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## Gains from trade liberalization with imperfectly competitive world markets. A note.

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**SUMMARY:** The paper shows how analyses assuming perfect competition can yield a distorted estimation of the expected effects of a trade liberalization when market imperfections exist. The analytical framework adopted is very simple and three extreme imperfect market structures are considered. In the first case, the exporting country maximizes its producer and consumer surplus by intervening in the world market. The second market imperfection considered is the existence of a private firm playing the role of «pure middleman» in the world market. Then the case of a producer-owned marketing board which is granted exclusive export authority is addressed. It is shown that estimates of the impact of a tariff reduction in terms of prices and volume traded obtained assuming perfect competition when this postulate does not hold, are distorted. When domestic demand and supply functions are assumed to be linear, the impact is overestimated; a ranking of the size of such distortions in the three cases analyzed is provided. When no restriction is imposed on the demand and supply functions, the error in the estimated impact of a tariff reduction involves the magnitude as well as the sign of the expected changes in prices and volume traded. Finally, it is proved that when a private firm exerts monopoly and monopsony power in the world market, both the importing and the exporting countries may well be better off if, rather than making a move towards trade liberalization, the importing country «compensates» the exporting country by means of a direct transfer.

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**KEYWORDS:** trade liberalization; imperfect markets; monopoly; monopsony; marketing board.

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**JEL classification:** F12; F13; Q17; Q18.

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### Ganancias de la liberalización comercial en mercados globales con competencia imperfecta. Una Nota.

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**RESUMEN:** El artículo muestra cómo los análisis que incorporan el supuesto de competencia perfecta pueden proporcionar una estimación distorsionada de los efectos esperados de una liberalización del comercio en presencia de imperfecciones de mercado. Adoptando un marco analítico muy sencillo, se consideran tres casos extremos de imperfecciones de mercado. En el primero, el país exportador maximiza los excedentes del productor y consumidor interviniendo en el mercado mundial. El segundo es el caso de una empresa privada que desempeña en el mercado mundial un papel de «intermediario puro». El último trata de una junta de comercialización, propiedad de productores que han conseguido derechos exclusivos de exportación. En este trabajo se demuestra la existencia de una desviación de las estimaciones del impacto de una reducción de aranceles sobre los precios y el volumen comercializado cuando en el análisis se supone competencia perfecta y dicho supuesto no se cumple. Además si las funciones de demanda y oferta domésticas son lineales, el impacto precedente queda sobreestimado. Asimismo, en el trabajo se presenta una ordenación de la magnitud de dichas desviaciones para cada uno de los tres casos analizados. Cuando no se impone ninguna restricción sobre las funciones de demanda y oferta, el error de estimación afecta tanto a la magnitud como al signo de los cambios esperados en precios y volumen comercializado, como consecuencia de una reducción de aranceles. Finalmente, se demuestra que, cuando una empresa privada ejerce un poder de monopolio y de monopsonio en el mercado mundial, tanto los países importadores como los exportadores pueden beneficiarse si, en lugar de inclinarse hacia la liberalización del comercio, el país importador «compensa» al país exportador mediante una transferencia directa.

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**PALABRAS CLAVE:** liberalización del comercio; mercados imperfectos; monopolio; monopsonio; junta de comercialización.

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**Clasificación JEL:** F12; F13; Q17; Q18.

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Mainly as a result of the Uruguay round of the GATT, since the late 1980s there has been a marked increase in the literature pertaining to the effects produced by liberalizing agricultural trade (Anania, 2001). Most empirical analyses assume perfect competition in both domestic and international markets. However, international agricultural trading occurs in markets where the holders of market power are particularly active. The need to give more attention to the existence of imperfectly competitive domestic market structures when analyzing agricultural and food policy changes is well discussed in McCorrison (2002).

This paper investigates the effects of a trade liberalization assuming imperfect competition in world markets and compares the results with those obtained under the hypothesis that perfect competition occurs. Three extreme imperfect market structures are analyzed in a very simple analytical framework. Though the aim of the paper is clearly explorative, its findings do in fact provide some useful indications regarding the distortions which result from assuming perfect competition in cases where this hypothesis does not hold.

