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Economics of Export Taxation in a Context of Food Crisis

A Theoretical and CGE Approach Contribution

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ABSTRACT

This paper aims to assess the rationales for the use of export taxes, in particular in the context of a food crisis. First, we summarize the effects of export taxes using both partial and general equilibrium theoretical models. When large countries have an objective of constant food domestic prices, in the event of an increase in world agricultural prices the optimal response is to decrease import tariffs in net food-importing countries and to increase export tariffs in net food-exporting countries. The latter decision is welfare improving while the former is welfare reducing: it is the price to pay to get domestic food prices constant. Small countries are harmed by both decisions. Second, we illustrate the costs of a lack of cooperation in and regulation of (binding process) such policies in a time of crisis using a global computable general equilibrium (CGE) model illustration, mimicking the mechanisms that have appeared during the recent food price surge. We conclude with a call for international regulation, in particular because small net food-importing countries may be substantially harmed by these beggar-thy-neighbor policies that amplify the already negative impact of the food crisis.

Keywords: export taxes, food crisis, optimum tariff, computable general equilibrium

JEL classification: F13, F15

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1. INTRODUCTION

The nature of the world trading system is deeply mercantilist. Consequently, policy decisions are usually aimed at increasing exports and/or decreasing imports, and governments frequently implement import taxes and export subsidies. Export taxes and export restrictions, however, are policy instruments that appear much more difficult to understand than import tariffs.

Nevertheless, export restrictions are a common practice. For instance, some developing countries implemented export taxes and export restrictions during the recent food crisis (2006–2008): Bangladesh, Brazil, Cambodia, China, Egypt, India, Madagascar, Nepal, Thailand, and Vietnam on rice, and Argentina, India, Kazakhstan, Nepal, and Pakistan on wheat (see Table A.1 in appendix).

Beyond crisis periods, export restrictions are, in fact, trade measures that are permanently adopted by countries throughout the world. In 2004 Piermartini noted that approximately one-third of World Trade Organization (WTO) members impose export duties. She gave the examples of export taxes implemented by Indonesia on palm oil; by Madagascar on vanilla, coffee, pepper, and cloves; by Pakistan on raw cotton; by the Philippines on copra and coconut oil; by Indonesia on palm oil; and by the European Union on wheat (see Table A.2 in appendix).

Economic analysis provides several rational justifications for using these instruments:

i. *Terms-of-trade justification.* This is perhaps the most important justification. By restricting its exports, a country that supplies a significant share of the world market in a commodity can raise the world price of that commodity. This implies an improvement in that country's terms of trade. The reasoning behind this argument is very similar to the optimum tariff argument (Bickerdike 1906; Johnson 1953), which states that by implementing a tariff on its imports, a "large" country can significantly decrease the demand for a commodity that it imports; this therefore leads to a decrease in the commodity's world price, which is again an improvement in the terms of trade. Rodrik (1989) derives an optimal tax structure, with taxes differentiated by domestic exporting firms, and shows that it depends on foreign demand elasticity and the size distribution of firms. Eaton and Grossman (1986) study the use of export taxes but focus on the profit-shifting argument and less on the terms-of-trade argument.

ii. *Food security and final consumption price.* By creating a wedge between the world price and the domestic price, a government can lower the latter by reorienting domestic supply toward the domestic market. Piermartini (2004) provides the example of the Indonesian government imposing export taxes on palm oil products, including crude and palm cooking oil, in 1994, as it considered cooking oil an "essential" commodity. This rationale was often used during the food crisis of 2006–2008 by governments to justify the implementation of export taxes and other forms of export restrictions.

iii. *Intermediate consumption price.* Export taxes on primary commodities (especially unprocessed ones) work as an indirect subsidy to higher-value-added manufacturing or processing industries by lowering the domestic price of inputs compared to their world—nondistorted—price. While the previous justification addresses the use of export taxes to lower price for final consumption, this one is concerned with decreasing prices for intermediate consumption. This justification follows a reasoning that is similar to the theory of effective protection and is noted by Corden (1971). For example, in 1988, Pakistan imposed an export tax on raw cotton in order to stimulate the development of the yarn cotton industry. Export taxes on palm oil are imposed in Indonesia and Malaysia in order to support the development of downstream industry (biodiesel and cooking oil; see Amiruddin 2003).

iv. *Public receipts.* Export taxes provide revenues to developing countries with limited capacity to rely on domestic taxation. This is a second-best argument because in order to raise a given amount of revenue, the imposition of lump-sum taxes is a first-best policy (Ramsey 1927; Diamond 1975). Deardorff and Rajaraman (2005) demonstrate under a simple partial

equilibrium model, then under general equilibrium, that for a country exporting a (primary) product under monopsony's power, the best available policy may be to tax exports so as to extract some of the profits of the monopsonist; doing so worsens the distortion but increases domestic public receipts to the detriment of monopsony's rents.

v. *Income redistribution.* Like import tariffs, export taxes are measures that imply redistribution of income to the detriment of domestic producers of the commodity taxed and to the benefit of domestic consumers and public revenues.

vi. *Stabilization of domestic prices.* In order to stabilize domestic prices for export producers, some developing countries use variable tax rates. Piermartini (2004) provides the example of Papua New Guinea, which established an export tax / subsidy rate for cocoa, coffee, copra, and palm oil equal to one-half the difference between the reference price—calculated as the average of the world price in the previous 10 years—and the actual price for the year.

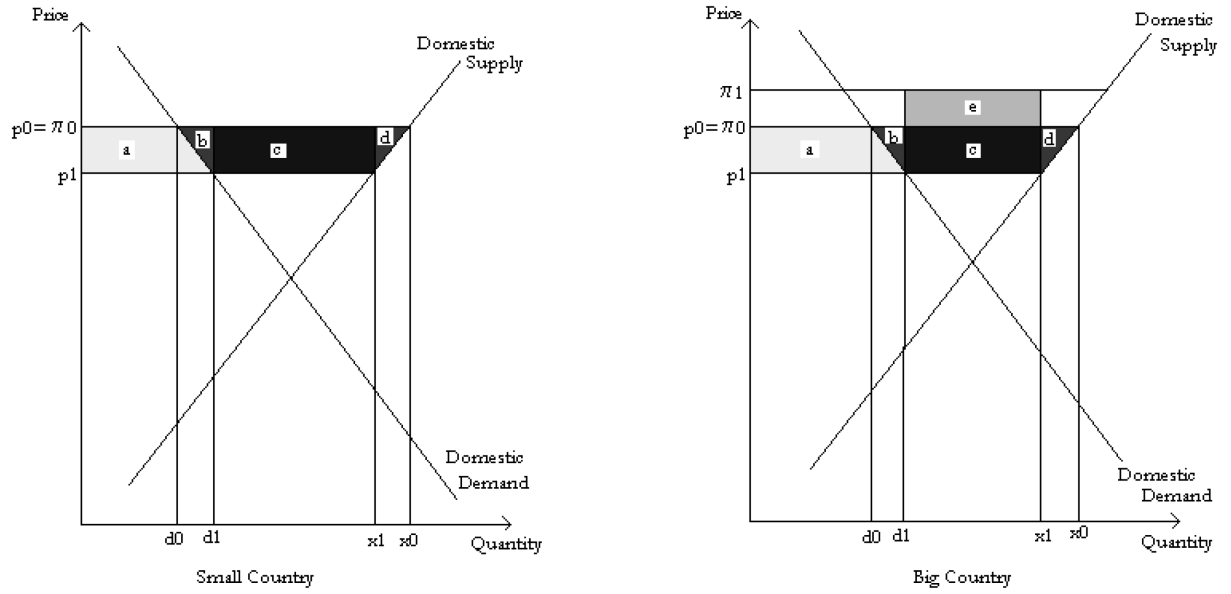
It appears that countries have a relatively large degree of freedom in the implementation of such taxes, as the WTO does not prohibit export taxes and other forms of export restrictions. More precisely, as stated by Crosby (2008), "general WTO rules do not discipline Members' application of export taxes," but "they can agree—and several recently acceded countries, including China, have agreed—to legally binding commitments in this regard." In addition, the Uruguay Round Agreement on Agriculture stipulates that when implementing a new export restriction, a WTO member must (i) consider the implications of these policies on food security in importing countries, (ii) give notice to the Committee on Agriculture, and (iii) consult with WTO members that have an interest. This agreement does not institute any penalty for countries ignoring the rules. Finally, this form of trade policy does not receive a great deal of attention from the public or the academic establishment.

