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World Trade Organization
Economic Research and Statistics Division

Natural Resources and Non-Cooperative Trade Policy

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Natural Resources and Non-Cooperative Trade Policy ^{*}

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Abstract

When looking at the conditions of trade in natural resources the world appears upside down: tariff protection in natural resources sectors is generally lower than for overall merchandise trade, while export restrictions are twice as likely as in other sectors. On the other hand, tariff escalation is significant in natural resources sectors, where materials in their raw state face, on average, lower duties than in their processed form. In this paper, we discuss how export taxes and tariff escalation may be the result of an uncooperative trade policy. Specifically, tariff escalation and export taxes can be "beggar-thy-neighbor" policies because governments may be tempted to use them to alter the relative price of exports to their advantage (terms-of-trade effect) or to expand the domestic processing industry at the expenses of foreign production (production relocation effect). In equilibrium, these policies offset each other in a Prisoners' Dilemma situation, where trade is inefficiently low.

Keywords: Natural Resources, Export Taxes, Tariff Escalation, Prisoner's Dilemma, WTO

JEL Classification: F13, F59, Q34

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Introduction

At first sight, the world of natural resources trade appears upside down. Tariffs on natural resources are generally lower than for overall merchandise trade, while policies affecting exports such as export taxes are more common in natural resource sectors than elsewhere. On the other hand, "tariff escalation" (i.e. a structure of protection such that tariffs tend to rise with the stage of processing) is significant in natural resource sectors, where raw materials face on average lower duties than their processed forms. This paper analyzes the relationship between these two sets of measures.

Some peculiar economic features of natural resources make these sectors different from others and may explain the importance of both tariff escalation and export restrictions in resources trade. One such factor is the fact that natural resources are often essential inputs in the production of more processed goods. To the extent that governments value specialization in high-value added sectors, tariff escalation and export taxes may be used to pursue this objective. On the one hand, export taxes on the raw material imposed by a resource-rich country act as an indirect subsidy to processing industries as they reduce the domestic price of the resource relative to its international price. On the other hand, tariff escalation increases the effective rate of protection (ERP) of the downstream industry in resource-poor countries.

In this paper we discuss how the asymmetry between the regulation of export and import policy in the WTO agreement may lead to uncooperative trade outcomes. While import duties are strictly regulated (GATT Article II) and WTO members have bound most of their import tariffs at specific ceiling levels, export duties are more loosely disciplined (GATT Article I and Article XI). Specifically, while export taxes are subject to the general principle of non-discrimination across WTO members (the so called Most Favored Nation, MFN, principle), they are, in general, not covered by binding commitments. Therefore, apart from specific provisions in accession protocols (several newly acceded members have bound their export duties), in regional trade agreements¹ or in national legislations that may restrict the use of export taxes, "potentially, WTO members may heavily restrict trade by imposing export taxes, without having to comply with specified procedural requirements,

without having to demonstrate the existence of specified circumstances and without the limitation imposed by sunset reviews" (WTO 2009, p. 114).

We argue that tariff escalation and export taxes have "beggar-thy-neighbor" effects, in the sense that they can be unilaterally attractive for the country imposing them, but are multilaterally destructive. While trade restrictions can be justified in certain cases², governments may be tempted to use trade policy to alter to their advantage (and to the disadvantage of their trading partners) the relative price of their exports (terms-of-trade effect) or to expand production of domestic industries at the expenses of foreign production (production relocation effect). In this context, export taxes on natural resources or import tariffs on downstream sectors may trigger what could be called a "resources trade war", which is a non-cooperative equilibrium where all countries involved end up in a welfare-inferior situation. The only effect of the contemporaneous imposition of tariff escalation and export taxes is to restrict trade inefficiently in the resource and the processed good sectors.

The rest of the paper is organized as follows: section 1 details the legal aspects of import and export duties related to the WTO; section 2 briefly traces the history of WTO negotiations on tariff escalation and export taxes; section 3 presents evidence on tariff escalation and export taxes; section 4 describes the effects of export taxes on natural resources and tariff escalation and discusses the non-cooperative trade policy equilibrium; concluding remarks are in section 5.

¹ For example the North American Free Trade Agreement (NAFTA), the Caribbean Community (CARICOM), the Southern Common Market (MERCOSUR) or the Australia New Zealand Closer Economic Agreement (ANZCERTA).

² The World Trade Report 2010 (WTO, 2010) discusses how other features of natural resources may explain the significant use of export restrictions in these sectors. First, natural resources, both renewable and non-renewable, are exhaustible. Governments may favour export restrictions (as a second best policy) to move toward a more conservative extraction path than under free trade. Second, the extraction and consumption of natural resources tend to be associated with negative environmental externalities. Export restrictions can in this case be justified as second-best policy to reduce production and environmental impact. Finally, natural resources frequently account for a large share of GDP in resource-rich countries and are often characterized by significant price volatility. As a consequence, resource-abundant countries may suffer from income stabilization problems, be locked into inefficient specialization patterns (e.g. the so-called Dutch disease) or be subject to other forms of problems related to single-sector dependence. Export restrictions may also be adopted as second-best policy with the purpose of offsetting volatility in the short run and fostering diversification of the export base in the long term.

1. Legal aspects of import and export duties

A key feature of legal provisions covering export and import duties under the GATT is the very different level of commitments that, in general, WTO member countries have subscribed for these two types of trade policies.

Tariffs and "other duties and charges" are strictly regulated under Article II: 1(b) of the GATT. Under this article, WTO members are prohibited to apply any import duty at a higher rate than specified in their commitments. In other words, tariffs are subject to binding rates that can only be exceeded in exceptional circumstances.³ Furthermore, the number of products subject to tariff bindings, also known as binding coverage, has increased over time, as a consequence of the eight successive GATT/WTO rounds of negotiations. Each round aimed both at increasing the binding coverage and reducing binding rates (WTO, 2007).

In contrast, export taxes are loosely regulated in the GATT/WTO. Although subject to the Most Favored Nation (MFN) principle⁴, they are, in general, not covered by binding commitments. This implies that there are no export duties ceiling rates and no limitations regarding the timeframe for applying or increasing an export duty. This legal framework generally gives WTO members a significant discretionary scope in applying export taxes, except for those WTO members that, as part of their accession protocol, have negotiated commitments schedule for export duties.⁵

As far as quantitative restrictions are concerned, both import and export restrictions are prohibited under Article XI ("General Elimination of Quantitative Restrictions"). Members are prohibited from instituting or maintaining "prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licenses or other measures".