In the first section, the relevance of market imperfections in agricultural world trade is briefly discussed. The two-country model described in the second section combines both a graphical and algebraic approach in assessing the impact of a trade liberalization in three imperfect world market scenarios: *i*) when the exporting

country intervenes in world markets in order to maximize its consumer and producer surplus; *ii*) when a firm exists in the international market acting as a «pure middleman» which maximizes its own profits; and *iii*) when a producer-owned marketing board is granted exclusive authority to export. The last section gives a summary of the principal results obtained.

## **Agricultural Trade and Imperfect Markets**

Almost all countries, and in particular the major traders, do, in one way or another, intervene in international markets. In many countries, whether importing or exporting, developed or developing, effective marketing boards and State Trading Enterprises (STEs) exist (Ackerman and Dixit, 1999; Veeman, Fulton and Larue, 1999). Examples include the Canadian Wheat Board, the Australian Wheat Board, the Japanese Food Agency, the New Zealand Dairy Board, as well as many STEs active in developing countries.

Around about the beginning of the 1990s, 80% of world cereals exports was controlled by just six multinational firms, while four firms controlled 80% of the trade in oilseeds; if commodities exported by developing countries are also considered, there is no significant change in the market concentration: four firms controlled 60% of the trade in sugar; three 80% of that in tea (Scoppola, 2000, p. 64).

The effects of different market imperfections on international agricultural trade have been analysed both from theoretical and empirical points of view<sup>1</sup>. Market imperfections can affect the impact of a trade liberalization on prices, volume traded and welfare. Since current WTO negotiations are likely to bring about a significant reduction in the barriers to agricultural trading, it is of interest to ascertain whether or not the attempts to evaluate the effects of an agricultural trade liberalization which assume perfect competition are biased, and the direction of such bias.

### **The analytical framework**

A very simple partial equilibrium framework with one commodity, two large countries, and zero transportation costs has been used in developing the analysis. It is

<sup>1</sup> Theoretical analyses include those by Bieri and Schmitz, 1974; Dixit and Josling, 1997; Just, Schmitz and Zilbermann, 1979; McCalla, 1966; McCalla and Josling, 1985; McCorrison and MacLaren, 2000; Sarris and Schmitz, 1981; Schmitz, McCalla, Mitchell and Carter, 1981; and Veeman, Fulton and Larue, 1999. Empirical analyses, involving a wide range of market imperfections, have been carried out, among the others, by Abbott, 1979; Alaouze, Watson and Sturgess, 1978; Carter and Schmitz, 1979; Carter and Smith, 2001; Francois, McDonald and Nordstrom, 1996; Hertel, Brockmeier and Swaminathan, 1997; Karp and McCalla, 1983; Kawaguchi, Suzuki and Kaiser, 1997; Kolstad and Burris, 1986; Lanlos, Hertel and Devadoss, 1996; McCorrison, 1996; Paarlberg and Abbott, 1986; Pick and Park, 1991; Schmitz, McCalla, Mitchell and Carter, 1981; Swaminathan, Hertel and Brockmeier, 1997; Thursby and Thursby, 1990; and Warr, 2001.

assumed, moreover, that perfect competition holds on the domestic markets. Initially, to simplify the analysis, supply and demand functions are assumed to be linear; the implications for the results obtained of removing this assumption are discussed in the final part of the paper.

Country A is a tariff-imposing importing country and country B the exporting country.

Let  $X_A(q)$  and  $X_B(q)$  be the inverse excess demand and supply functions of countries A and B respectively,  $q$  being the volume of trade, with  $\partial X_A/\partial q = X_A' < 0$ ,  $\partial X_B/\partial q = X_B' > 0$ .

Let us first derive the effects produced by a trade liberalization in the «reference» scenario, i.e. where perfect competition prevails in all markets. This particular case is shown in figure 1, where  $X_A$  is the inverse excess demand of A,  $X_B$  is the inverse excess supply of B, and  $t = AB$  is the per unit import tariff.  $X_A''$  is the tariff-inclusive excess demand of A expressed as function of the price in the exporting country. When A imposes the tariff, the volume of trade is  $q^{PC/t}$ , A's domestic price is  $P_A^{PC/t}$ , and B's is  $P_B^{PC/t}$ . The shaded areas represent the «gains from trade» of A and B, i.e. the increases in the closed-economy producer and consumer surplus due to international trading (assuming that the tariff revenue is redistributed to producers and consumers in country A as a lump sum transfer). If a trade liberalization takes place, the volume of trade increases to  $q^{PC}$  and the price in the two countries equals  $P^{PC}$ .