This paper provides a theoretical and an empirical background contributing to a better understanding of export taxes, in particular in the context of food crises. Sections 2 and 3 provide an analytical framework that can help understand these trade policies better; while Section 2 uses a partial equilibrium framework, Section 3 uses a general equilibrium framework and studies the case of countries with an objective of food security. In Section 4 we use the MIRAGE model to illustrate the potential impact of world price shocks and how countries may react using either increased export taxes and/or reduced import taxes, emphasizing the effects of noncooperative trade policies in this context. Section 5 concludes.

2. THE ECONOMICS OF EXPORT TAXATION: A PARTIAL EQUILIBRIUM ANALYSIS

The objective of this section is to provide a simple theoretical framework that enables an understanding of the effects of export restrictions. Figure 1 depicts the impacts of an export restriction imposed by a small country (on the left side) and by a large country (on the right side). The difference between restrictions in small and large countries consists of the impact of a variation in net supply (exports) upon world prices. A change in a small country's exports does not lead to a variation in world prices, as the country is too small to have an influence on world markets. In contrast, when a large country modifies its net supply (level of exports) to the world markets, the quantity is sufficiently large to exert an influence on world prices.

Figure 1. A partial equilibrium analysis of an export tax



Source: Authors' investigation.

The Case of a Small Country

Consider first the case of a small country imposing an export tax t (defined in specific terms). The initial domestic price is p_0, while the initial world price is π_0. At these initial prices, domestic demand is d_0 and is less than domestic supply, x_0, the difference being exported on the world market. As these exports are taxed, at initial prices domestic producers prefer offering their supply on the local market (untaxed) rather than on the world market (taxed). On the domestic market, supply is increased, reducing the domestic price until $p_1 + t = \pi_0$, while the world price is, by definition, unchanged. At this level of prices, domestic producers are indifferent between selling their products on local markets and exporting them.

Domestic consumers benefit from this policy, as they consume more ($d_1 > d_0$) at a lower price ($p_1 < p_0$). Their surplus is increased by the yellow area denoted as a.

Domestic producers are hurt by this policy, as they produce and sell less ($x_1 < x_0$) at a lower price ($p_1 < p_0$). Their surplus is reduced by ($a + b + c + d$).

Finally, the export tax increases public revenues by the blue area, denoted as c, as the post-tax level of exports is the difference between x_1 and d_1 and as the unit tax is $\pi_0 - p_1$.

As a consequence, policymakers should not implement such a policy if it is assumed that one dollar of consumers' surplus has the same value as one dollar of producers' surplus and one dollar of

public revenue; indeed, an export tax policy is detrimental to a small country, as the loss of producers' surplus ($a + b + c + d$) is larger than the gain in consumers' surplus (a) and in public revenues (c). All these effects sum up to a loss of domestic welfare measured by the red areas ($b + d$), which are equivalent to the Haberger triangles (deadweight losses) in the theory of protectionism.

This policy has distributional effects. For instance, if policymakers have a food security objective that implies a decrease in the domestic price, export taxes are efficient in the sense that they augment domestic consumption and reduce the local consumer price. They increase the surplus of food consumers that may be overweighted in the government function in this case.[1] A consumption subsidy will be a first-order instrument (more efficient), but it will have a cost for the government. Similarly, if we assume that the government has difficulties raising taxes on other products and/or sources of income (for example, tax on firm profits), the shadow price of the export tax will be superior to unity.[2] Both arguments explain why one dollar of increase in the surplus ($a + c$) will be more important for the government than one dollar of inefficiency losses ($b + d$).

The Case of a Large Country

The case of a large country differs in the sense that the world price is affected by the export tax. The reason is that a large country is assumed to export a significant share of world exports, such that if these exports are reduced, world exports are significantly reduced and the world price increases. Consumers' and producers' surpluses are identically affected, but public revenues are augmented by ($c + e$) as the world price is raised up to π_1; the post-tax level of exports is still the difference between x_1 and d_1, but the unit tax is now $\pi_1 - p_1$. This is all the more important, as the implementation of this policy can lead to an augmentation of domestic welfare if the green area denoted by e is larger than the sum of the red areas ($b + d$). While $b + d$ represents welfare losses coming from these new distortions, e represents an improvement in national terms of trade. Final exports ($x_1 - d_1$) are sold at π_1 and not π_0, with the difference ($\pi_1 - \pi_0$) representing a gain in terms of trade for each unit exported. Simultaneously, the same political economy elements are still in play, as domestic consumers and the public budget are favored while domestic producers are hurt by this decision.

It is noteworthy that in the long run, consequences could be different because, as noticed by Mitra and Josling, "producers in the rest of the world will increase their supply in response to higher prices. As a result of increased supply, the price adjusts downward from the short-run level, but still remains above the pre-restriction level" (2009, 11). Therefore, it is quite possible that export restrictions could be beneficial in the short run while having negative consequences in the long run thanks to adjustments in the terms of trade.

Finally, if we consider the case of an export tax on a primary commodity used for intermediate consumption in a manufactured good, the implication is that the export tax decreases the domestic price of the intermediate good under the world price and increases the unit value added in the manufacturing sector. This kind of "degressive export tax structure" (greater than zero on the raw commodity; zero or close to zero on the processed good) exists in Pakistan (raw cotton), China (steel products, metal ore sand, and ferro-alloys), and Indonesia and Malaysia (palm oil). It results in an expansion of the production volume of the manufactured sector to the detriment of the raw commodity in the country that implements it. As stated by Corden (1971), "An export tax on an exportable input reduces its domestic price, and so raises the effective protection for the using industry, irrespective of whether the latter produces an exportable or an importable. Thus a country which exports raw cotton and imposes an export tax on it reduces the costs of its textile industry and hence protects the latter."

[1] When large net food importers reduce import tariffs or large net food exporters increase export taxes or implement export prohibitions on food, the objective is clearly to reduce domestic food prices. This policy favors local consumers of food and is at the detrimental of local producers.

[2] It has also been argued that export taxes on commodities (cocoa, oil) have been administrated in a very convoluted way in several developing countries (for example, Côte d'Ivoire) and have fostered corruption, as this resource is less monitored than other taxes paid by local customers/constituencies.

3. THE ECONOMICS OF EXPORT TAXATION IN THE CONTEXT OF A FOOD CRISIS: A GENERAL EQUILIBRIUM ANALYSIS

The objective of this section is to provide a more complete theoretical framework in order to understand the effects of export taxation in general equilibrium. We develop a general model of international trade between three countries, two large and one small. The purpose is to understand that as far as a food crisis is concerned, there is a distinction to be made between (i) large food-exporting countries that can increase the world price of the commodity they export while decreasing the domestic price of this commodity, (ii) large food-importing countries that can also have an impact on world prices and accept a deterioration in their terms of trade in order to decrease the domestic price of an agricultural commodity, and (iii) small countries that cannot affect world prices and are harmed by the beggar-thy-neighbor policies of large countries, whether food exporting or food importing. The entire process is a "trade game" with strategic interdependence and decisions on import tariffs and export taxes.