GATT Article XX ("General Exceptions") provides the legal basis for WTO members to take actions otherwise inconsistent with their GATT commitments. In relation with natural resources and, in particular, with respect to export restrictions, Article XX:(g) foresees the possibility to apply

³ Such as safeguard measures, anti-dumping, and countervailing duties, see WTO (2009).

⁴ The Most Favored Nation principle embedded in Article I of the GATT, states that WTO member countries should not discriminate between trading partners. The most favorable treatment granted to one partner should, therefore, be "accorded immediately and unconditionally" to all other partners.

⁵ These include, for example, China, Mongolia, Saudi Arabia, Ukraine and Vietnam.

quantitative restrictions "relating to the conservation of exhaustible natural resources". However in order to invoke this provision, WTO members must show, for example, that the natural resource in question is exhaustible, that the restrictive measure relates to the conservation of this resource and that the measure is "made effective in conjunction with restrictions on domestic production or consumption". Article XX:(i) deals with the possibility of introducing quantitative export restrictions on raw materials "to ensure essential quantities of such materials to a domestic processing industry during periods when the domestic price of such materials is held below the world price as part of a governmental stabilization plan". Such exception to the general prohibition of quantitative restrictions, however, is also subject to specific requirements. Specifically, export restrictions on raw materials can only be used "[p]rovided that such restrictions shall not operate to increase the exports of or the protection afforded to such domestic industry" (Art. XX:(i)). In both cases, the chapeau of Article XX requires that the measure is not applied in a manner that would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade (Appellate Body Report, *US – Shrimp*, paras. 118-121).

2. History of negotiations on export taxes and tariff escalation

Tariff escalation and export taxes have long been discussed in the context of multilateral trade negotiations. In fact, the drafters of the GATT already considered the inclusion of export restrictions in the 1947 agreement. "During negotiations on the text of the Havana Charter on which the GATT is based, some parties were of the opinion that in some countries export duties have the same purpose as import duties in others and that they had to be negotiated too. They pointed to cases of raw material processing industries jeopardized by the import tariffs of other countries, which could be protected through the imposition of export taxes on raw materials" (MTN.GNG/NG/W/40, p.5).⁶ Export restrictions were again part of the agenda at the end of the Tokyo Round in 1979: " In the light of the examination referred to, participants agree upon the need to reassess in the near future the GATT provisions relating to export restrictions and charges, in the context of the international trade system

⁶ Roessler (1975) reports that: "During a preparatory session preceding the GATT, a representative of the United States said: "If we had put in the draft exactly what we ourselves would have liked there would have been a prohibition of export duties and a prohibition of restrictions on raw materials", but he added that for some countries export duties have the same purpose as import duties for other countries "and therefore to be logical you must negotiate on that, too."" (p.28)

as a whole, taking into account the development, financial and trade needs of the developing countries. They request the CONTRACTING PARTIES to address themselves to this task as one of the priority issues to be taken up after the Multilateral Trade Negotiations are concluded" (MTN/FR/W/20/Rev.2, p 5/1).

More recently, records of the discussions on these issues can be found in negotiating documents dating from the earlier times of Uruguay Round (UR). In 1987, at the beginning of the Round, a sub-group of market access negotiations was created specifically to deal with natural resources-based products (MTN.GNG/NG3/1). Relatively early on, the group formally recognized and agreed on the need to reduce or eliminate tariff barriers, tariff escalation⁷ and non-tariff measures and to deal with other trade related policies, including pricing policies such as dual pricing, government ownership and management of natural resource products production or trade, natural resources development policies and practices, and state trading enterprises.⁸ (MTN.GNG/NG3/W/8/Rev.1)

From the reading of negotiating documents, one can sketch two broad sets of positions. On the one hand, several developing and developed countries acknowledged the negative impact of tariff escalation.⁹ For example, a joint declaration from Cameroon, Côte d'Ivoire, Senegal and Zaire stated that "the fullest liberalization of trade in such products (i.e. natural resources-based products), including in their processed and semi-processed forms, in particular by the elimination of tariff and non-tariff measures (...), should be considered as the minimum we expect from these negotiations" (MTN.GNG/NG3/W/10, pp.1-2).

On the other hand, several developed countries, while recognizing the negative impact of tariff escalation, emphasized the need to regulate export measures. For example, the European

⁷ The Generalized System of Preferences (GSP), integrated in the GATT in 1979, had not proven to be truly satisfactory in dealing with commodity dependence of developing countries. One of the main reasons was that raw materials were given greater preferences than their respective processed forms, hence preserving tariff escalation (WTO, 2010).

⁸ Dual pricing mechanisms establish a different domestic price from the export price. Such mechanisms include: export taxes and restrictions, state monopolies, and maximum domestic prices on natural resources. State trading enterprises are defined as governmental and non-governmental enterprises, including marketing boards, which deal with goods for export and/or import.

⁹ Argentina, Australia, Bangladesh, Brazil, Canada, Chile, Czechoslovakia, EC, Hong Kong, Hungary, Republic of Korea, Japan, Malaysia, Mexico, New Zealand, Pakistan, Peru, Poland, Senegal, Singapore, Switzerland, United States and Yugoslavia submitted negotiating propositions specifically referring to tariff escalation.

Community (EC) stated that: "From a multilateral standpoint, finally, the Community considers that contracting parties should be able, if they so desire, to agree on concessions not only in the tariff and non-tariff spheres but also any measure which can affect trade in natural resource-based products, in particular export duties and taxes" (MTN.GNG/NG3/W/11, p.2). The EC emphasised that its "tariff and non-tariff barriers on imports of industrial natural resource-based products" were among "the lowest in the world" and therefore felt that "the discussions could also cover all the issues relating to tariff escalation"; in particular "factors hindering free trade in natural resource-based products should also be the object of negotiations" (MTN.GNG/NG3/W/11, p.3).

Almost five years later (1990 and onward), parties had not yet come to an agreement concerning the scope of measures to be included: "Although offers and proposals have been multilaterally examined in the light of the emphasis in the agreed negotiating objectives on reduction or elimination of tariffs and tariff escalation (...), other problems relate to export restrictions, export taxes, dual pricing practices, subsidies, voluntary export restraints and state trading" (MTN.GNG/MA/W/1, p.3). There is evidence, however, that one delegation recognised that: "In respect to natural resource-based products (...), measures affecting imports and exports should be negotiated in parallel" and more importantly, exporters of natural resource-based products should "negotiate tariff escalation against reduction of export measures such as export restrictions, export levies and dual pricing. Such negotiations could also include conversion of export measures into bound export duties" (MTN.GNG/NG1/23, pp. 3-4).