The market equilibrium condition under perfect competition is given by:

$$X_A(q) - t - X_B(q) = 0 \tag{1}$$

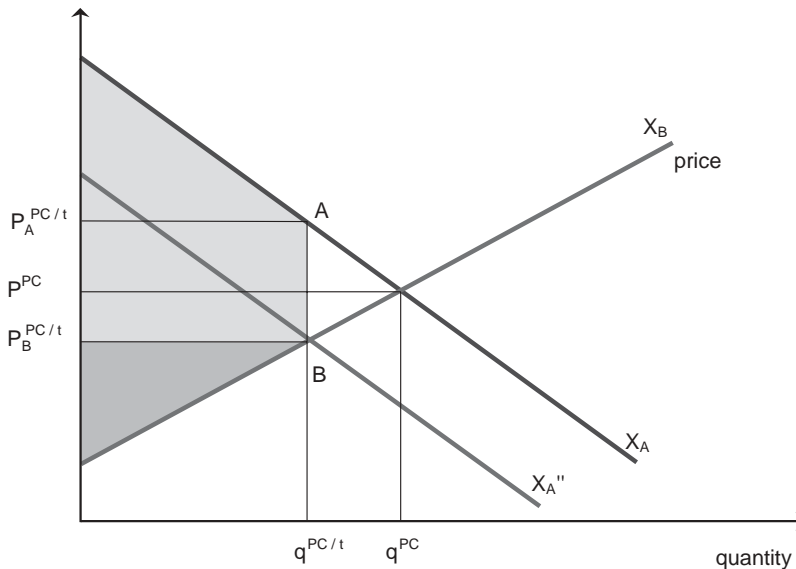


Figure 1. Perfect competition.

By taking the total differential of [1] we obtain:

$$X_A' dq - dt - X_B' dq = 0 \quad [2]$$

The impact on prices and volume traded of a tariff change can be described as follows:

$$[dq/dt]_{PC} = 1 / [X_A' - X_B'] < 0 \quad [3]$$

$$[dP_A/dt]_{PC} = X_A' dq/dt > 0, \text{ and} \quad [4]$$

$$[dP_B/dt]_{PC} = X_B' dq/dt < 0 \quad [5]$$

where  $P_i$  is the equilibrium price in country  $i$ .

The producer and consumer surpluses of A and B are given by:

$$W_A = W_A^{AUT} + \int_0^q X_A(z) dz - q [X_A(q) - t] \quad [6]$$

$$W_B = W_B^{AUT} + q X_B(q) - \int_0^q X_B(z) dz \quad [7]$$

where  $W_A^{AUT}$  and  $W_B^{AUT}$  are the closed-economy consumer and producer surpluses of countries A and B, respectively, and the remaining terms in [6] and [7] are the «gains from trade». The welfare effects of a tariff change are given by:

$$[dW_A/dt]_{PC} = [t - q X_A'] dq/dt + q, \text{ and} \quad [8]$$

$$[dW_B/dt]_{PC} = q X_B' dq/dt < 0 \quad [9]$$

While the welfare of the tariff-imposing country will, in general, either increase or decrease as the tariff decreases, the welfare of the exporting country will definitely increase.

### **Case I: the exporting country maximizing its producer and consumer surplus**

The first case of market imperfection to be discussed is where the exporting country (country B) intervenes in order to maximize its consumer and producer surplus, which is assumed to include the export tax revenue, redistributed to consumers and producers as a lump sum transfer.

The volume of trade is obtained by solving the problem faced by country B:

$$\max_q W_B = W_B^{AUT} + q [X_A(q) - t] - \int_0^q X_B(z) dz \tag{10}$$

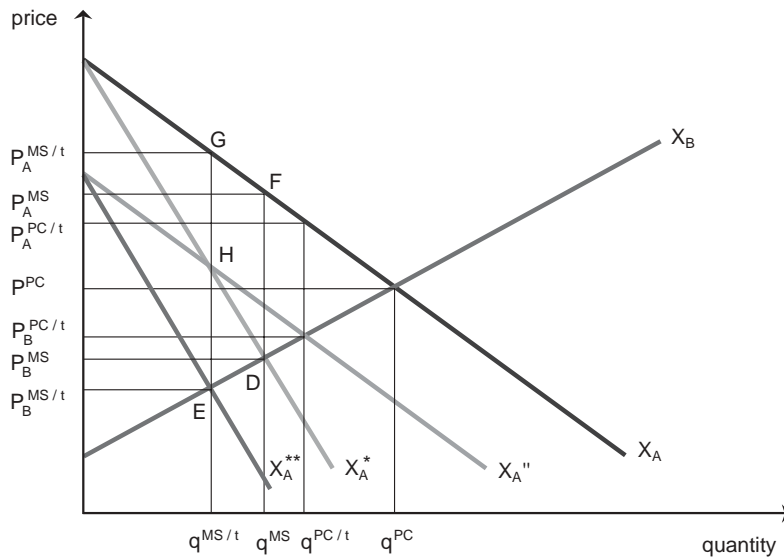
Hence, the volume traded which maximizes  $W_B$  and the optimal export tax are such that

$$\partial W_B / \partial q = X_A(q) - t + q X_A' - X_B(q) = 0, \text{ and} \tag{11}$$

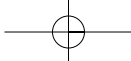
$$\tau = -q X_A' \tag{12}$$

B maximizes its consumer and producer surplus by exporting up to the point where its marginal export revenue  $[X_A(q) - t + q X_A']$  equals its marginal export social cost  $[X_B(q)]$ . The marginal export social cost is defined as the sum of the domestic consumer welfare losses and the increase in producer costs which result from a marginal increase in exports. In figure 2 the marginal export revenue curve of B when A imposes an import tariff is given by  $X_A^{**}$ ; the equilibrium condition [11] is satisfied in point E. The volume of trade is  $q^{MS/t}$ , the prices in countries A and B are respectively given by  $P_A^{MS/t}$ , and  $P_B^{MS/t}$ . The import tariff of A is GH and the export tariff of B is equal to HE.

If A unilaterally eliminates its import tariff, the marginal export revenue curve of country B becomes  $X_A^*$ ; the equilibrium condition is now satisfied in D. The volume traded increases to  $q^{MS}$ , the export tax is now equal to FD and the prices in the two countries are  $P_A^{MS}$  and  $P_B^{MS}$ , respectively.



**Figure 2.** The exporting country maximizing its producer and consumer surplus.



When the exporting country exercises market power to maximize its producer and consumer surplus, an elimination of the tariff by the importing country has a smaller impact in terms of the changes both in prices ( $P_B^{MS}$   $P_B^{MS/t}$  is less than  $P_B^{PC}$   $P_B^{PC/t}$ , and  $P_A^{MS}$   $P_A^{MS/t}$  is less than  $P_A^{PC}$   $P_A^{PC/t}$ ), and in the volume of trade ( $q^{MS/t}$   $q^{MS}$  is less than  $q^{PC/t}$   $q^{PC}$ ). This is because the marginal export revenue curves of country B ( $X_A^*$  and  $X_A^{**}$ ) are steeper than the excess demand curves of country A in the two scenarios ( $X_A$  and  $X_A''$ ).

The same result can be proved by taking the total differential of [11]. By doing so, under the assumption that the excess demand and supply functions are linear, we obtain:

$$[dq/dt]_{MS} = 1 / [2 X_A' - X_B'] < 0 \quad [13]$$

and the following condition holds:

$$0 > [dq/dt]_{MS} > [dq/dt]_{PC} \quad [14]$$

from whence:

$$[dP_A/dt]_{PC} > [dP_A/dt]_{MS} > 0, \text{ and} \quad [15]$$

$$0 > [dP_B/dt]_{MS} > [dP_B/dt]_{PC} \quad [16]$$

Hence, when the exporting country exerts market power to maximize its producer and consumer surplus, a movement toward trade liberalization by the importing country has a smaller impact on prices and volume traded than it would do when perfect competition obtains.

### **Case II: the «pure middleman» case**

The second imperfect market structure involves the case where a private firm acts as an international intermediary between the two countries; we assume the very extreme situation where it exerts both monopoly and monopsony power in the world market, while domestic markets remain perfectly competitive and the two countries do not intervene.