The Model

We consider a model of international trade between three countries: two are large (called 1 and 2), meaning that they are price makers on the world market, and the third (called 3) small, meaning that it is a price taker. They produce and trade two commodities, the agricultural one (A) and the industrial one (I). Country 1 has a comparative advantage in and exports the agricultural good while it imports the industrial one. In contrast, countries 2 and 3 have a comparative advantage in and export the industrial good while they import the agricultural good. Country i's welfare function is denoted as U_i, and the local demand of country i for good k is $\mathrm{D_i^k}, \forall \mathrm{i} = 1,2,3;\ \forall \mathrm{k} = \mathrm{A}, \mathrm{I}$. Let us call $\mathrm{X_i^k}, \forall \mathrm{i} = 1,2,3, \forall \mathrm{k} = \mathrm{A}, \mathrm{I}$ the production of good k in country i. π^k is the nominal world price of good k, and $p^k{}_i$ is the nominal local price of good k in country i. π is the relative price of good A on the world market in terms of industrial good p_i within country i. y_i is the real income in country i, while Y_i is the nominal income in country i.

Let us assume the following:

i. Technology is given by "well-behaved" production functions.

ii. Competition is perfect in each country in both product and factor markets.

iii. Welfare depends only on local consumption of both goods:

$$\mathrm{U_i} = \mathrm{U_i}\left(\mathrm{D_i^A}, \mathrm{D_i^I}\right) \text{ with: } \frac{\partial \mathrm{U_i}}{\partial \mathrm{D_i^k}} > 0, \forall i, \forall k. \tag{1}$$

iv. Government selects either an import tariff/subsidy or an export tax/subsidy in order to maximize the national welfare function.

v. Trade is balanced in each country:

$$\mathrm{X_i^I} - \mathrm{D_i^I} = \pi.\left(\mathrm{D_i^A} - \mathrm{X_i^A}\right) \tag{2}$$

Both sides are positive for $i = 2$ or 3 and negative for $i = 1$.

i. There is no transportation cost.

ii. The tariff/export tax revenue is redistributed totally to local agents without losses.

We first derive analytically the effects of an import tariff in countries 2 and 3 and of an export tax in country 1. The reasons we select these instruments will become apparent later. We then determine the optimal policy for each country and conclude.

An Import Tariff in the Large Food-importing Country

Let us first consider the traditional case for the impact of a tariff on import demand. In the case of 2, the demand for imports is:

$$M_2^A = D_2^A(p_2, y_2) - X_2^A\left(X_2^I(p_2)\right). \tag{3}$$

Total differentiation brings:

$$dM_2^A = \frac{\partial D_2^A}{\partial p_2}(p_2, y_2)dp_2 + \frac{\partial D_2^A}{\partial y_2}(p_2, y_2)dy_2 - \frac{dX_2^A}{dX_2^I}\frac{dX_2^I}{dp_2}dp_2. \tag{4}$$

We have:

$\sigma^c{}_2 = -\frac{p_2}{M_2^A}\frac{\partial D_2^A}{\partial p_2}(p_2, y_2)$; $\sigma^c{}_2$ is the compensated relative price elasticity of demand for agricultural imports in country 2; $m_2 = p_2\frac{\partial D_2^A}{\partial y_2}(p_2, y_2)$; m_2 is the marginal propensity to spend on agricultural goods in country 2; $e_2 = -\frac{p_2}{E_2^I}\frac{dX_2^I}{dp_2}$; e_2 is related to a relative price elasticity of supply for industrial products in country 2.

Let us find an expression of dy_2. If $V_2 = V_2(p_2, Y_2)$ is the maximum utility that can be attained by 2 when the domestic price is p_2 and nominal income is Y_2, Roy's theorem gives:

$$D_2^A = -\left.\frac{\partial V_{2(p_2,Y_2)}}{\partial p_2}\right/\frac{\partial V_{2(p_2,Y_2)}}{\partial Y_2} = -\left.V_{2p_2}\right/V_{2Y_2} \tag{5}$$

Therefore:

$dy_2 = \frac{dV_2}{V_{2Y_2}} = dY_2 - D_2^A.dp_2 = dX_2^I + p_2.dX_2^A + X_2^A.dp_2 + d(\pi t M_2^A) - D_2^A.dp_2$. Since perfect competition ensures that the economy is located on the production frontier: $dX_2^I + p_2.dX_2^A = 0$, we have

$$dy_2 = -M_2^A.dp_2 + M_2^A d(p_2 - \pi) + \pi t dM_2^A = -M_2^A.d\pi + \pi t dM_2^A\,. \tag{6}$$

Equation (6) states that in this international trade model, a country's real income is affected either by a change in world prices ($d\pi < 0$ means that the world price for the agricultural good decreases; this is the good that 2 imports) or a variation in quantities traded (real income increases when trade increases, other things being equal).

Integrating equation (6) and the previous definitions inside (4), we obtain:

$$\frac{dM_2^A}{M_2^A} = \left\{-\sigma^c{}_2.\frac{dp_2}{p_2} - \frac{m_2}{1+t}\frac{d\pi}{\pi} - \frac{e_2}{1+t}\frac{dp_2}{p_2}\right\}/d_2 \tag{7}$$

Where:

$$d_2 = 1 - [m_2 t/(1+t)].$$

Result 1. In the large food-importing country, when imposing a tariff, four mechanisms are at play.

i. *A substitution effect on domestic consumption: under constant real income, a tariff increase leads to a domestic agricultural price increase, which reduces domestic consumption of the agricultural good in favor of other goods.*

ii. *A substitution effect on domestic production: under constant real income, a tariff increase leads to a domestic agricultural price increase, which expands domestic production of the agricultural good to the detriment of other goods.*

iii. The imposition of a tariff on this large country's imports of agricultural goods reduces the world price of this good, which implies that terms of trade are improved for this country.

iv. A multiplier effect: an increase in real income increases demand for imports, which in turn increases tariff receipts, which increases real income, and so on. Starting from free trade (t = 0), this effect is nil.

An Export Tax in the Large Food-Exporting Country

We turn now to the case of country 1. Its supply of agricultural exports is:

$$E_1^A = X_1^A\left(X_1^I(p_1)\right) - D_1^A(p_1, y_1). \tag{8}$$

Total differentiation brings:

$$dE_1^A = \frac{dX_1^A}{dX_1^I}\frac{dX_1^I}{dp_1}dp_1 - \frac{\partial D_1^A}{\partial p_1}(p_1, y_1)dp_1 - \frac{\partial D_1^A}{\partial y_1}(p_1, y_1)dy_1 \tag{9}$$

$\sigma^c{}_1 = -\frac{p_1}{E_1^A}\frac{\partial D_1^A}{\partial p_1}(p_1, y_1)$ is the compensated relative price elasticity of supply of agricultural exports in 2, $m_1 = p_1\frac{\partial D_1^A}{\partial y_1}(p_1, y_1)$ is the marginal propensity to demand agricultural goods in 1, and $e_1 = -\frac{p_1}{M_1^I}\frac{dX_1^I}{dp_1}$ is the relative price elasticity of the supply of industrial goods in 1. Let us find an expression of dy_1. As for $i = 2$, $V_1 = V_1(p_1, Y_1)$ is country 1's indirect utility and Roy's theorem is:

$$D_1^A = -\frac{\frac{\partial V_{1(p_1,Y_1)}}{\partial p_1}}{\frac{\partial V_{1(p_1,Y_1)}}{\partial Y_1}} = -\frac{V_{1_{p_1}}}{V_{1_{Y_1}}} \tag{10}$$

Therefore:

$$dy_1 = \frac{dV_1}{V_{1_{Y_1}}} = dY_1 - D_1^A.dp_1 = dX_1^I + p_1.dX_1^A + X_1^A.dp_1 + d\left(p_1t_1E_1^A\right) - D_1^A.dp_1$$

