Agricultural Trade Liberalization: Evidence from an Emerging Small Country

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Abstract

InoduThis paper analyzes the agricultural trade liberalization in a oligopolistic market. We explore a two- country two good model where a foreign country exports intermediate and …nal goods toward a developing country. We assume that the government of the exporting country wishes to support primary agricultural income and to maximize the national welfare using price policy instruments.The results obtained show that it is often optimal for the exporting country to support their agricultural producers. This practices have disastrous e¤ects on the developing countries. The concern was that the liberalization of agricultural trade combined with the high levels of support for agriculture in exporting countries would lead to rising international prices for food imports. This price rise would deteriorate the competitiveness of the developing countries and would threaten their development programs.

Key words: Liberalization; Agricultural Trade; Emerging Country

JEL: F1; Q1

1 Introduction

In recent years, agricultural trade has become an issue of a growing importance and interest in both developed and less developed countries Hertel (1990), Jorgenson. and Gollop. (1992) and Lancos. and Hertel (1995). Much of the existing analysis assumes competitive, price-taking …rms in the industries a¤ected by liberalization. While this assumption may be valid in many instances, it is unlikely to be appropriate in industries where economies of scale occur over an extended range of output. This paper analyzes the agricultural trade in the later type of market where oligopolistic behavior is likely to prevail.

We explore a two- country two good model: a foreign country exports intermediate and …nal goods toward a developing country. We assume that the government of the exporting country wishes to support primary agricultural income and to maximize the national welfare using price policy instruments.

The model results from a two-stage game. In a …rst stage, the government of the exporting country sets the levels of export and product taxes/subsidies

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in order to maximize the national welfare. Then, the processing …rms of both countries compete for the purchases of the intermediate good (seeds, chemical fertilizers,...) in the foreign country and the sales of the …nal good (wheat, barley, sugar,...) in the developing country.

This paper is organized as follow. Section 2 describes the model. Section 3 analyzes the reaction functions of the …rms and characterizes the equilibrium quantities of the second stage of the game. In section 4 the optimal public intervention in the exporting country is determind. Section 5 concludes, and the appendix contains formal proofs.

2 The model

We consider two countries D (developing country) and F (foreign country) and two goods 1 and 2 with good 1 being an intermediate input for the production of good 2. Foreign country exports goods 1 and 2 towards developing country . In each country, good 1 is produced with perfect competition, while there exists a …xed number of …rms producing good 2, n (resp. $\bar{n}$) …rms in country F (resp. D).

The model results from a two-stage game. In a …rst stage, the government of the exporting country sets the levels of export and product taxes/subsidies in order to maximize the national welfare. In a second stage, the processing …rms of both countries compete a Cournot game, where they set simultaneously levels for the purchases of the intermediate good in the foreign country and the sales of the …nal good in the developing country. Markets of goods 1 and 2 are assumed to be segmented (i.e., each …rm sets its quantities independently in both countries).

We assume that ¯ units of good 1 being used for the production of one unit of good 2. The inverse o¤er function of good 1 in the foreign country is $f(Y_1)$,with $Y_1$is the production of good 1.The …rms' pro…t function is noted $R_1 (Y_1)$. The derivative of $R_1$with respect to Y_1 is then: $R_1^0 = Y_1 f^0 > 0$.

If we denote by X_2 the consumption of good 2, let $h(X_2)$ and $SC(X_2)$ represent respctively the inverse demand function for good 2 in the foreign country and the surplus function of consumers of good 2. The derivative of SC with respect to X_2, is then: $SC' = -X_2 h' > 0$. We adopt similar notations in country D, where the variables are overlined.

We assume that each …rm i of the foreign country consumes X_1^i of good 1 to produce a quantity$Y_2^i$of good 2, of whichX_2^i is consumed in the internal market and E_2^j is exported. In the developing country, a firm j consumes $\tilde{X}_1^j$ of good l to produce $\tilde{Y}_2^j$ of good 2 (entirely consumed in locally), of which E_1^j is imported from country F and $\tilde{Y}_1^j$ is produced locally.