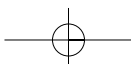
Assuming that transaction costs are nil, the profit maximization problem of the firm can be stated as follows:

$$\max_q \pi = q [X_A(q) - t - X_B(q)] \quad [17]$$

The volume traded will be such that

$$\partial\pi/\partial q = X_A(q) - t - X_B(q) + q X_A' - q X_B' = 0 \quad [18]$$

The firm maximizes its profits by buying from B and selling to A a quantity such that its marginal revenue equals its marginal cost. This case is shown in figure 3,



where  $X_A^{**}$  is the firm marginal revenue and  $X_B^*$  is its marginal cost. Equilibrium condition [18] is satisfied in C; the volume traded is now equal to  $q^{PM/t}$ , prices in A and B equal  $P_A^{PM/t}$  and  $P_B^{PM/t}$ , and the firm per unit profit equals HE. If A eliminates the tariff, the firm's marginal cost becomes  $X_A^*$  and the equilibrium condition is satisfied in point F; the volume of trade increases to  $q^{PM}$ , country A's price becomes  $P_A^{PM}$ , country B's  $P_B^{PM}$ , and the firm per unit profit DM, which is greater than HE, the per unit profit under the tariff.

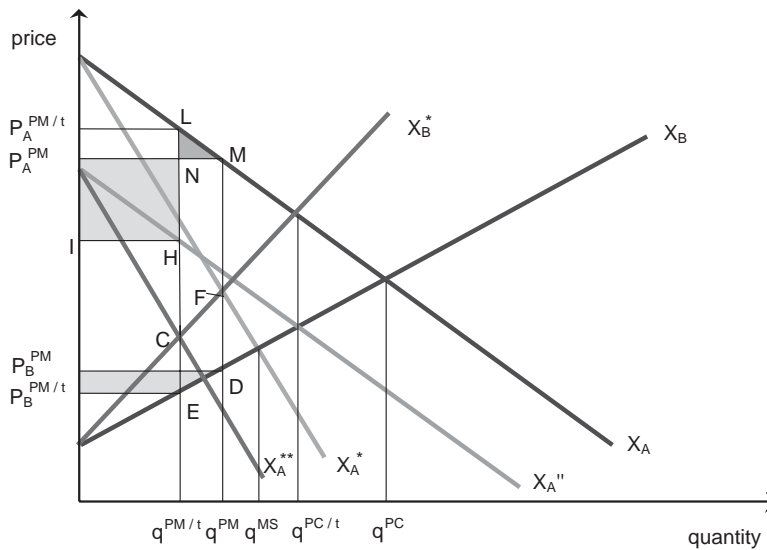


Figure 3. The «pure middleman» case.

The price and volume of trade changes due to a trade liberalization in this case are smaller than those occurring under perfect competition, and are also smaller than those occurring when the exporting country exerts market power to maximize its producer and consumer surplus. This is because *i*) the marginal revenue curve of the firm is steeper than the excess demand curve of A, and *ii*) the marginal cost curve is steeper than the excess supply curve of B.

These results can be easily proved by using some algebra. By taking the total differential of [18] we obtain:

$$[dq/dt]_{PM} = 1 / [2 (X_A' - X_B')] < 0, \text{ and} \tag{19}$$

$$0 > [dq/dt]_{PM} > [dq/dt]_{MS} > [dq/dt]_{PC}, \text{ from whence} \tag{20}$$

$$[dP_A/dt]_{PC} > [dP_A/dt]_{MS} > [dP_A/dt]_{PM} > 0 \tag{21}$$

$$0 > [dP_B/dt]_{PM} > [dP_B/dt]_{MS} > [dP_B/dt]_{PC} \tag{22}$$



As one can expect, the profits of the firm acting as a «pure middleman» in the market will always increase as the importing country reduces the tariff:

$$[d\pi/dt] = [X_A(q) - t - X_B(q)] dq/dt - 1/2 < 0 \quad [23]$$

If we think of the overall welfare as the sum of (a) producer and consumer surplus in the importing country, assuming that tariff revenue is redistributed among them ( $W_A$ ), (b) producer and consumer surplus in the exporting country ( $W_B$ ), and (c) the profits of the «pure middleman», the impact of a tariff reduction on the welfare of country B is given by:

$$[dW_B/dt]_{PM} = q X_B' dq/dt < 0, \text{ with} \quad [24]$$

$$0 > [dW_B/dt]_{PM} > [dW_B/dt]_{PC} \quad [25]$$

Hence, when a firm acting as a «pure middleman» in the world market exists, a trade liberalization has an impact on the exporting country's welfare smaller than that which would occur in a perfect competition scenario.