Following similar manipulations we obtain:

$$dy_1 = E_1^A.d\pi + p_1t_1dE_1^A \tag{11}$$

Equation (11) is important as it states that country 1's real income is affected either by a change in world prices (terms of trade effect; $d\pi > 0$ means that the agricultural good's world price increases; this is the good that 1 exports) or a variation in quantities traded (real income increases when trade increases, other things being equal). The terms-of-trade effect is proportional to the amount of country 1's agricultural exports. Integrating equation (11) and the previous definitions inside (9), we obtain:

$$\frac{dE_1^A}{E_1^A} = \left\{\sigma^c{}_1.\frac{dp_1}{p_1} - m_1(1+t_1)\frac{d\pi}{\pi} + (1+t_1).e_1\frac{dp_1}{p_1}\right\}/d_1 \tag{12}$$

Where:

$$d_1 = 1 + m_1t_1.$$

Result 2. *In the large food-exporting country, when imposing a tax on its agricultural exports, four mechanisms are at play.*

i. A substitution effect on domestic consumption: under constant real income, a tax on agricultural exports leads to a domestic agricultural consumer price decrease, which in turn augments the domestic consumption of the agricultural good ("food security effect").

ii. A substitution effect on domestic production: under constant real income, a tax on agricultural exports leads to a domestic agricultural producer price decrease, which decreases domestic production of the agricultural good ("antifarmer effect").

iii. The imposition of a tax on exports of an agricultural good increases the world price of the good, as this is a large country, which implies that its terms of trade are improved.

iv. A divisor effect: an increase in real income increases demand for the agricultural commodity, which decreases export supply of the agricultural commodity, which in turn reduces export tax receipts, which decreases real income. Starting from free trade (t = 0), this effect is nil.

As far as country 3 is concerned, the problem is similar to 2, as it has a comparative disadvantage in the production of the agricultural good and the country imports this good. The only difference is that it is a small country, such that a change in its real income is expressed as:

$$dy_3 = \pi t_3 dM_3^A \tag{13}$$

A Trade War of Import Tariffs and Export Taxes

If country 3 implements a tariff on its agricultural imports, it decreases its traded imports and real income is negatively affected. Country 3's reaction function is:

$$t_3 = 0 \tag{14}$$

The definition of the optimal responses for countries 2 and 1 is easy. As far as 2 is concerned, its program consists of selecting a production structure and a world price that maximize real income:

$$\mathrm{Max}_{X_2^I,\pi}\, U_2 = U_2\left(D_2^A; D_2^I\right) = U_2\left(X_2^A + M_2^A; X_2^I - E_2^I\right)$$

Under:

$$E_2^I(\pi) = \pi M_2^A \tag{15}$$

$$X_2^I = -p_2 X_2^A + \text{constant} \tag{16}$$

$$p_2 = \pi(1 + t_2) \tag{17}$$

(15) defines trade balance. (16) defines production frontier. (17) defines the relation between world and domestic prices.

This program can be rewritten as:

$$\mathrm{Max}_{X_2^I,\pi}\, U_2 = U_2\left(-\frac{X_2^I}{p_2} + \frac{E_2^I(\pi)}{\pi}; X_2^I - E_2^I(\pi)\right) \tag{18}$$

Solving (18) yields country 2's reaction function:

$$t_2 = \frac{1}{\sigma_2^* - 1} \tag{19}$$

where $\sigma_2^* = \frac{\pi}{E_2^I}\frac{\partial E_2^I}{\partial \pi} > 0$ is the reciprocal demand elasticity facing 2. It is a general equilibrium elasticity measuring how much the rest of the world is willing to trade agricultural goods against country 2's industrial goods. In this elasticity, substitution effects (on both consumption and production sides), real income effects, and multiplier effects are embedded.[3]

As far as country 1 is concerned the same approach gives:

$$\text{Max}_{X_1^A,\pi}\, U_1 = U_1\left(D_1^A; D_1^I\right) = U_1\left(X_1^A + M_1^A; X_1^I - E_1^I\right) \tag{20}$$

Under:

$$M_1^I = \pi E_1^A(\pi) \tag{21}$$

$$X_1^I = -p_1 X_1^A + \text{constant} \tag{22}$$

$$\pi = p_1(1 + t_1) \tag{23}$$

This can be rewritten as:

$$\text{Max}_{X_1^A,\pi}\, U_1 = U_1\left(X_1^A - E_1^A(\pi); -p_1 X_1^A + \pi E_1^A(\pi)\right) \tag{24}$$

Solving (18) yields country 1's reaction function:

$$t_1 = \frac{1}{\sigma_1^* - 1} \tag{25}$$

where $\sigma_1^* = -\frac{\pi}{E_1^A}\frac{\partial E_1^A}{\partial \pi} > 0$ is the reciprocal demand elasticity facing country 1. Under the conditions that 1 and 2 are large countries, these elasticities are greater than unity, and optimal taxes (on imports for 2, on exports for 1) are strictly positive.

Result 3. Under these assumptions, four factors are at play.

i. Each time either the large food-importing country or the large food-exporting country increases its tax, this move has a double effect. The first is the terms-of-trade effect, which consists of an improvement in the terms of trade for the country that implements the tax increase and a deterioration for the other large country. The second effect is a traded volume effect, which consists of a decrease in traded volume for both the country that implements the policy and its partners. A change in the small country's trade policy does not have an impact on its terms of trade and affects only traded volume.

ii. Concerning large countries (1 and 2), as any policy change in this context has these two effects, at a given stage a country may decide to decrease its tax and accept a deterioration in its terms of trade while benefiting from an increase in trade volumes.

iii. If the government's objective is to maximize real income, the Nash equilibrium is the intersection of reaction functions (14), (19), and (25). This Nash equilibrium implies a loss of real income for country 3 and a reduction in world real income. Consequently, at equilibrium a large country may benefit from augmented real income as compared to free trade.

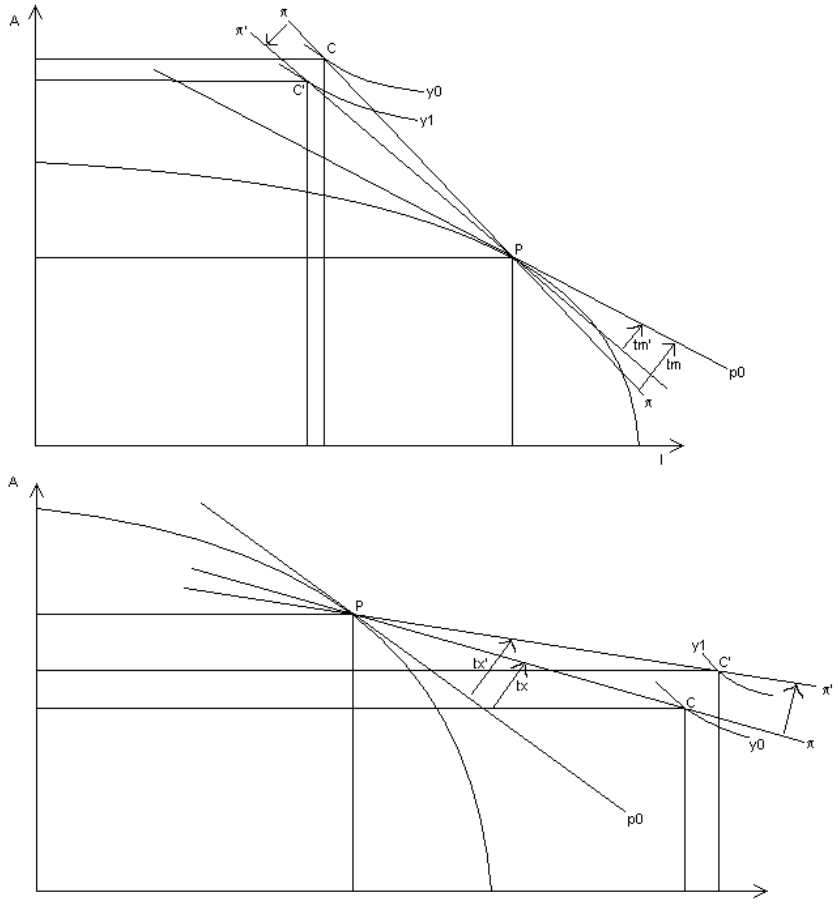
[3] We can easily derive a relation between the reciprocal demand elasticity and the parameters σ^C_2, e_2, m_2, and d_2 defined previously.

iv. If the objective of a government is to decrease the domestic price of the agricultural good, the policy to be implemented is a decrease in the import tax in the large food-importing country and an increase in the export tax in the large food-exporting country, both policies having the effect of increasing the world price of the agricultural good and therefore hurting the third country, for which the optimal policy is always free trade, both in terms of welfare and of food security (low domestic price for agricultural goods).