After seven and a half years of discussions, the Uruguay Round was sealed in 1995 and export duties were ultimately left out.¹⁰ The issue of negotiation on export taxes has been raised again during the Doha Round. In particular, the European Community has been proactive in trying to include export duties in the scope of negotiated measures: "Because of GATT's traditional focus on import policies, export taxes remain a policy instrument still not subject to specific disciplines, hence

¹⁰ However, Australia eliminated export taxes on a certain number of tariff lines in its schedule of commitments (Schedule - Australia, Part I (MFN duties), Section II (Other Products)) and the EC conditioned certain tariff reductions to an elimination of certain export taxes ("The implementation of the reductions to the final rates in column 4 relating to tropical wood will be delayed until such time as no export basis or export taxes are imposed by Malaysia and Indonesia on wood products of this chapter", WT/Let/666, Schedule CXL-European Communities, note in Part I (MFN duties), Section II (Other Products)).

the significance of the effects such policies have. Export taxes, whenever used to protect industries that process primary commodities, tend to be the flip-side to tariff escalation thus causing adverse effects on commodity producers, who tend to receive a price which is below the price prevailing on world markets" (TN/MA/W/11/Add.3, p.3). Later on, the EC circulated a proposal advocating the elimination of export taxes "by all WTO members with the possibility for developing and least-developed countries to maintain certain export taxes". The proposal also required that any remaining export tax should be on an MFN basis and maximum levels should be bound in the lists of Schedules (TN/MA/W/11/Add.6, p.2).

In reaction, Argentina, the Bolivarian Republic of Venezuela, Brazil, Egypt, India, Indonesia, Namibia, Philippines, South Africa, and Tunisia submitted a document stating that: "there is no legal basis to negotiate these issues [export taxes & duties] in this Round. The Doha Ministerial Declaration requires negotiations for reduction or elimination of non-tariff barriers on products of export interest to developing countries. This mandate does not cover addressing issues relating to sourcing of imports." This group of countries considered that: "export duties and restrictions are legitimate tools of economic development" (JOB(08)/42, p.1).¹¹

The Doha Ministerial Declaration recognized from the start that negotiations "shall aim, by modalities to be agreed, to reduce or as appropriate eliminate tariffs, including the reduction or elimination of tariff peaks, high tariffs, and tariff escalation, as well as non-tariff barriers, in particular on products of export interest to developing countries" (Doha Ministerial Declaration paragraph 16, 2001). Indeed, according to the latest official draft (Fourth Revision of Draft Modalities for NAMA Access, December, 2008), parties are seemingly agreeing on reducing tariffs according to the so-called Swiss Formula¹². This formula implies that high tariffs are reduced relatively more than low tariffs. Therefore, it will help reduce tariff peaks and tariff escalation. The version of the formula applied to developed countries would imply that the maximum tariff rate would be below 8 percent.

¹¹ In parallel to negotiations, several disputes concerning export policy on raw materials and natural resources were raised during the GATT years. For example, export restrictions of certain unprocessed salmon and unprocessed herring (L/6268 - 35S/98), on scrap copper (L/6518) and on unprocessed uranium (L/6104). Export measures on various raw materials are the object of an on-going dispute at the WTO (DS394, DS395, DS398).

¹² Algebraically the Swiss Formula can be written as $t_1 = at_0 / (a + t_0)$ where t_0 is the original tariff rate, t_1 is the new reduced tariff rate, and a is a coefficient.

For the developing countries applying the formula¹³, three versions are possible, setting the maximum tariff rate at, either, 20, 22 or 25 percent. Each version, however, implies a different set of commitments regarding, *inter alia*, the maximum percentage of tariff lines not subject to any cut¹⁴ and the binding coverage. It is foreseen that the number of WTO Members (approximately 40) applying the Swiss formula will account for around 90 percent of world trade in goods.

3. Empirical evidence

This section reviews the available evidence on export taxes and tariff escalation.

3.1. Data on Export Taxes

The commonly used source of data on export taxes are WTO Trade Policies Reviews (TPRs). This data source presents, however, significant limitations. First, available information for different countries may refer to different time periods. This is because the frequency at which WTO members are reviewed depends on their shares in world trade, implying that some countries and customs territories are reviewed more often than others. The second caveat refers to product information. As export duties are reported at varying degrees of disaggregation, in order to make information comparable, it is necessary to aggregate data up at the HS two-digit classification level. It is important, however, to note that statistics estimated from this type of data are likely to represent upper bound estimates, because any time an export tax on a certain product is reported, including when the information is available at the six-digit level, the whole two-digit sector is considered to be covered by an export tax.

The World Trade Report 2009 (WTO, 2009) presents evidence on the use of export taxes, on the basis of data collected from WTO Trade Policies Reviews from 1995 to 2008. Collected data suggest that most WTO Members applying export taxes do so quite narrowly: only a few HS two-digit sectors are affected and, most of the time, export taxes concern less than five HS chapters. Sectors most affected are: forestry, fisheries, hides and skins products, gold and precious stones,

¹³ Several countries are exempted from applying any tariff cutting formula; in particular, Least Developed Countries (LDCs), Recently Acceded Members and several other members.

¹⁴ The higher the coefficient, the lower the percentage.

mineral and metal products, as well as agricultural products such as sugar, coffee and cocoa and cereals.

The World Trade Report 2010 (WTO, 2010) reveals that export taxes on natural resources sectors appear twice as likely as export taxes in other sectors and that major exporters tend to use export taxes more often. In particular, export taxes on fish and forestry products cover more than 15% of world trade in those sectors. Trade figures are lower for mining products (around 11%) and fuels (less than 7%).

Aggregated trade numbers hide substantial variation at the country level. Table 1 shows the share of trade in natural resources covered by export taxes. Although the percentages in Table 1 are likely to be upper bound estimates, for several countries, export taxes appear to cover a substantial share of their trade in natural resources. Furthermore, several countries exhibit export concentration, in the sense that one or two types of natural resources subject to export duties, represent a large share of their trade in natural resources.

Within the stated objective to encourage domestic processing, many resource-rich countries set de-escalating (or degressive) export tax structures. In practice, this means that tax rates on raw materials are higher than on the corresponding processed forms. Based on information provided in Trade Policy Reviews, we can give some illustrative examples. For instance, Mongolia applies significantly higher rates on exports of raw copper and aluminium than on their processed forms (Table 2). The tax structure on wood in Central African Republic exhibits the same pattern (Table 3).¹⁵

¹⁵ Pakistan is another example of a country that has set in place a de-escalating tax structure on cotton in 1988. Hudson and Ethridge (1999) find, however, that the effect of such export tax structure was not as expected. Although yarn exports (processed cotton) effectively increased after 1988, export taxes mainly prevented investments and therefore negatively affected the long-run growth of the sector.

