*)$		$x_{22}(x_{22}^*)$	$x_{21}(x_{21}^*)$	
	CGF	soya(1)	CGF	soya(1)		CGF	soya(1)
EC	+0.10	+0.20	-	-	-	-0.20 to +7.00	
ROW(2)	+0.02	+0.60	-0.013	-0.023	+5.00	-0.095	-0.55

(1) in meal equivalent.

(2) rest of the World.

2. Sensivity analysis

A sensivity analysis was carried out using parameters calculated from the MISS model²⁵ price elasticities. These parameters and obtained results are presented in tables 4 and 5 respectively.

Table 4. Parameters calculated from the MISS model price elasticities

	$x_{11}(x_{11}^*)$		$x_{12}(x_{12}^*)$		$x_{22}(x_{22}^*)$	$x_{21}(x_{21}^*)$	
	CGF	soya(1)	CGF	soya(1)		CGF	soya(1)
EC	+0.066	+0.200	-	-	-	-0.20 to +7.00	
ROW(2)	+0.018	+0.554	-0.004	-0.081	+9.506	0.000	-0.211

(1) in meal equivalent.

(2) rest of the World.

Table 5. EC welfare effects of import tariffs

EC export supply cross price derivative	Sign of the EC welfare change	
	Import tariff on CGF	Import tariff on soyameal
	With a distortion	With a distortion
-0.2	+	+
-0.1	+	+
0.0	+	+
0.1	+	+
0.2	+	-
0.3	-	-
0.4	-	-
1.5	-	-
7.0	-	-

²⁵ "Modèle International Simplifié de Simulation". For more details about this model, see Guyomard and al. (1991).

Results are similar to those presented in table 1. However, in table 5, the import tariff on CGF becomes welfare decreasing for the EC since the complementarity relationship between CGF and grains reaches 0.3, while in table 1, the corresponding parameter was 0.4. Thus, the import tariff on CGF is more fastly welfare decreasing here for the EC. This is due to the fact that CGF and grains are weaker substitutes in the MISS model than in Le Mouël (1991) in the rest of the world (the resulting export supply cross price derivative is 0 in table 4 instead of -0.095 in table 3). On the other hand, opposite effects are observed for the import tariff on soyameal. It can be seen from tables 1 and 5 that with the MISS model parameters, the import tariff acts less fastly as welfare decreasing (the degree of complementarity between soyameal and grains required for the tariff become welfare decreasing is 0.1 in table 1 and 0.2 in table 5). Indeed, parameters from the MISS model imply an EC stronger position on soyameal world market : the EC own-price derivative of soyameal export supply (0.554) is lower in the MISS model than in Le Mouël, 1991 (0.60). Then, following the imposition of an import tariff, the EC terms of trade gain on the soyameal market is greater here than in table 1, and grains must be stronger complements with soyameal in the Community for the loss on the grain market offset this terms of trade gain.

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