Point (i) comes from the expression of real income's changes as stated by equations (6), (11), and (13). Point (ii) is implied by the fact that from free trade to autarky, others things being equal, a big country's real income augments and then decreases; as a consequence, it is possible that due to excessive taxation of trade flows, trade is too small and a country will want to increase it by reducing the distortion that the tax caused. As far as point (iii) is concerned, from the two effects under play, one being positive and one negative, the improvement in terms of trade for one country means deterioration for the other, while the reduction of trade is negative for both countries, and at Nash equilibrium involving a positive export tax in country 1 and a positive import tax in country 2, trade volumes are reduced. Therefore, either both large countries are worse off than under free trade, or one is better and the other is worse. Point (iv) is straightforward.

We thus see the possibility of governments engaging in a trade war for food security purposes, through which they respond to increases in world agricultural prices by increasing export taxes in agriculture-exporting countries and decreasing import taxes in agriculture-importing countries. This is illustrated in Figure 2.

Figure 2. A general equilibrium analysis of export tax and import tax under domestic price target



Source: Authors' investigation.

The top part of Figure 2 illustrates the case of an agriculture-importing country (A is the agricultural good and is located on the vertical axis) that has an objective of maintaining the domestic agricultural price constant at p_0. Initially, the world price is at π, which leads this country to impose a tariff of tm on agricultural imports such that $\pi.(1 + tm) = p_0$ (this accounts for the impact of tm on π). If an increase in the agricultural world price occurs, from π to π', this country must reduce its import tariff to tm' such that $\pi'.(1 + tm') = p_0$. It must be noted that the agriculture-importing country's real income is decreased from y_0 to y_1.

The bottom of Figure 2 depicts the case of an agriculture-exporting country that also has an objective of maintaining the domestic agricultural price constant at p_0. Initially, the world price is at π, which leads this country to impose a tax of tx on agricultural exports such that $\pi/(1 + tx) = p_0$ (this accounts for the impact of tx on π). If an increase in the world agricultural price occurs, from π to π', this country must augment its export tax up to tx' such that $\pi'/(1 + tx') = p_0$. While its two trading partners are hurt by this world price shock and policy reaction, it is noteworthy that the agriculture-exporting country's real income is increased from y_0 to y_1.

We see that the design of optimal export taxes requires the estimation of consumption, production, and trade elasticities. Broda, Limao, and Weinstein (2006) find evidence that non–WTO members have market power and implement relatively high tariffs compared to WTO members. As far as export taxes are concerned, Warr (2001) concludes that available econometric estimates for the world demand elasticity of rice facing Thailand imply optimal export taxes ranging from 25 to 100 percent. This assessment may lead to false interpretations; Bautista (1996) gives the example of the Philippine government implementing an export tax on copra and coconut oil based on the principle that the country represented a large share of the world market for these products and faced a "negative elasticity" in world export demand. In fact, this evaluation did not take into account substitutability with other vegetable oils and the Philippines' consequent low share of the world market: the Philippines should have been treated as a "small country."

Demand and supply elasticities may change over time, and consequently a country may gain in the short run while losing in the longer run. In particular, a country with net agricultural exports may benefit in the short run from inelastic agricultural supply from other countries, resulting in substantial short-term world price increases as a consequence of export taxes. In the longer run, other countries may increase their agricultural supply on the world market, and world prices may decrease as a result.

The fact that WTO regulations do not deal with the use of export taxes and restrict import tariffs clearly supports this sequence of policy options, which can hurt trade partners, in particular small countries. No option to retaliate is available for small countries that are harmed by these beggar-thy-neighbor policies (of course, small net food-importing countries can decrease import tariffs or implement import subsidies with a cost in terms of public revenues). Finally, it must be emphasized that if under free trade a country (either 1 or 2 in our example) has an interest in implementing an export tax or an import tariff in the sense that this decision increases its real income (or decreases domestic agricultural prices), it does not mean that at the end of the process each country is better off as compared to free trade. In particular, each country's real income can be reduced as compared to free trade: this is the classical "prisoner's dilemma." Nonetheless, a country can win from a trade war, in the sense that its real income can be greater than initially.

A final look at the impact on poverty is worthwhile. It is well known (McCulloch, Winters, and Cirera 2001) that trade policy operates on poverty through various channels, in particular through the domestic consumption prices of traded goods, domestic activity and demand for unskilled labor, public revenues, and transfers from governments to households, among others. Here, an export tax on agricultural commodities should reduce demand for (agricultural) unskilled labor while decreasing the domestic consumption prices of food. The first effect is poverty augmenting while the second is poverty reducing. Warr (2001) undertakes a general analysis of export taxes in Thailand and shows that the earning effects (through demand for unskilled labor) are greater than the expenditure effects (through the domestic consumption price of rice). His conclusions on the Philippines and coconut oil are similar (Warr 2002).

4. AN ILLUSTRATION OF THE ADOPTION OF EXPORT TAXES ON AGRICULTURAL COMMODITIES AND THEIR EFFECTS THROUGH THE MIRAGE MODEL OF THE WORLD ECONOMY

This section uses the MIRAGE model of the world economy to assess the economic consequences of various trade policies.

These simulations rely on low supply and demand elasticities. They are compatible with a short-run situation. We simulate a demand shock that implies a 10% increase of the world price of wheat, and also various trade policies implemented to react to this shock and maintain domestic food security. We use short-term elasticities to generate the price increase: our objective is to understand the mechanisms that take place in the short run and explain the adoption of policies that preserve food security at home, but generate negative consequences for trading partners.

The Model

The MIRAGE model is a multinational, multisector computable general equilibrium (CGE) model (see Bchir et al. 2002; Decreux and Valin 2007). We use the MIRAGE model under its static version, with a perfect competition hypothesis and without modeling foreign direct investment. We use perfect competition instead of imperfect competition because the latter framework necessitates supplementary data (number of firms, mark-up, and magnitude of scale economies) for calibration purposes that are difficult to gather for many regions. Moreover, we focus on agriculture, which is usually characterized by strong competition. The use of the static version is also justified by the fact that we are not interested in the dynamics of the reform, but only in the long-term impact on world prices and various regions' macroeconomic variables.

The first source of data is GTAP7 (see Narayanan and Walmsley 2008 for full documentation), which provides world macroeconomic accounts and trade flows for the year 2004. The market access data come from the MacMap-HS6 version 2.1 database (Boumelassa, Laborde, and Mitaritonna 2009), which measures protection in 2004 and includes all regional agreements and trade preferences existing to this date.

The geographic decomposition is a key element of the methodological design of the study. On the basis of the GTAP7 database, we select countries that are net wheat exporters and net wheat importers.[4] Table 1 presents the geographic decomposition.

Table 1. Geographic decomposition

MIRAGE label
Australia
Rest of Asia
China
Thailand
Vietnam
Bangladesh
India
Pakistan
Rest South Asia
Canada
United States
Mexico

[4] In the GTAP7 database (base year 2004), the EU-27 position on wheat is atypical with a balanced position. Therefore, we do not treat the EU as a net exporter (or a net importer).