Table 1. Percentage of natural resources exports covered by export taxes (upper bound estimates)

Country	Natural Resources	Fish	Mining products	Forestry	Fuels
Argentina	100.00	11.18	31.93	3.85	53.03
Cameroon and Gabon	100.00	0.19	4.41	11.72	83.67
Gambia	100.00	92.42	2.59	4.98	
Central African Republic	99.90		75.06	24.84	
Lesotho	99.30		99.30		
Solomon Islands	98.73	15.78	1.28	81.68	
Mali	98.70		98.70		
Dominica	98.51		98.51		
Sri Lanka	86.78	18.80	67.98		
Maldives	86.50	86.50			
Zambia	83.52		83.52		
Colombia	79.15		6.66		72.50
Malaysia	77.58	1.59		11.91	64.08
Guyana	76.78	14.85	45.08	16.84	
Mexico	72.50				72.50
St. Kitts and Nevis	68.32	68.32			
Indonesia	63.98			6.19	57.79
Tunisia	59.76		4.48		55.28
China	55.46	3.68	36.32		15.46
Madagascar	44.88	44.88			
Papua New Guinea	36.62	3.27	25.27	8.08	
South Africa	33.87		33.87		
Fiji	32.85	21.18	0.80	10.86	
Namibia	31.52		31.52		
Jordan	29.86		29.86		
Guinea	25.30		25.30		
Benin	22.64		20.14		2.50
Mauritania	16.92	16.92			
Kenya	14.11		14.11		
Philippines	12.56			12.56	
Côte d'Ivoire	10.62		0.00	10.62	
Canada	9.24	1.89		7.35	
Norway	5.50	5.50			
Thailand	4.23			4.23	
Mozambique	3.46	3.46			
Burundi	2.97		2.97		
Panama	2.12			2.12	
Mongolia	1.68		1.61	0.07	
Pakistan	1.39		1.39		
Ghana	1.32				1.32
Suriname	1.01			1.01	

Source: Trade data are from Comtrade, year 2007; information on export taxes is drawn from TPRs (from 1995 to 2009)

Note: Author's calculations are based on HS-2 digit data

Table 2. Export tax structure on selected products: Mongolia (2005)

unprocessed form	tax rate	processed form	tax rate
Copper waste and scrap	Tog 1,500/kg.	Copper, zinc alloys/brass	Tog 128/kg.
Waste and scrap aluminium Aluminium, unwrought	Tog 450/kg. Tog 450/kg.	Bars, rods and profiles of aluminium	Tog 350/kg.

Source: Trade Policy Review on Mongolia, 2005

Table 3. Export tax structure on selected products: Central African Republic (2007)

product	tax rate
Logs	10.5%
Sawn wood	4.5%

Source: Trade Policy Review on Central African Republic, 2007

3.2. Data on tariff escalation

Several studies have presented evidence on tariff escalation across countries and products. Lindland (1997) examined the Japanese, European and American agricultural import market to investigate the effect of the Uruguay Round on tariff escalation. He found that more than 80% of the bound tariff wedges between processed and primary products had decreased as a result of the Uruguay Round. However, after full implementation of Uruguay Round commitments more than 50% of the commodity pairs examined would still have escalating bound tariffs, with an average nominal tariff wedge of 17%.

There are, however, significant differences across countries. For example, WTO (2001) shows that in some developed countries, like Japan and Switzerland, MFN bound tariff rates appear to escalate only between raw materials and semi-manufactures, but de-escalate between semi-manufactures and finished products. In other countries, such as Canada, Australia, New Zealand, Turkey and Norway "the tariff structures (...) are characterized by increases in tariffs at each production stage. In the United States, tariffs increase significantly only between raw materials and semi-manufactured goods, while in Iceland and the Republic of Korea the biggest tariff increase takes place between semi-manufactured and finished products" (p.13). Among developing countries in their

sample, Latin American countries do not show any evidence of tariff escalation mainly due to their uniform bindings¹⁶, while in India, Thailand and South Africa tariffs increase by more than 10% along the production chain.

At the product level, the World Trade Report 2003 (WTO, 2003) found that tariff escalation was the highest in textiles and clothing, leather, rubber, footwear and travel goods and fish and fish products and that "escalation is more prevalent in sectors subject to higher overall average tariff rates" (p.134). On the whole, tariff escalation is less prevalent in agricultural products. However, some categories of products are more affected than others. Fruits and vegetables, coffee and tea, and spices, cereals and other food preparations sweeteners based on sugar, vegetable oils and vegetable juice are on average the agricultural sectors with the highest degrees of escalation.

Tariff data reveal evidence of tariff escalation in forestry and mining products, but not in fuels, for the world as a whole. Table 4 presents the change in percentage points between the first two stages of processing, namely raw materials and semi-processed goods, for all these natural resource sectors. On average, forestry products face a tariff increase of 67% between the first and the second stage of processing; in nominal rates this reflects an increase of the average import duties from 6.5% on raw forestry products to 10.24% on semi-processed products. The negative value for fuels indicates that tariffs actually decrease between these two stages of processing.

In developed countries, all three sectors show tariff escalation¹⁷ and although nominal rates are low, rates on processed products are, at least, twice as high as rates on raw materials. For example, raw forestry products face an average rate of 0.57 % when entering developed countries, while their processed counterparts are taxed at a rate of 1.91%. The presence of tariff escalation in developed

¹⁶ However, it is important to point out that even if bound tariffs do not escalate, there may well be tariff escalation at the applied tariff level.

¹⁷ One implication of this result is that developing countries, contrary to developed countries, do not have escalating tariffs in fuels. One explanation can be the following: developing a petro-chemical industry (the processing sector) requires large initial investments and, often, developing countries lack adequate capital. Therefore, opportunities to enter the market are very low; for this reason, this sector is usually not subject to import protection.

countries is particularly significant, given they represent the biggest market for developing country exporters of natural resources.

Table 4. Changes in tariff (percentage points) between first and second stage of processing

sector	world	developed countries
forestry	4.12	1.33
fuels	-1.09	1.20
mining	5.51	1.58

Source: WTO Integrated Databases and International Trade Center

4. Non-cooperative trade policy in resource sectors

This section looks at the incentives of countries to use export taxes and tariff escalation in resource sectors and the effects of these measures. The first two subsections deal with unilateral effects (i.e. assuming that export taxes and tariff escalation do not trigger a reaction by countries that stand to lose from these measures), while the third subsection takes into account trading partners' retaliation.