Finally, producers and consumers, as a whole, in both countries might well be better off if, rather than abolishing the tariff, A were to compensate B through a direct welfare transfer. This is the case, for example, of the specific market represented in figure 3, where country A's losses due to the trade liberalization (area  $P_A^{PM}NHI$  minus area  $LMN$ ) are in fact greater than country B's gains (area  $P_B^{PM}DEp_B^{PM/t}$ ). Hence, both countries would be better off if A, rather than eliminating the tariff, were to compensate B with a direct welfare transfer greater than  $P_B^{PM}DEp_B^{PM/t}$  and less than  $P_A^{PM}NHI$  minus  $LMN$ .

The necessary and sufficient condition whereby consumers and producers, as a whole, in the two countries are both better off when A, rather than eliminating the tariff, directly compensates B by means of a proper welfare transfer, is given by:

$$d[W_A + W_B] / dt > 0, \text{ or} \quad [26]$$

$$q > [X_A(q) - X_B(q)] / [2(X_B' - X_A')] \quad [27]$$

### **Case III: a producer-owned marketing board with exclusive export authority**

The third imperfect market structure considered is that where in the exporting country a producer-owned marketing board has been granted exclusive export authority; this allows the marketing board to exert market power in the world market (while domestic markets remain perfectly competitive).

Let  $Q$  be the quantity produced in country B and  $S_B(Q)$  the inverse domestic supply function, with  $\partial S_B / \partial Q = S_B' > 0$ . In equilibrium,

$$P_B = X_B(q) = S_B(Q) \quad [28]$$

From [28] the quantity produced in country B as a function of the quantity exported can be derived:

$$Q(q) = S^{-1}_B [ X_B(q) ] , \text{ with} \quad [29]$$

$$0 \leq Q' = \partial Q / \partial q \leq 1^2 \quad [30]$$

Being the marketing board owned by country B's producers, we assume that it acts with the goal of maximizing their profits<sup>3</sup>. Hence, the problem faced by the marketing board can be stated as follows:

$$\max_q \Gamma = q [ X_A(q) - t - X_B(q) ] + X_B(q) Q(q) - \int_0^{Q(q)} S_B(z) dz - FC \quad [31]$$

where the four addenda in [31] are, respectively: the profits made by the marketing board; producer revenue; variable and fixed production costs. It is assumed that the marketing board pays producers the domestic market equilibrium price and distributes its profits to its owners, producers in country B.

The volume exported by the marketing board which will maximize producer profits will be such that

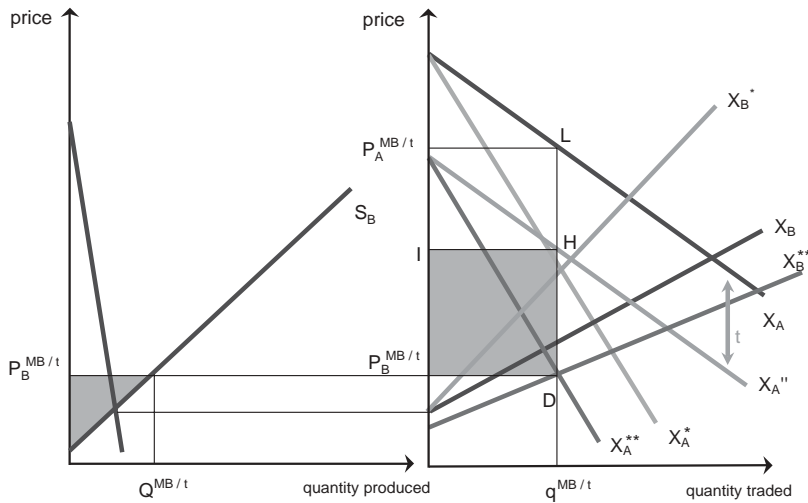
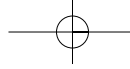
$$\partial \Gamma / \partial q = X_A(q) - t - X_B(q) + q X_A' - q X_B' + X_B' Q(q) = 0 \quad [32]$$

The marketing board maximizes producer profits by exporting to country A a quantity such that producer marginal revenue equals marginal cost. This case is shown in figure 4, where gross producer profits (i.e. profits plus fixed production costs) are given by the sum of the shaded areas. The equilibrium condition given in [32] is satisfied in point D, where  $X_A^{**}$  is  $[X_A(q) - t + qX_A']$  and  $X_B^{**}$  is  $[X_B(q) + qX_B' - X_B'Q(q)]$ .  $X_B^{**}$  intercept and slope are both smaller than those of  $X_B^*$ , the marginal revenue curve of the profit maximizing private firm considered in the previous case.<sup>4</sup> In figure 5 the market equilibrium when A eliminates the tariff is represented. The equilibrium condition is satisfied in point C; volume of trade increases to  $q^{MB}$ , prices in the two countries become  $P_A^{MB}$  and  $P_B^{MB}$ , production in country B expands to  $Q_{MB}$  and the per unit profit of the marketing board to EC (from HD).