Table 1. Continued

MIRAGE Label
Rest of Europe
Argentina
Rest of LAC [Latin American and Caribbean]
Brazil
Oil exporters
EU 27 [European Union]
Rest of CIS [Commonwealth of Independent States]
Russia
Ukraine
MENA [Middle East and North Africa]
Egypt
West Africa
East Africa
Southern Africa
South Africa

Source: Authors' investigation.

The sector decomposition focuses on agriculture and identifies 25 sectors, 13 of which are agricultural (see Table 2).

Table 2. Sector decomposition

MIRAGE Label
Paddy and processed rice
Wheat
Other grains
Vegetable and fruits
Oilseeds
Sugar
Plant fiber
Other crops
Livestock
Other natural resources
Other food
Fossil fuels
Meat
Vegetal oil
Dairy products
Textile
Wearing and apparel
Leather
Other manufacturing products
Chemical products
Motor vehicles and transport equipment
Capital goods
Services
Construction
Transportation

Source: Authors' investigation.

We design and study scenarios to evaluate the impact of trade policies (implemented through either variation of import duties or variation of export taxes) on world prices and national real incomes. We suppose that these trade policies are aimed at keeping constant domestic price of an agricultural commodity, of which world price is shocked: these are clearly food security policies. The objective is to understand what are the international implications of these 'beggar-thy-neighbor' policies on world prices and national real income, in particular of small countries.

We implement six scenarios (Table 3). The first is called "Base" and represents a demand shock in the wheat sector. We assume that the demand from oil-exporting countries increases such that the world price of wheat is augmented by about 10 percent. Similar results could be driven by alternative assumptions, such as an increased demand for wheat for biofuel (ethanol production in Europe) or increased demand from large Asian countries (India, China). We have chosen to locate the demand increase in oil exporters' countries due to the diversity of their suppliers and the desire not to blur the results for other important importing regions.

We then endogenize export taxes in net exporters of wheat such that the real domestic price of wheat remains constant (scenario ET). The next scenario is an endogenization of import taxes (scenario IT) under the same objective in net importing countries of wheat. As scenario IT implies the adoption of import subsidies, we implement another scenario in which the decision to decrease import taxes is limited by 0 (free trade); this scenario is called IT0. Finally, we study two scenarios that cumulate two political situations described earlier: import taxes are fixed at the level of scenario IT and export taxes are endogenous such that the real domestic price of wheat remains constant (called scenario ETIT), and import taxes are fixed at the level of scenario IT0—no import subsidy—and export taxes are endogenous such that the real domestic price of wheat remains constant (called scenario ETIT0).[5]

Table 3. Scenarios

Scenario	Description
Base	Base demand shock.
ET	Implementation of export taxes in countries that are net exporters of wheat such that the real domestic price of wheat is constant.
IT	Implementation of import taxes (or import subsidies) in countries that are net importers of wheat such that the real domestic price of wheat is constant.
IT0	Implementation of import taxes (import subsidies are forbidden) in countries that are net importers of wheat such that the real domestic price of wheat is constant; the domestic price is not constant if the strategic rigidity (no import subsidies) is binding.
ETIT	Implementation of IT import taxes in countries that are net importers of wheat and of export taxes in countries that are net exporters of wheat such that the real domestic price of wheat is constant.
ETIT0	Implementation of IT0 import taxes in countries that are net importers of wheat and of export taxes in countries that are net exporters of wheat such that the real domestic price of wheat is constant (import subsidies are forbidden).

Source: Authors' investigation.

[5] In a scenario in which export and import taxes are both endogenous, countries enter a spiral of never-ending escalation of export taxes and import subsidies because on the importing countries' side, the governments have no fiscal constraints and can finance the subsidies using a lump-sum transfer from households.

Results

Table 4 presents the import taxes required in net importers of wheat to keep the domestic price of wheat constant. Variations of import tariffs are substantial, in particular in the Middle East and North Africa and the "rest of Europe" region. For instance, Egypt and Thailand would be obliged to implement an import subsidy in order to keep the domestic price of wheat constant.

Table 4. Additional import taxes

Country/region	IT
Rest of Asia	-19.9%
China	-29.8%
Thailand	-28.1%
Vietnam	-12.6%
Bangladesh	-18.6%
Pakistan	-28.8%
Rest of South Asia	-19.3%
Mexico	-27.5%
Rest of Europe	-32.0%
Rest of Latin America	-30.0%
Brazil	-25.2%
Rest of Commonwealth of Independent States	-29.8%
Middle East and North Africa	-41.9%
Egypt	-25.8%
West Africa	-21.3%
East Africa	-24.3%
Southern Africa	-18.7%
South Africa	-27.7%

Source: Authors' calculation.

Table 5 presents the augmentations of export taxes needed to keep the domestic price of wheat constant in net exporting countries under three scenarios. When only export taxes are implemented in net exporters of wheat, the changes in export taxes are systematically less than 6 percent, while they are always more than 45 percent when import taxes are also implemented in net importers of wheat. This illustrates the interdependence of trade policies and how a process of retaliation and counter-retaliation can worsen the whole process of policy decision making. If no import subsidies are implemented (column ETIT0), which may be a more realistic case, the changes in export taxes are much less important but remain substantial, in particular as compared to the scenario ET. In this case, the range of export taxes is quite realistic too: from 19 percent to 50 percent.

Table 5. Additional export taxes

Country	ET	ETIT	ETIT0
Australia	3.3%	47.0%	19.0%
India	3.9%	46.0%	21.0%
Canada	3.6%	52.0%	25.0%
United States	4.2%	52.0%	27.0%
Argentina	3.8%	50.0%	25.0%
Russia	5.6%	57.0%	37.0%
Ukraine	4.5%	50.0%	50.0%

Source: Authors' calculations.

Table 6 indicates how world prices on traded quantities of agricultural goods are affected in various scenarios. Almost all agricultural prices are positively affected by various shocks due to substitution effects on the demand and supply sides, but wheat is by far the most exposed commodity to world price shocks. While the world price of wheat increases by 10.8 percent thanks to the demand shock, it increases by 16.8 percent when net exporters of wheat react by increasing export taxes. Therefore, this policy reaction is typically a beggar-thy-neighbor decision, as it is a rational decision from the single-country point of view but it amplifies the negative aspects of the initial shock. The effects are even larger when net importing countries implement reductions in import tariffs (27.3 percent). When no import subsidies are implemented, the impact of import taxes on world prices (12.6 percent) is much more comparable to the impact of export taxes. Finally, the combination of increased export taxes in net wheat exporters and reduced import taxes in net wheat importers causes a dramatic increase in this commodity's world price (41.1 percent when import subsidies are implemented; 20.6 percent when they are not), as the disconnection between domestic and world prices is fueled by these border distortions.