4.1. Export taxes

An export tax is a tax (*ad valorem* or specific) imposed on goods exported to the world market. Figure 1 provides a graphical analysis of the effects of a specific export tax (T) imposed by a large country, i.e. a country that has some market power on the international market, in a static partial equilibrium setting. An export tax contracts the world supply of the good on which it is imposed, because exporters receive a lower price per unit exported. The S_w curve shifts backwards to S'_w leading to a lower quantity traded at a higher world price. At the same time, supply in the domestic market increases, as producers seek to expand their sales at home to avoid paying the export tax. Therefore, the domestic price falls. In equilibrium the price that producers receive selling at home equals the price they receive when they export. The international price rises from p_w to p_w' and the domestic price falls from p_w to p_I , with $p'_w - p_I = T$, i.e. the price differential equals the tax (Appleyard *et al*, 2010; Bouet and Laborde, 2010, among others).

In terms of welfare analysis, domestic consumers gain from this policy as the domestic price of the good decreases (they consume more at a lower price), while foreign consumers lose because they face a higher world (and domestic) price. On the supply side, domestic producers lose: they

produce less, sell at a lower domestic price and have to pay the tax on exports. The government collects a revenue equal to the quantity exported times the tax (the striped area in Figure 1). In the case of natural resource goods, applying an export tax allows the government to capture part of the economic rent associated with the resource.¹⁸

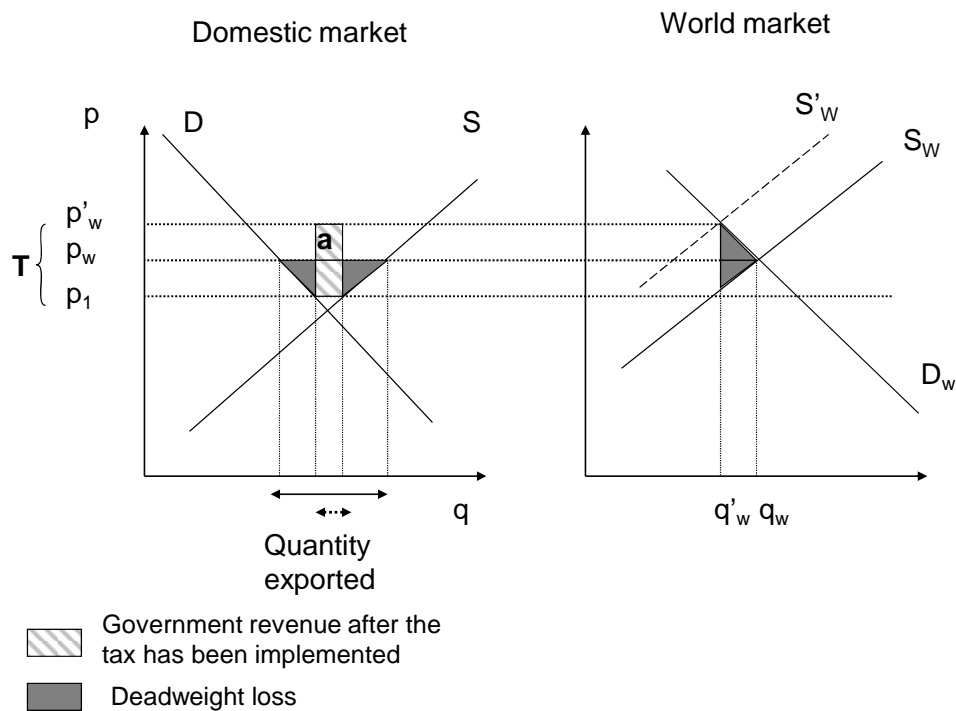
The net welfare effect of the export tax on the imposing economy is ambiguous. Graphically, the surface *a* represents the terms-of-trade gain for the exporting country resulting from the increase in the world price. Mirroring the term-of-trade gain due to the imposition of a tariff by a large importing country, a large exporting country will improve its terms of trade when restricting the quantity sold on the world market. The deadweight efficiency loss (the two traditional –shaded-triangles) represents the distortions in production, generated by the export tax. Due to the tax, too little of the good is produced compared to the efficient free trade equilibrium. These areas then represent the loss in producer surplus that are not transferred to anyone in the economy. Overall, if the terms-of-trade gain more than offsets the efficiency deadweight loss, a large country may be tempted to improve its welfare through the introduction of an export tax.¹⁹ At the world level, however, an export tax will result in an aggregate efficiency loss, as the term of trade gain is matched by an equivalent loss for the imposing country's trading partner.²⁰

¹⁸ Taking into account the nature of the resource ownership, domestic or foreign, complicates the analysis. For example, foreign ownership of the resource-exploiting company can give further incentives to the government to implement an export tax. For a discussion on this topic see Collier and Venables (2010).

¹⁹ The fact that large exporters of natural resources tend to use export taxes to a larger extent (see Section 3.1) can be seen as indirect evidence supporting the terms-of-trade argument.

²⁰ An export tax can also raise dynamic issues that are not addressed in this paper.

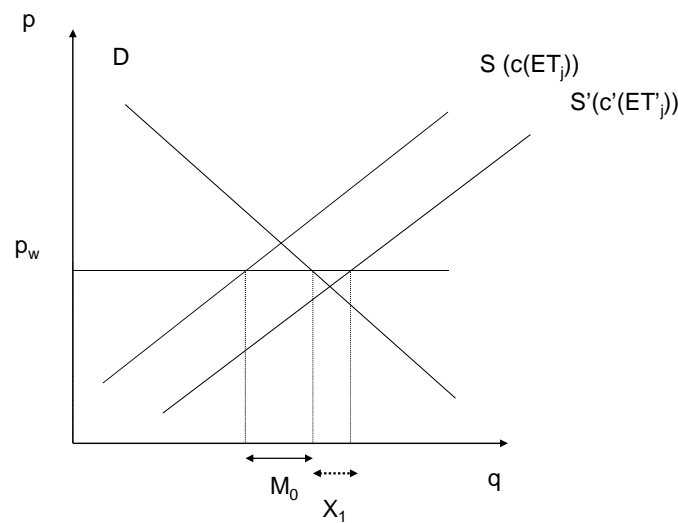
Fig. 1 Graphical analysis of an export tax in the case of a large country