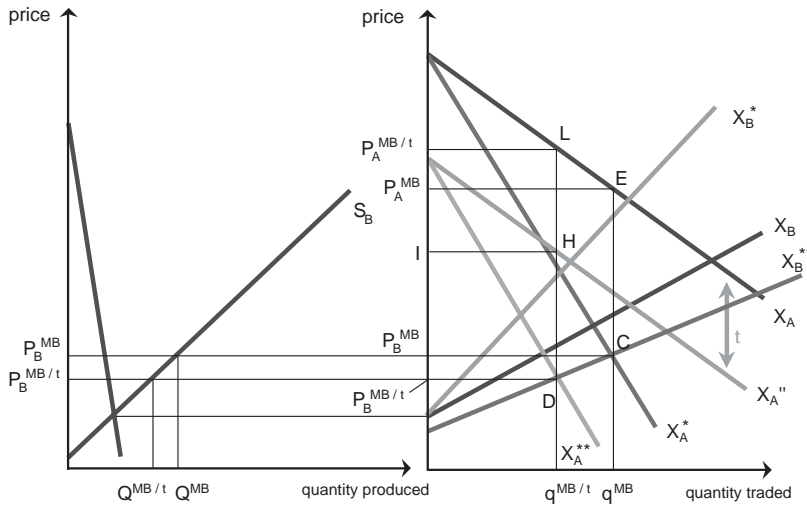
<sup>2</sup> A change of the volume exported is always associated to a smaller change, in the same direction, of the quantity produced; in fact, an increase (decrease) in the quantity exported is equal to the sum of the increase (decrease) in domestic production and the reduction (increase) in domestic consumption, taken in absolute values.

<sup>3</sup> Different hypotheses have been made with respect to the objective pursued by a marketing board, including maximizing sales, producer revenues and their own revenues (Sexton and Lavoie, 2001). Although all these hypotheses appear to be justified under specific circumstances, a producer-owned marketing board maximizing producer profits seems to us to represent the most general case.

<sup>4</sup> While the intercept of  $X_B^{**}$  is always smaller than that of  $X_B^*$ , the excess supply function of country B, no ranking of the slopes of the two functions is, in general, possible; this means that, differently from the case depicted in figure 4,  $X_B$  and  $X_B^{**}$  could intersect. However, this does not affect the results derived.

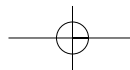


**Figura 4.** *A producer-owned marketing board.*



**Figura 5.** *Trade liberalization in the presence of a producer-owned marketing board.*

The price and volume of trade changes due to a trade liberalization are in this case smaller than those occurring under perfect competition or when the exporting country exerts market power to maximize its producer and consumer surplus, and larger than those which occur when a private firm exists which is able to act as a «pure middleman» on the world market. In fact, by taking the total differential of [32], and recalling that  $Q'$  cannot exceed 1, we obtain:



$$[dq/dt]_{MB} = 1 / [2 (X_A' - X_B') + X_B' Q'] < 0, \text{ from whence} \quad [33]$$

$$0 > [dq/dt]_{PM} > [dq/dt]_{MB} > [dq/dt]_{MS} > [dq/dt]_{PC} \quad [34]$$

$$[dP_A/dt]_{PC} > [dP_A/dt]_{MS} > [dP_A/dt]_{MB} > [dP_A/dt]_{PM} > 0 \quad [35]$$

$$0 > [dP_B/dt]_{PM} > [dP_B/dt]_{MB} > [dP_B/dt]_{MS} > [dP_B/dt]_{PC} \quad [36]$$

Producer profits in the exporting country increase as the importing country reduces the tariff:

$$[d\Gamma/dt] = dq/dt [X_A(q) - t - X_B(q)] + X_B' dq/dt [Q(q) - q] + q [X_A' dq/dt - 1] < 0^5 \quad [37]$$

while the welfare of country B always increases when a tariff reduction takes place:

$$[dW_B/dt]_{MB} = dq/dt [X_A(q) - t - X_B(q)] + q [X_A' dq/dt - 1] < 0 \quad [38]$$

### What if the demand and supply functions are not linear?

So far it has been assumed that domestic demand and supply functions - and, as a consequence, excess demand and supply functions - are linear. We will now briefly discuss the implications of this assumption for the results derived above.