Table 6. World prices (% changes compared to reference situation)

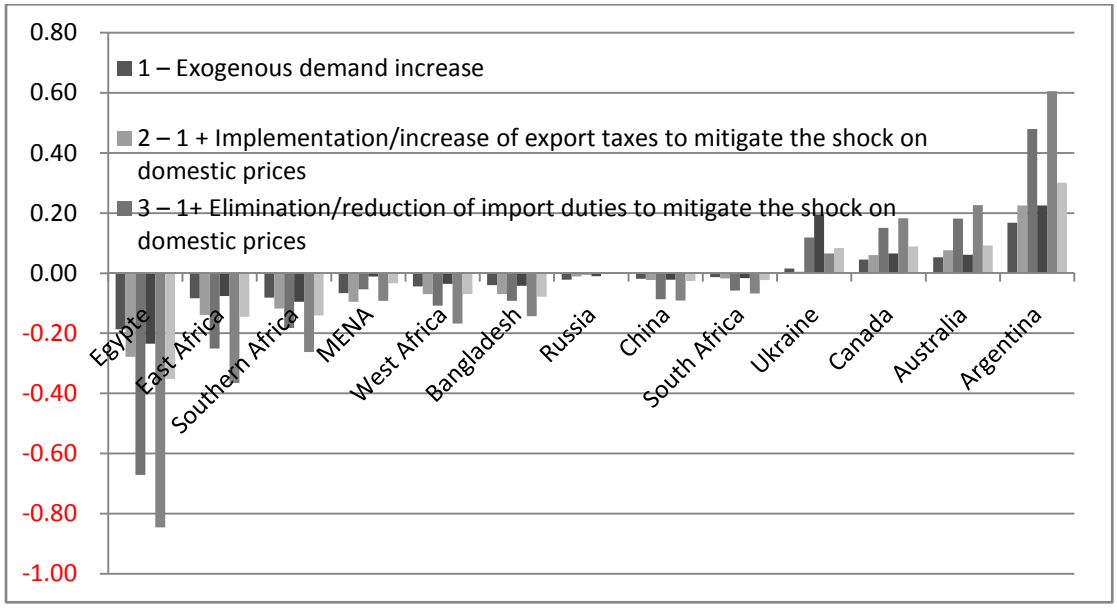
Sector	Base	ET	IT	IT0	ETIT	ETIT0
Wheat	10.84	16.76	27.31	12.62	41.10	20.58
Dairy products	0.04	0.05	0.00	0.02	0.03	0.04
Livestock	0.19	0.21	0.18	0.13	0.24	0.17
Meat	0.07	0.08	0.06	0.06	0.07	0.07
Oilseeds	0.09	0.06	0.09	0.08	0.05	0.04
Other crops	0.16	0.17	0.18	0.12	0.18	0.13
Other food	0.04	0.08	-0.04	0.00	0.04	0.04
Paddy and processed rice	0.21	0.13	0.32	0.20	0.10	0.11
Plant fiber	0.13	0.11	0.14	0.10	0.13	0.09
Sugar	0.14	0.12	0.20	0.12	0.16	0.10
Vegetable and fruits	0.20	0.21	0.25	0.14	0.27	0.14
Vegetal oil	0.01	0.01	-0.01	0.00	0.00	0.00

Source: Authors' calculations.

Figure 3 indicates how the national real income of a few countries is affected by these various policy shocks. From the previous section, it was expected that net wheat exporters' welfare would be positively affected by the initial shock and their policy response (increased export taxes), while net wheat

importers' welfare would be negatively affected. That is clearly confirmed by this modeling exercise. Argentina's welfare is significantly increased under all shocks, in particular under the one that combines endogenous export taxes and import tariffs with allowed import subsidies (scenario ETIT): its real income is increased by 0.6 percent. Australia (+0.23 percent under ETIT), Canada (+0.18 percent), and Ukraine (+0.07 percent) are other beneficiaries. On the other side, net wheat importers are significantly hurt by these shocks in terms of real income: -0.85 percent in the case of Egypt under the ETIT scenario, and -0.37 percent for eastern Africa. These results rely on low supply and demand elasticities that are compatible with a short-run situation. In reality, these parameters can change over time; in particular, if agents expect that price changes will remain, both producers and consumers will change their behaviors. Producers, including new producers, will invest more (technology, irrigation, and so on.) and world supply elasticity will increase in the long run.[6] Consumers will shift to other products and/or new suppliers (increase in demand elasticity for wheat and in the Armington elasticities) and counteract initial real income benefits.

Figure 3. Welfare impact of various scenarios (% changes compared to reference situation)



Source: Authors' calculation.
Note: MENA for Midde East and North Africa

The case of Argentina also reveals how increased export taxes on a primary commodity can be used to encourage high-value processed sectors to buy this primary commodity as an intermediate good. When the demand shock augments the world price of wheat by about 10 percent, the Argentinean production of wheat is increased by 4.5 percent (in volume) while production of the "other food" sector, which includes milling industries and other flour-related products, is reduced by 0.6 percent. Under the ET scenario, in which governments of net wheat-exporting countries increase their export taxes as a reaction to this world price shock, the production volumes of wheat and "other food" sectors are constant. An increased export tax on a primary commodity is clearly a way to promote the production of sectors using this commodity as an intermediate good.

[6] As explained in 4.1 above, we used the static version of the MIRAGE model. We also used short-term elasticities to generate the price increase needed for the initial shock with a reasonable increase in oil producers' demand.

5. CONCLUDING REMARKS

This paper provided an economic analysis of the use of export taxes and illustrated why they have been so popular during the food crisis. Several elements can justify the implementation of such trade practices: (i) export taxes can raise the world price of exports and therefore improve terms of trade; (ii) export taxes can reduce the domestic price of the taxed commodity and benefit final consumers of this commodity (important when the commodity is an agricultural one and food security is at stake); (iii) export taxes can reduce the domestic price of the taxed commodity and benefit intermediate consumption of this commodity (important when the commodity is a primary one and expansion of the manufacturing sector that buys it is at stake); (iv) export taxes increase public revenue, which is beneficial in a country where fiscal receipts on the domestic base are small; and (v) export taxes are a means of redistributing income from domestic producers to domestic consumers and the public sector.

As a consequence, export taxes are attractive trade policy instruments. However, this paper draws attention to one key element of the implementation of export taxes: these are typically beggar-thy-neighbor policies that deteriorate the terms of trade and real incomes of trading partners. This often leads to retaliation by partners whose terms of trade have been negatively affected by initial export taxes. We showed in this paper that these trading partners can react by either reducing import tariffs or augmenting export taxes, depending on their status as either net importers or exporters of the commodity. The 2006–2008 Food Crisis clearly illustrates the point about retaliation and counter-retaliation in response to either reduced import duties or augmented export taxes.

Several policy conclusions are worthwhile. First, this process implies the implementation of a non-cooperative policy equilibrium that worsens world welfare and calls for international cooperation. Second, although large countries can implement beggar-thy-neighbor policies that increase national welfare at the expense of trading partners, small countries do not have this option and changes in their own policies neither improve their welfare nor harm their partners' situation. Finally, there is a key asymmetry between net exporters and net importers of an agricultural commodity in a situation of food crisis, as net exporters can benefit from increases in world prices while net importers are hurt and have no capacity to retaliate efficiently.

Today, the European Union and the United States are wondering whether certain Chinese export taxes are WTO consistent and whether they can bring the case to the WTO dispute settlement body (see Crosby 2008). In 2008 China raised export taxes on some metal resource products such as parts of steel products, metal ore sand, and ferro-alloys. The objective of this policy is to reorient the supply of these goods on the domestic market in order to decrease the price of intermediate goods for domestic manufacturing sectors.

In these conditions it is understandable that the European Union has just proposed to discipline such practices.[7] While this proposal has been well received by countries such as Canada, the United States, Switzerland, and Korea, it has been highly criticized by some developing countries such as Argentina (which also confirms what was expected from our analytical framework), Malaysia, Indonesia, Brazil, Pakistan, Cuba, India, and Venezuela, with Argentina leading the opposition to this proposal. The reasons advanced by this group of countries is that "export taxes are a right and a legitimate tool for developing countries; they help increase fiscal revenue and stabilize prices; there is no legal basis for a negotiation; there is no explicit mandate for a change in WTO rules on this issue" (Raja 2006). It is noteworthy that the European Union makes a distinction between trade-distorting taxes and "legitimate" export taxes like those applied in the context of balance-of-payments imbalances. The European Union proposes a full prohibition of trade-distorting export taxes. The European Union and the United States frequently implement bans of export taxes in bilateral agreements that they negotiate.