The equilibrium conditions of the markets for goods 1 and 2 are:

$$Y_1 = X_1 + E_1 \tag{1}$$

$$\tilde{X}_1 = \tilde{Y}_1 + Y_1; \tag{2}$$

$$\tilde{X}_2 = \tilde{Y}_2 + E_2 \tag{3}$$

$$Y_2 = E_2 + X_2 \tag{4}$$

In the foreign country, let

$p_1 = f(X_1)$ be the offer price of good 1,

π_1 the internal demand price for good 1,

p_2 the offer price of good 2 in the internal market and

$\bar{p}_2$ the offer price of good 2 in country D

$\pi_2 = h(D_2)$ the final demand price for good 2,

In the developing country, let

$\tilde{p}_1$ be the offer price of good 1, equal to the demand price for good 1 produced in country D,

$\tilde{\bar{\pi}}_1$ the demand price for good 1 produced in country F,

$\tilde{p}_2 = \tilde{h}\ \tilde{D}_2$ the offer price of good 2 in D, equal to the demand price for good

2 in D.

Let t_i and $^1{}_i$ the unit export and production taxes/subsidies of good i in country F.

3 The equilibrium quantities

In the second stage of the game, the firm j producing the good 2 of country D maximizes its profit with respect to $\tilde{Y}_j$ and E_1^j, taking as given the purchases of good 1 in F by the firms 2 of F and by the other firms 2 of D, $X_1$and$E_1^{i\,j}$, the purchases of good 1 in country D by the other firms 2 of D, $\tilde{Y}_1^{i\,j}$, and the sales of the firms 2 of F in D, E_2.

The profit of the firm j producing the good 2 of the foreign country is:

$$\tilde R_2^j = \tilde h\left(\tilde Y_1 + E_1 + E_2\right)\tilde Y_2^j - \tilde f\left(\tilde Y_1\right)\tilde Y_1^j$$
$$- f\left(E_1 + X_1\right)E_1^j - \tilde C_2^j\left(\tilde Y_2^j\right) + \Phi E_1^j \quad (5)$$

where $\Phi = \mu_1 + t_1 = p_1 - \pi_1$ and $\tilde C_2^j\left(\tilde Y_2^j\right)$ is the cost of the factors of production except good 1.

The first order conditions of the profit maximization are:

$$\frac{\partial \tilde R_2^j}{\partial \tilde Y_1^j} = \tilde h + \tilde h' \tilde Y_2^j - \tilde f - \tilde f' \tilde E_1^j - \tilde c_2^j = 0 \quad (6)$$

$$\frac{\partial \tilde R_2^j}{\partial E_1^j} = \tilde h + \tilde h' \tilde Y_2^j - f - f' E_1^j - \tilde c_2^j + \Phi = 0 \quad (7)$$

where $\tilde c_2^j = \tilde c_2^{j*}\left(Y_2^j\right)$ is the marginal cost of production.

These conditions indicate that in the absence of intervention ($\Phi = 0$), the firm j producing the good 2 of the developing country equalizes the perceived marginal revenue of its sales on the internal market, $\tilde h + h'\tilde Y_2^j$; with the perceived marginal outlay for imports of the intermediate good 1, $f + f'E_1^j + \tilde c_2^j$, as well as with the perceived marginal outlay for local purchases of good 1, $\tilde f + \tilde f'\tilde Y_1^j + \tilde c_2^j$. The introduction of $\Phi < 0$ leads to an increase in the perceived marginal outlay for imports, from $f + f'E_1^j + \tilde c_2^j$ to $f + f'E_1^j + \tilde c_2^j - \Phi$.

The net marginal profitability of imports of good 1 by the firm of the developing country, becoming positive, the profit being captured as a budgetary revenue by the country F, and the total marginal profitability being equal to zero. Thus, the use of Φ at a negative level allows the government of the foreign country to tax the profit of the developing firms 2 via their imports of good 1. On the other hand, the firm i producing the good 2 of country F maximizes its profit with respect to its domestic sales, X_2^i, and its exports, E_2^i, taking as given the purchases of good 1 in the foreign country by the firms 2 of the developing country, E_1, the domestic sales of good 2 by the other firms 2 of country F, X_2^{-i}, as well as the sales of good 2 in the developing country by the firms 2 of country the developing country and by the other firms 2 of the foreign country, $\tilde Y_2$ and E_2^{-i}.