Since one of the effects of an export tax is to lower the domestic price, it will usually favor domestic consumers. Consider the case when domestic consumers are producers themselves and use the taxed good as an input in their production process. In these circumstances, an export tax effectively subsidizes downstream industries, because it allows them to source inputs at a lower price than otherwise prevailing on the international market. Figure 2 presents a graphical representation of the effects of an export tax on raw material in the market of the downstream sector. The country is assumed to be small on the international market of the processed good. The supply of the downstream sector S is written as a function of the input cost (c) which, in turn, depends on the export tax applied on the raw material, $c(ET_j)$. Before the imposition of the export tax on raw materials (i.e. $ET_j=0$), the country imports the quantity M_0 of the processed good. When a tax ET'_j is levied on the raw materials used by the industry, the processing industry benefits from the lower costs of production because the tax induces a reduction in the input cost. In terms of figure 2, the domestic supply curve shifts to the right, for example from S to S' . If the tax is sufficient to provide domestic producers a comparative

advantage, the country can now export to the world market (quantity X_1). Therefore there can be cases, at least in theory, where an export tax on raw materials can allow domestic producers to gain competitiveness in international markets to the expenses of foreign producers of processed goods. This is a "production relocation" effect à la Venables (1987), but in the context of export taxes rather than import tariffs.

Fig. 2 Effect of an export tax on raw materials on the downstream sector



Where $c(ET_j)$ is the the cost of input as a function of the export tax (ET) on the upstream sector j and $ET'_j > ET_j$

Apart from terms-of-trade and production relocation effects, there are many other motives for countries to adopt export restrictions. These include stabilization of income and domestic prices, controlling inflationary pressures, infant industry protection, ease of revenue collection, income redistribution, environmental protection or resource conservation. The use of export taxes in all these cases is a second best policy.²¹

²¹ See WTO (2008, 2010).

4.2. Tariff escalation and the Effective Rate of Protection (ERP)

Tariff escalation is defined as a situation characterized by "higher import duties on semi-processed products than on raw materials, and higher still on finished products" (WTO Glossary)²². As illustrated in section 2, its existence has been widely acknowledged by policy makers and negotiating parties. Nevertheless, the concept has mainly stayed inside the WTO-related community. In the economic literature, the conceptual counterpart of tariff escalation relates to the theory of the Effective Rate of Protection (ERP), that has been studied since the sixties (Balassa, 1965; Bhagwati, 1973; Corden, 1966).

The main idea highlighted in the literature on the effective rate of protection is twofold. First, trade policy aims specifically at protecting domestic value added industries, on the ground that returns to factors of production are positively linked to value added. Second, in presence of tariff escalation the nominal tariff rate imposed on imports of the processed good does not accurately reflect the level of protection granted to the processing industry, because nominal rates do not take into account the impact that a tariff wedge between raw material and processed good has on the value added of the processing industry (Lindland 1997, Antimiani *et al.* 2003).

The ERP is defined as "the percentage increase in value added per unit in an economic activity which is made possible by the tariff structure, relative to the situation in the absence of the tariff" (Corden 1966). Formally, for a given sector, in the case of one tradable input, the ERP can be written as:

$$ERP \equiv \frac{V_t - V_w}{V_w} = t_a + P_c \left(\frac{t_a - t_c}{P_a - P_c} \right) \quad (2)$$

where V_w is the value added under free trade, V_t is the value added under tariff protection, t_a is the *ad valorem* tariff on the unprocessed good, t_c is the tariff on processed good, P_a and P_c are the

²² Available on the WTO website at: http://www.wto.org/english/thewto_e/glossary_e/glossary_e.htm

world prices of the unprocessed good and the processed good respectively. The ERP can be positive or negative, in the latter case the domestic industry is discriminated against the imported good.²³

From (2) it follows that, in the absence of any imported input or if the tariff structure is flat, the ERP and the nominal rate are equal. However, with one imported input and a tariff escalation, the ERP on the processed good is higher than the nominal rate. Therefore, "an escalated structure biases trade in favor of raw materials against processed products" (Corden, 1966, p. 229).

As an illustrative example of the relationship between nominal tariff rates and the ERP, consider that a downstream sector, say the furniture industry, sells initially its table (final good) at a final price of \$100 (see Figure 3), where the input cost of wood is \$40 and the value added of the furniture industry is \$60. Now suppose that the government imposes a flat tariff structure: an *ad valorem* tariff of 30% is imposed on both imports of tables *and* wood. This will have the effect of increasing the sale price of tables, from \$100 to \$130. At the same time, the cost of wood also increases by 30%. The effective rate of protection on tables is therefore the same as the nominal tariff rate, 30%. If the government were to protect specifically the value addition in the country by imposing a tariff of 30% on tables but only of 5% on wood, the picture would change significantly. In effect, this would lead the input cost to shrink, while increasing the share of value added. In this case, the effective rate of protection is 46.6%. Tariff escalation can therefore give significant protection to processed goods, despite sometimes low nominal rates.

²³ Anderson (1998) proposed an alternative and more operational definition of the ERP (both in partial and general equilibrium settings): for a given sector, the ERP is the uniform tariff which would have the same impact on the profit of the sector as the actual tariff structure. See Antimiani *et al.* (2003), Antimiani and Salvatici (2005) and Bhagwati *et al.* (1998).

Fig. 3 Tariff escalation and the effective rate of protection on the downstream sector