The European Union has been very active in demanding under the Doha Development Agenda substantive commitments by all WTO members to eliminate or reduce export taxes. Our paper shows that

[7] The European Union's proposal is available on the WTO website (TN/MA/W/11/add. 6).

export taxes and import tariffs exhibit strong similarities or can even be equivalent in terms of their impact on domestic and foreign welfare. Bringing some penalties into the WTO context in the area of export taxes may be justified, as these penalties exist in the domain of import tariffs. Moreover, another justification is the consideration of net food-importing small countries that can be strongly harmed in the event of a food crisis and by the escalation of export taxes throughout the world, and that do not have many policy instruments with which to address this kind of issue. Export taxes and export restrictions could clearly become a new and major bone of contention between high-income countries and agrifood-exporting middle-income countries in trade negotiations.

APPENDIX: SUPPLEMENTARY TABLES

Table A.1. Implementation of export restrictions during the food crisis (2006–2008)

Country	Trade restriction
Thailand	*Export ban on rice. (05/07/08)
Russia	*Russia raised wheat export tariffs from 10% to 40%. (02/08)
Indonesia	* The government passed new export laws to prevent produce from flooding out of the country, selling at high international prices. Under Indonesia's new rules, only the state procurement agency Bulog is allowed to sell overseas, and only when national stocks are above 3 million metric tons and domestic prices are below a government target price. (04/08)
Bolivia	*Ban on exports of grain and meat products. (04/08) *Ban on exports of vegetable oil.
Egypt	*Ban on rice exports from April to October 2008. (04/08–10/08)
Pakistan	*Banned private wheat exports to Afghanistan. (04/08) *Imposed a 35% tariff on wheat and wheat products exports. (04/08)
Vietnam	*Extended ban on rice exports until June. The permitted rice exports were to be cut to 3.5 million metric tons in 2008, from 4.5 in 2007, between the months of January and September. (03/08)
Ecuador	*Restriction on exports.
Nepal	*The government announced on April 30, 2008, that it would ban exporting paddy, rice, and wheat until mid-November 2008. (04/30/08)
Bangladesh	*The government banned exports of all but aromatic varieties of rice for six months, until November 7, 2008. (05/07/08) *The government banned exports of soybeans and palm oil for six months. (04/08)
Madagascar	*The government banned rice exports. (05/14/08)
Kazakhstan	*The government banned wheat exports, which led to the World Food Programme (WFP) not purchasing 5,500 metric tons as planned. (04/08) *The government restricted exports of sunflower seeds. (06/08/08) *The government set new export tariffs on cereals. (02/08)
Ethiopia	*The government banned exports of major cereals and grain stockpiling, and suspended the WFP's local purchases for emergency interventions. (02/08)
China	*The government banned rice and maize exports to ensure sufficient domestic supply and to prevent further increases in food prices. (01/01/08) *China began to adopt export quota license administration on some grain powder products. (01/01/08) *The government increased taxes on food exports. (02/26/08) *The government announced that it would remove the value added tax (VAT) rebate for grain exports and levy provisional export taxes on grains and their flour products to discourage grain exports. (03/01/08) *The government introduced export duties of 20% on wheat, buckwheat, barley, and oats and stepped up wheat and maize sales from state reserves. (early 2008) *China began to collect a one-year-long provisional export tariff on 57 categories of raw grain and powder products such as wheat and corn in the range of 5–25%. (02/12/08)
Brazil	*The government temporarily banned rice exports. (04/25/08)
Niger	*The government imposed export controls on key agricultural commodities. (03/13/08)
Iran	*The government imposed a US$300,000 export tax on the WFP, and as a result the WFP had to cancel an order for 3,000 metric tons of wheat. (05/14/08)

Table A.1. Continued

Country	Trade restriction
Cambodia	*The government issued a two-month ban on rice exports. (04/08)
India	*The government announced that it would ban exports of maize until October 15, 2008. (07/03/08)
	*The government banned exports of nonbasmati rice, wheat, and edible oils; raised the minimum export price of basmati rice from $1,100 to $1,200; and extended the ban on exports of pulses for one more year, beginning April 1, 2008. (03/31/08)
	*The government banned exports of rice at less than $650 per ton, which is a 30% increase. This does not include the 500,000 tons bought by Bangladesh under a state-to-state deal negotiated November 15, 2007. (03/09/08)
	*The government banned milk powder exports. (2007)
	*The government banned rice exports priced under $505 per ton. (12/31/07)
	*The government banned rice exports priced under $425 per ton. (10/07)
	*Export of nonbasmati rice was restricted, with the imposition of a high minimum export price of $500 per ton. (02/09/08)
Tanzania	*The government announced that it would ban re-exports of rice in order to curb a looming food shortage. (05/02/08)
	*The government banned exports of agricultural commodities. (02/08)
Argentina	*To guarantee domestic grain supplies during an election year and keep prices under control, the government closed its wheat export registry in March 2007. (05/14/08)
	*The government halted rice exports except to Brazil. (04/08)
	*The government delayed the reopening of its export registry from March 17 to April 21. (04/08)
	*The government raised export taxes on soybeans from 35% to 45% and increased a tax on exports of corn, wheat, and beef to curb fast-rising domestic food prices. (04/02/08)
	*The government, in order to boost revenue, introduced a new system of sliding-scale export taxes on grains and oilseeds, which significantly raised levies on soy and sunflower seed products. (04/08)
	*The government reinforced the variable tax system for oilseeds and cereal exports.
	*The government postponed the renewal of the liberalization regime for bovine meat exports.
Malaysia	Flour exports were allowed only with a special license. (03/09)
Zambia	The government reinstated the export ban applicable for any new maize contracts.

Source: IFPRI.

Table A.2. Export restrictions in effect today (nonexhaustive list)

Country	Product	Tax Rate (%)	Date	Source
	Soy	35	Nov-07	http://www.worlenegy.net/public_information/show_news.php?nid=97
	Soy meals; Soy oils	32	Nov-07	
	Soy-based biodiesel	2.5 (effective)	Nov-07	
	Corn	25	Nov-07	
	Corn and sugar-based ethanol	1	Nov-07	
Argentina	Biodiesel	20	Mar-08	
	Crude palm oil	3	Jun-09	http://www.worldenergy.net
Indonesia	Raw hides and skins	15	Dec-07	http://trade.ec.europa.eu/doclib/docs/2008/february/tradoc_137761.pdf
	Anthracite, not agglomerated, pulverized or non-pulverized	0	Jan-08	http://www.steelchinese.com/index.php?option=com_content&task=view&id=32&Itemid=2
	Bituminous coking coal, not agglomerated, pulverized or non-pulverized	0	Jan-08	
	Other bituminous coal, other than coking coal, not agglomerated, pulverized or non-pulverized	0	Jan-08	
	High-carbon-content coal, not agglomerated, pulverized or non-pulverized	0	Jan-08	
	Briquettes, ovoids & similar solid fuels manifactured from coal	0	Jan-08	
	Coke & semi-coke, agglomerated or non-agglomerated	0	Jan-08	
	Retort carbon	0	Jan-08	
	Coal, water, producer gas & similar gases, other than petroleum gases & gaseous hydrocarbons	1	Jan-08	
	Tar distilled from coal, lignite, peat or other mineral tars	1	Jan-08	
	Motor gasiline & aviation gasoline	1	Jan-08	
	Naphtha	1	Jan-08	
	Aviation kerosene	1	Jan-08	
	Light diesel oil	1	Jan-08	
	Fuel oil No.5 to No.7 (National Code)	3	Jan-08	
	High-purity polysilicon, weight less than or equal to 99.99% of silicon	2	Jan-08	
	Nickel ore sand and concentrate	15	Jan-08	
	Unalloyed pig iron	25	Jan-08	
	Partial steel billet	25	Jan-08	
China	Semi-finished stainless steel products	15	Jan-08	

Source: Authors' investigation.

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