The profit of the firm i producing the good 2 in the foreign country is:

$$R_2^i = \left[h\left(X_2\right)X_2^i + \tilde h\left(E_2 + \tilde Y_2\right)E_2^i -\right.$$
$$\left. f\left(X_2 + E_2 + E_1\right)X_1^i - C_2^i\left(Y_2^i\right)\right] + \left(AX_2^i + BE_2^i\right) \quad (8)$$

where $C_2^i(Y_2^i)$ is the cost of the production factors except the cost of the intermediate good.

$$A = \mu_1 + \mu_2 = (p_1 - \pi_1) + (p_2 - \pi_2);$$

$$B = \mu_1 + t_1 = (p_1 - \pi_1) + (\tilde{p}_2 - \tilde{\pi}_2);$$

The first term of R_2^i is the profit net of budgetary transfers, the second term, $(AX_2^i + BE_2^i)$, is the budgetary transfers.

The two first order conditions of profit maximization are:

$$\frac{\partial R_2^i}{\partial X_2^i} = h + h' X_2^i - f - f' X_1^i - c_2^i + A = 0 \qquad (9)$$

$$\frac{\partial R_2^i}{\partial E_2^i} = \tilde{h} + \tilde{h}' E_2^i - f - f' X_1^i - c_2^i + B = 0 \qquad (10)$$

where $c_2^i = c_2^i(Y_2^i)$ is the marginal cost of production.

Thus in the absence of intervention, the firm i producing the good 2 in the foreign country equalizes the perceived marginal revenue of its sales on the internal market, $h + h' X_2^i$, as well as the perceived marginal revenue of its export sales, $\tilde{h} + \tilde{h}' E_2^i$, with its perceived marginal outlays, $f + f' X_1^i + c_2^i$. For the sales of good 2 on the internal market, optimality requires the equalization of the price and the marginal cost of production, and thus the correction of two distortions.

For the sales of good 2 on the developing market, optimality requires the equalization of the real marginal outlay (taking into account the adjustment of the sales of firms 2 of D as well as the adjustment of the sales of the other firms 2 of country F and of the production cost. The market equilibrium equations follows that

$\tilde{Y}_1 = \beta \tilde{Y}_2 - E_1$

and

$X_1 = \beta (E_2 + X_2)$

The resolution of the system formed by these two equations and equations (6), (7), (9) and (10) determines the equilibrium level of X_2, E_2, E_1, $\tilde{Y}_2$, $\tilde{Y}_1$ and X_1.

4 The optimal intervention

We assume that the government of the exporting country wishes to support primary agricultural income and maximize the national welfare (equal to the sum of the surplus levels of the producers of good 1, the n firms producing good 2 and the final consumers less the cost of intervention) using price policy instruments (production and export taxes/subsidies). Our objective is to characterize the optimal levels instruments using the targeting principle.

Lemma

Under the assumption of strategic substitutability between the purchases of good 1 and between the sales of good 2 for the different firms and if $f + f''E_1 > 0$ and $\bar{c}'_2 \geq 0$ we have:

$\frac{\partial \bar{Y}_2}{\partial E_2} < 0$, $\frac{\partial \bar{Y}_2}{\partial E_1} > 0$, $\frac{\partial \pi_1}{\partial E_1} < 0$, $\frac{\partial \pi_1}{\partial E_2} < 0$ and $\frac{\partial \pi_1}{\partial X_1} = -f''E_1/n$, which positivity depends on the concavity /convexity of the inverse offer function of good 1 in country D.