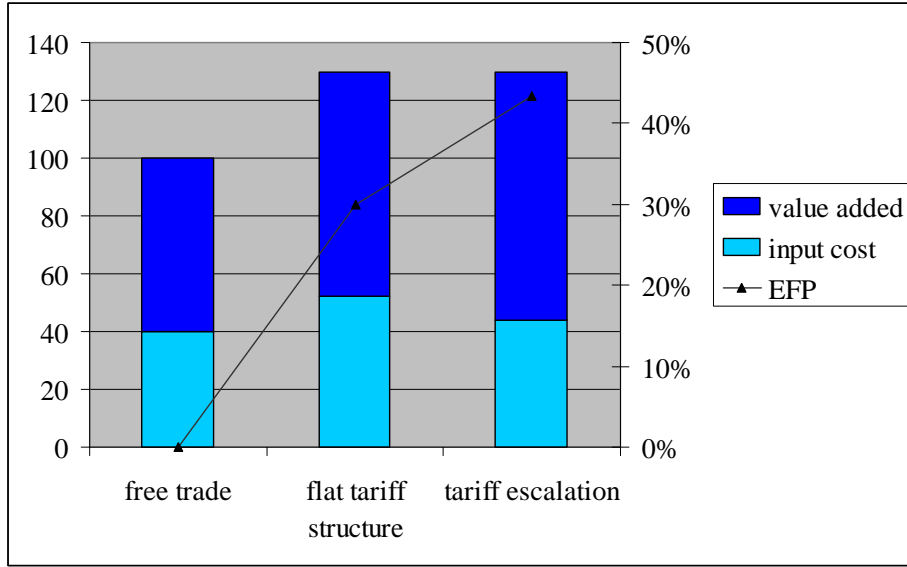
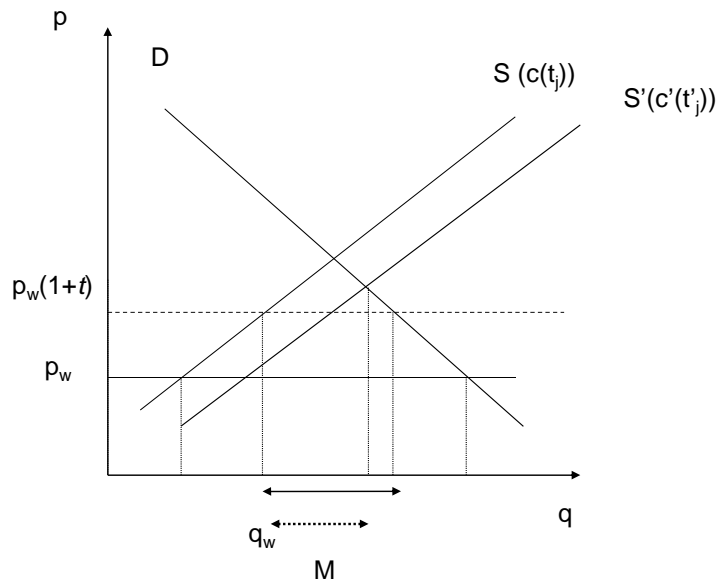


Figure 4 shows the effects on trade of tariff escalation in a partial equilibrium model. In line with our previous example, S depicts the supply curve of the processing industry and, under free trade, q_w is the quantity of tables sold on the home market at a price p_w . In the standard tariff analysis, if the importing country imposes an import tariff on tables to protect its domestic processing industry, it has the following effects: an increase of the domestic price of tables to $p_w(1+t)$, a reduction in the quantity imported of foreign tables and an increase of the domestic production. Showing the effects on trade of tariff escalation in a partial equilibrium requires to write the supply of the downstream sector (S) as a function of the input cost (c) which, in turn, depends on the tariff applied on the raw material $c(t_j)$: $S(c(t_j))$. Changes in tariffs on the raw material will alter the ERP of the downstream sector. Suppose that the initial tariff structure is flat (tariff rates on wood and tables are of 30%). If the tariff applied on wood goes from 30% to 5% as in our previous example, this reduces the input cost and therefore shifts the supply of tables to the right to $S'(c'(t'_j))$. Consequently, domestic production increases and imports decrease, while the domestic price remains unaffected at $p_w(1+t)$.

Fig. 4 Reduction of tariff on raw material on the downstream sector



Where $c(t_j)$ is cost of the input as a function the tariff on the upstream sector j and $t'_j < t_j$

Using the same graph, it is possible to analyze the combined effect of tariff escalation and export taxes on trade. This analysis provides the basis for the discussion in the next section. Suppose that initial supply curve is the one depicted as S' and that the tariff structure is flat (tariff rates on wood and tables are of 30%). If the exporting country imposes an export duty on wood, this will increase the world price of wood and hence increase the cost of inputs for the furniture industry. An increase in the cost of wood will shift the supply to the left in S . The quantity imported rises and the quantity produced domestically declines. To offset this export duty, the government will have an incentive to decrease the tariff imposed on wood, and, therefore, put in place a tariff escalating structure of protection. There exists a tariff on wood such that the cost of wood will decline to its previous level (in this case $c'(t'_j)$) and shift back the supply curve to S' . As a result, domestic production and imports of tables are left unchanged. The two measures cancel each other out.

4.3. Non-cooperative policy equilibrium

The previous two subsections study the effects of taxes on resource exports and of tariff escalation in the resource importing country on the trade flows of raw materials and processed products. In particular, so far we have only looked at the unilateral effects of these measures and disregarded the potential countermeasures implemented by trading partners. In this subsection, we take the analysis one step further and focus on the multilateral effects of non-cooperative trade policy in natural resource sectors. Specifically, we briefly review how export taxes on raw materials and tariffs on processed goods affect the welfare of trading partners, how trading partners are likely to react to these measures and how global welfare is influenced by the joint imposition of export taxes and tariff escalation in resource sectors.

Trade measures are "beggar-thy-neighbor" policies, in the sense that they can be unilaterally attractive for the country imposing them, but multilaterally destructive. The trade literature has formalized two main types of externalities associated to trade measures: the terms-of-trade effect (Johnson, 1954) and the production relocation effect (Venables, 1987). In a nutshell, these theories suggest that governments may use trade policy to alter to their advantage (and to the disadvantage of their trading partners) the relative price of their exports or to expand domestic production at the expenses of foreign production. Below we discuss why these two externalities matter for resource trade and provide simple examples of how these cross-border effects may lead to a non-cooperative resources trade equilibrium.

Consider a neoclassical model with two large countries, a resource-rich and a resource-scarce economy, trading in raw materials, processed goods and in a third "outside" sector. The resource-rich country exports the raw material and the processed good to the resource-scarce country and imports the outside good. An export tax on the raw material in the resource-rich country lowers the supply of the raw material in international markets and increases its world market price (for a given level of world demand). This price change represents a terms-of-trade gain for the resource exporting country, as the price of its exports has increased relative to the price of its imports, and a terms-of-trade loss

for the resource importing country.²⁴ On the other hand, a tariff on the downstream sector in the resource-scarce country has the opposite effect on its relative price of exports, as the fall in the domestic demand raises the world price of the processed good, thus improving the terms-of-trade of the resource-scarce economy and lowering the terms-of-trade of its trading partner.

The above discussion points to the possibility that export taxes and import tariffs can be policy measures that countries implement to offset negative terms-of-trade effects that their policy impose on each other. If the government of the resource-rich country imposes an export tax on the raw material, while the government of the resource-scarce country sets a tariff on its imports of processed goods, each in an attempt to alter to their advantage the terms-of-trade, no one will actually succeed as these measures offset each other and do not alter the terms-of-trade. Not only, the contemporaneous imposition of tariffs and export taxes inefficiently restricts trade in the resource and the processed good sectors. In equilibrium, both countries are stuck in a welfare-inferior situation²⁵, sometimes referred to as a "terms-of-trade driven Prisoner's Dilemma" (Bagwell and Staiger, 1999 and 2002).