Let us consider the impact of a tariff reduction on the volume of trade. If the assumption on the linearity of the demand and supply functions is removed, [3] above is unaffected, while [13], [19] and [33] become, respectively:

$$[dq/dt]_{MS} = 1 / [2 X_A' - X_B' + q X_A''] \quad [39]$$

$$[dq/dt]_{PM} = 1 / [2 (X_A' - X_B') + q (X_A'' - X_B'')] \quad [40]$$

$$[dq/dt]_{MB} = 1 / [2 (X_A' - X_B') + X_B' Q' + q X_A'' + X_B'' (Q - q)] \quad [41]$$

with  $X_A'' = \partial^2 X_A / \partial q^2$  and  $X_B'' = \partial^2 X_B / \partial q^2$

Not surprisingly, the results derived in the paper under the assumption that the demand and supply functions are linear now hold only under specific conditions.

This is true even for results one would intuitively think they would hold under very general conditions. When the demand and supply functions are linear  $dq/dt$  is always negative (the volume of trade increases when a tariff reduction occurs, no matter what the market structure is). However, when demand and supply functions are not restricted to be linear this result still holds under perfect competition, but this is no more always the case in the other three market structures considered above. In

<sup>5</sup> Note that  $X_A' dq/dt$  is always smaller than 1.

fact, the volume of trade may decline as a result of a tariff reduction even under the usual assumption regarding the convexity of the inverse domestic demand and supply functions (which implies the convexity of the inverse excess demand and supply functions, i.e.  $X_A'' > 0$  and  $X_B'' > 0$ ).

This means that, when demand and supply functions are not linear, assuming perfectly competitive world markets when they are not may induce a distortion of the estimated impact of a trade liberalization which involves not only the *magnitude* of the impact, but the *direction* of the expected changes as well.

[39], [40] and [41] depend on the volume of trade, the first and the second derivatives of the excess demand and supply functions at the equilibrium; these differ in the four scenarios considered, making it impossible to derive under reasonably general conditions relative rankings of the bias in the estimates of the impact of a trade liberalization obtained assuming perfectly competitive world markets when they are not.

Finally, it is still possible that consumers and producers, as a whole, in the two countries are both better off when A, rather than eliminating the tariff, directly compensates B by means of a proper welfare transfer. The necessary and sufficient condition for this to be true now becomes:

$$q > [q(X_A' - X_B') - t] / [2(X_A' - X_B') + q(X_A'' - X_B'')] \quad [42]$$

## Conclusions

The aim of the paper was to investigate how the effects of an agricultural trade liberalization change when market imperfections are present. Three extreme cases have been considered within a very simple analytical framework: the first involves an exporting country which intervenes to maximize its producer and consumer surplus, the second describes the situation where all international trading is controlled by one firm acting as a «pure middleman», whereas the third considers the existence of a producer-owned marketing board which is given exclusive export authority.

The results reached show that estimates of the impact of a tariff reduction in terms of prices and volume traded obtained assuming perfect competition when this postulate does not hold, are distorted. When domestic demand and supply functions are assumed to be linear the impact is overestimated. When no restriction is imposed on the demand and supply functions, the distortion of the estimated impact of the tariff reduction involves both the magnitude and the sign of the expected changes in prices and volume traded.

In addition, it has been proved that, when there exists a firm exerting both monopoly and monopsony power in the world market, it could well be that a system of direct transfers makes all countries better off with respect to a trade liberalization.

Because of *a*) the relevance of market imperfections in many internationally traded agricultural commodities, *b*) the fact that perfect competition is assumed in most of the attempts to measure the effects of a reduction in the barriers to agricultural trade, and *c*) the significant impact that such attempts may have on the on-going WTO negotiations, it would appear that the results of this paper might be of some interest.

If a conclusion can be drawn, it is the need for further work involving a larger number of imperfect market structures, and a more realistic analytical setting. In spite of all the limitations of the present paper, its findings suggest caution at the bargaining table when evaluating the results of the simulations which assume that perfect competition obtains.

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