Proof: see appendix A1

Proposition 1 :

The optimal equilibrium can be obtained with the following level of the intervention:

$$\mu^*_1 = Y_1 f' + \frac{1}{n} X_1 f' + E_1 \frac{\partial \pi_1}{\partial X_1}$$

$$t^*_1 = \lambda Y_1 f' + n \frac{\partial Y_2}{\partial E_1} \frac{\partial R^i_2}{\partial \bar{Y}_2} + E_1 \frac{\partial \pi_1}{\partial E_1} - \mu_1$$

$$\mu^*_2 = \frac{1}{n} SC' = -\frac{1}{n} X_2 h'$$

$$t^*_2 = \frac{n-1}{n} \bar{h}' E_2 + n \frac{\partial \bar{Y}_2}{\partial E_2} \frac{\partial R^i_2}{\partial \bar{Y}_2} + E_1 \frac{\partial \pi_1}{\partial E_1} - \mu_2$$

Proof: See appendix A2

The instrument on exports of the intermediate good, t^*_1, is used simultaneously to improve the terms of trade on this market ($E_1 \frac{\partial \pi_1}{\partial E_1} < 0$); and to diminish the imports of good 1 by the foreign firms 2, in order to reduce their total production, and thus increase the marginal revenue of exports by the domestic firms 2 ($n \frac{\partial \bar{Y}_2}{\partial E_1} \frac{\partial R^i_2}{\partial \bar{Y}_2} < 0$). The intervention thus corresponds to an export tax on good 1, $t^*_1 < 0$. Hence, we may state:

Proposition 2:

- According to the targeting principle, If only price instruments are at disposal, the least-distorting way to redistribute income towards producers of good 1 is a producer subsidy, $\mu_1 = \lambda Y_1 f' > 0$.

- The instrument on exports of the intermediate good, corresponds to an export tax on good 1, $t_1 < 0$.

If we suppose that $\mu_2 = 0$, t_2 is the sum of three terms: (i) a negative term representing improvement of the terms of trade on the market of good 1, $E_1 \frac{\partial \pi_1}{\partial E_2} < 0$, (ii) a positive term that may be seen as a correction of the strategic distortion on the downstream foreign market, $n \frac{\partial \bar{Y}_2}{\partial E_2} \frac{\partial R_2^{j}}{\partial \bar{Y}_2} > 0$ and, (iii) a negative terms of trade correction on market 2, $(n - 1)\bar{d}' E_2 / n < 0$.

Proposition 3:

If $\mu_2 = 0$, an export tax may be the optimal instrument to prevent the foreign firms from excessive competition in the developing market.

Concluding comments

The results obtained in this paper show that support their agricultural producers is an often optimal strategy for the exporting countries. Indeed a number of countries, particularly the EU, built up large agricultural surplus disposal programs based on export subsidies. This practices, considered unacceptable under general WTO rules, have disastrous effects for the developing countries. The concern was that the liberalization of agricultural trade combined with the high levels of support for agriculture in exporting countries would lead to rising international prices for food imports. This price rise would deteriorate the competitiveness of the developing countries and would threaten their development programs.

Appendix

1. Proof of Lemma 1

Equation (6) implicitly defines $\bar{Y}_2 = \bar{Y}_2(E_2; E_1)$, with

$$\frac{\partial \bar{Y}_2}{\partial E_2} = -\frac{\bar{n}\frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial E_2}}{\frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial \bar{Y}_1^j} + (\bar{n} - 1)\frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial \bar{Y}_1^{-j}}} \qquad (A.1)$$

and

$$\frac{\partial \bar{Y}_2}{\partial E_2} = -\frac{\left(\frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial \bar{Y}_1^j} - \frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial E_1^j}\right) + (\bar{n} - 1)\frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial E_2}}{\frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial \bar{Y}_1^j} + (\bar{n} - 1)\frac{\partial^2 \bar{R}_2^j}{\partial \bar{Y}_1^j \partial \bar{Y}_1^{-j}}}$$

(A.2)