The terms-of-trade effect, however, is by no means the only possible beggar-thy-neighbor consequence of trade policy and a non-cooperative equilibrium could well materialize in the absence of such effects. In particular, trade policy may have the goal of expanding domestic production in a sector to the disadvantage of foreign production by changing relative prices. As mentioned earlier, this effect is referred to in the literature as the "production relocation effect" (Venables, 1987). In this spirit, export taxes on natural resources or import tariffs on downstream sectors may well have the effect of relocating the resource processing industry in the country imposing the measure. Below we provide an example of how production relocation effects may trigger a non-cooperative trade behavior.

²⁴ Note that the change in price of the resource will also affect the processed good market. Specifically, the supply of the processed good in the resource-scarce countries falls as the price of inputs increase, while the supply in the resource-rich country increases. The overall terms-of-trade effect, therefore, also depends on the change in the world price of the processed good. In the discussion in the main text, we abstract from this effect and assume that the expansion of the downstream sector in the resource-rich country fully offset the decline of the processed good supply in the resource-scarce economy, so that the world price of the processed good is not altered. It is, however, clear that the terms-of-trade improvement of the resource-rich economy can be magnified or reduced by an increase or a decline (respectively) of the world price of the processed good.

Consider the above economy with two large countries and three sectors, but assume now that the processed good sector is monopolistically competitive and is characterized by increasing returns as in Krugman (1980).²⁶ Furthermore, assume that the downstream good can be produced in both the resource-rich and the resource-scarce country. Focus first on the policy of the resource-rich country. A unilateral increase of the export tax on the resource creates a wedge between the domestic and the international price of the raw material. This price dispersion makes the downstream products produced abroad more expensive relative to the domestic ones in the market of the resource-rich economy. This implies that domestic consumers will shift their demand towards the locally produced goods. As the domestic resource processing sector sells more and the foreign sector less, local firms will sustain profits while foreign firms will incur losses. This mechanism triggers entry of new firms into the downstream market of the resource-rich economy and exit in the foreign downstream sector, so more of the production of the processed good will actually be in the resource-rich country. Such production relocation increases the welfare of the export tax imposing economy and reduces the welfare of the other country. In a model à la Krugman (1980) and Venables (1987), this is true as the expanded production of the domestic sector ensures that less of the goods consumed domestically are subject to trade costs. On the other hand, a tariff imposed on the downstream sector in the resource-scarce economy has precisely the opposite effect (i.e. relocates production of the processed good from the resource-rich economy to the resource-scarce and, hence, it expands welfare of the first to the expenses of the latter economy).

Similarly to a terms-of-trade driven Prisoner's Dilemma, if all governments chose trade policy in the attempt to host more of the downstream sector, no government actually succeeds. In equilibrium, production does not relocate across countries, but trade in raw materials and in processed goods falls in response to the rise in trade measures. To put it differently, countries are stuck in a "production relocation Prisoner's Dilemma" (Ossa, 2010).

²⁵ Our analysis does not take into account the possibility of market failures. If other distortions exist (environmental externalities or technological spillovers for example) welfare effects could be different.

²⁶ While some of these assumptions help fixing ideas, they are not necessary. For instance, a similar logic would apply if we abandon the assumption of perfect competition in the resource sector or if we consider an environment with heterogeneous firms in the downstream industry as in Melitz and Ottaviano (2008) (see Ossa, 2008). The key element in this story is the departure from perfect competition in the resource processing sector.

Independently of the form that the cross-border externality takes, the terms-of-trade and the production relocation approach have some important common grounds. First, the driving force of inefficient resources trade equilibrium is the negative effect of a trade measure (be a tariff on the downstream sector or an export tax on the resource) on the welfare of trading partners. It is this negative effect that triggers a response in kind and leads to an equilibrium where trade in both the resource and the processed good is inefficiently low (i.e. an export tax can be a countermeasure to an escalating tariff structure and vice versa). In this situation, no country will unilaterally find it convenient to open its market unless the trading partner moves its policy in the same direction. An important economic rationale for international trade agreements is precisely to provide a set of rules that allow countries to escape Prisoner's Dilemma type situations (Bagwell and Staiger, 2002).

Second, and more importantly, the asymmetry that characterizes WTO rules between export and import tariffs discussed in Section 1 limits the ability of countries to escape this inefficient equilibrium. As shown by Bagwell and Staiger (1999 and 2002) in the case of a terms-of-trade externality and by Ossa (2010) for a production relocation externality, the fundamental GATT/WTO principles of reciprocity and non-discrimination help governments internalize the negative cross-border effects that they impose on each other. Essentially, in both cases these principles ensure that joint reductions in trade restrictions neutralize the beggar-thy-neighbor effect of the policy while allowing trade to grow. This mechanism has served well GATT/WTO members in their effort to escape tariff wars. However, a prerequisite for such mutual exchanges is that countries are able to secure negotiated trade policy concessions by eliminating incentives to reverse them in the future. The weakness of rules on export policy may, therefore, prevent the ability to negotiate a joint reduction of export taxes on the resource and of tariffs on the processed good.

5. Conclusion

Natural resources have special economic features and, for various reasons, protection in those sectors exists on both import and export sides. In this paper we have discussed why large countries may be tempted to use export taxes and tariff escalation as a means of improving their terms-of-trade or to relocate domestic production toward more value added activities. However, we have argued that applying any of these measures (let's say tariff escalation to protect the domestic processing sector) will likely trigger a counter-measure (export tax on the resource) by the trading partner. This is a Prisoner's Dilemma-type situation where, in equilibrium, policies offset each other and international trade is inefficiently restricted.

Import and export policies are asymmetrically regulated under the GATT/WTO. While tariffs are multilaterally negotiated and strictly disciplined, export duties are generally not. In our view, this asymmetry leaves scope for more bargaining between exporters and importers of natural resources. In order to move away from the inefficient non-cooperative equilibrium toward a cooperative solution, countries should exchange commitments on export taxes against lower binding tariffs in downstream sectors. Joint reductions in trade restrictions would neutralize the beggar-thy-neighbor effect of the policy, while allowing trade to grow.

These considerations may have implications in the context of the Doha negotiations. On the import side, countries have moved towards the possible application of a Swiss formula to cut tariffs, which -as discussed above- implies a reduction of tariff escalation. On the export side, taxes are not under negotiation. To the extent that a trade agreement is motivated by the need to eliminate beggar-thy-neighbor effects of trade policies, this asymmetry between import and export policy is incoherent from the perspective of economic analysis and may limit the ability of countries to achieve meaningful gains in trade in natural resources and resource based products.

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