Differentiating (), we obtain $\bar{\pi}_1 = \bar{\pi}_1(X_1; E_1; E_2)$ with

$$\frac{\partial \bar{\pi}_1}{\partial X_1} = -\frac{1}{n} f'' E_1;$$

$$\frac{\partial \bar{\pi}_1}{\partial E_1} = -\frac{1}{\bar{n}}(f' + f'' E_1) + \frac{\partial \bar{Y}_2}{\partial E_2} \frac{\frac{\partial^2 \bar{R}}{\partial E_1^j \partial \bar{Y}_1^j} + (\bar{n} - 1)\frac{\partial^2 \bar{R}_2^j}{\partial E_1^j \partial \bar{Y}_1^{-j}}}{\bar{n}}; \qquad (A.3)$$

$$\frac{\partial \pi_1}{\partial E_2} = \frac{\partial^2 R_2^j}{\partial E_1 \partial E_2} + \frac{\partial Y_2}{\partial E_2}\frac{\frac{\partial^2 R_2^j}{\partial E_1^j \partial Y_1^j} + (n-1)\frac{\partial^2 R_2^j}{\partial E_1^j \partial Y_1^{i \neq j}}}{n} \qquad (A.4)$$

Using the second order conditions for the profit maximisation and the assumption of strategic substitutability we obtain $\frac{\partial^2 R_2^j}{\partial E_1 \partial E_2} < 0$, $\frac{\partial^2 R_2^j}{\partial E_1^j \partial E_1^{i \neq j}} < 0$, $\frac{\partial^2 R_2^j}{\partial Y_1^j \partial Y_1^{i \neq j}} < 0$ and $\frac{\partial^2 R_2^j}{\partial E_1 \partial X_1} < 0$.

When the strategic substitutability between the purchases of good 1 stands holds for a perfectly elastic final demand, we obtain: $f' + f''E_1 > 0$ and $f' + f''Y_1 > 0$.

From the assumption of strategic substitutability between the sales of good 2 we obtain: $\frac{\partial^2 R_2^j}{\partial Y_1^j \partial E_2} < 0$ and $\frac{\partial^2 R_2^j}{\partial E_1^j \partial E_2} < 0$ which yield $h' + h''Y_1 < 0$.

From inspection of the eqs. (A.1) and (A.2), it can seen that the numerator of $\frac{\partial Y_2}{\partial E_2}$ equals $-f' - n(f' + f''Y_1)$, that $\frac{\partial^2 R_2^j}{\partial E_1^j \partial Y_1^{i \neq j}} = h' + h''Y_1$ and that $\frac{\partial^2 R_2^j}{\partial E_1^j \partial Y_1^{i \neq j}} = 2h' + h''Y_2 - c_2^{j''}$. From the above and if $c_2^{j''} \ge 0$, these three expressions are negative. Assuming that $f' + f''X_1 > 0$, leads to the assertions of the lemma.

2. Proof of Proposition 1

The lagrangean associated with this program is:

$$L = R_1 + \sum_{i=1}^{n} \left[h(X_2)X_2^i + h\left(E_2 + Y_2\right)E_2^i - f(X_2 + E_2 + E_1)X_1^i - C_2^i(Y_2^i)\right] +$$
$$SC - \Phi E_1 + \lambda\left(R_1 - \bar{R}_1\right) \qquad (A.5)$$

The solution for optimal intervention is found by totally differentiating this lagrangean. From the previous lemma this total derivative can be written :

$$dL = \left[-A + \frac{1}{n}X_1 f' + E_1\frac{\partial \pi_1}{\partial X_1} + \lambda Y_1 f' + \frac{1}{n}SC'\right]dX_2 +$$
$$\left[-\Phi + n\frac{\partial Y_2}{\partial E_1}\frac{\partial R_2^i}{\partial Y_2} + E_1\frac{\partial \pi_1}{\partial E_1} + \lambda Y_1 f'\right]dE_1 +$$
$$\left[-B + \frac{1}{n}X_1 f' + E_1\frac{\partial \pi_1}{\partial X_1} + \lambda Y_1 f' + \frac{n-1}{n}h'E_2 + n\frac{\partial Y_1}{\partial E_2}\frac{\partial R_2^i}{\partial Y_2} + E_1\frac{\partial \pi_1}{\partial E_1}\right]dE_2 \qquad (A.6)$$

The optimal intervention is found by equating to zero the partial derivatives of the lagrangean with respect to X_2, E_2, and E_1. This directly gives the optimal levels of the instruments A and B. From equation (8), the optimal equilibrium $\rho_1^*; \rho_2^*; t_1^*$ and t_2^* can be obtained.

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