Estimating the Impact of Environmental SPS and TBT on International Trade

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Summary

According to World Trade Organization (WTO) rules, governments are allowed to take measures in order to protect human health, as well as animal and plant health, provided that the enforced measures are not disguised protectionism. The SPS and TBT agreements try to ensure that the regulations enforced at the country level do not translate into unnecessary barriers to trade. Whether they succeed is a key issue in the empirical literature. Contrasting with previous studies focusing on single cases (e.g. aflatoxins) we adopt a new approach tackling the impact of such measures at the border, across countries and industries. All notifying countries and products are covered at the most detailed level (tariff line). The econometric estimation (a censored Tobit with random effects) takes into account the bilateral (applied) protection at the same detailed level. Our results largely generalize the findings of recent studies, with a predominance of negative impacts of such measures on trade of fresh and processed food, while in the case of the majority of manufactured products, an insignificant or even positive impact is observed. Lastly, we identify a strong negative impact on leather trade, suggesting a protectionist use of such measures. In total, products with a negative impact of such measures on trade are Cut flowers, Swine meat, Vegetables, Citrus, Sugar, Juices, Wine, Animal feed preparation, and Leather.

I. Introduction [1]

Under Article 20 of the General Agreement on Tariffs and Trade (GATT), governments are allowed to take measures in order to protect human health, as well as animal and plant health, provided that the enforced measures are not disguised protectionism. The basic rules for this are set in a separate agreement regarding food safety and plant or animal standards: the Sanitary and Phyto-Sanitary Measures Agreement (SPS). In the same

spirit, the agreement on Technical Barriers to Trade (TBTs) tries to ensure that the regulations (standards, testing and certification procedures) enforced at the country level do not translate into unnecessary barriers to trade. Countries have a right to adopt regulations that protect their consumers and the environment, but these regulations, and the procedures used to check the conformity of products, must be used on a non-discriminatory basis.

Accordingly, environmental measures and standards[2] have been extensively used throughout the world (under the SPS and TBT agreements) in order to avoid the introduction of exotic species, predators and diseases, and to limit risks to human and animal health. Examples include quarantine, inspections, certificates, and bans. There are many other motivations for imposing technical standards than the environment; however, this paper will focus on environmental SPS measures and TBTs in order to appraise the potential impact of raising environmental concerns on trade.

Whether such environmental measures actually protect the environment or the domestic producers is a key issue that has been extensively discussed in the existing literature so far. Developing countries often point out that environmental policies become increasingly stringent for sectors in which they are competitive (UNCTAD [2002]). One must admit, however, that in recent years the global tariff reduction has increased the sensitivity of trade flows to environmental measures. Additional transaction costs progressively emerge as a major obstacle to market access. In response to this trend, SPS and TBT have been identified as a major issue for least-developed countries (LDCs) by International Institutions (World Bank [2001] and Wilson [2001]).

However, the dividing line between "measures at the border" and obstacles to trade is difficult to draw (Maskus *et al.* [2000]) and referring to multilateral rules does not help. The agreement on the application of SPS adopted in 1995 by World Trade Organization (WTO) members, states that notified measures must not be of a protectionist nature, but based on scientific evidence or international sanitary standards. The same logic applies for the agreement on TBTs. However, this does not guarantee that such measures have no effects on trade, but that impact is not always negative. For sensitive products, enforcing a measure at the border may guarantee the existence of trade flows that would otherwise not be recorded at all - hence the coexistence of arguments in favor of a negative impact (hidden green protectionism), as well as a positive impact (based on informational considerations).

This is why the direction and the magnitude of impact of environmental SPS and TBTs on trade is essentially an empirical issue, which must be tackled at the most detailed level. The difficulty is, however, the following: in order to assess accurately the restrictiveness of the measure under consideration, it is convenient to focus on cases for which precise information is available. The evidence provided by the calculation of *ad valorem* equivalents of phytosanitary regulations for specific products (see Krissoff *et al.* [1997] on apples) is a step in the right direction. Another strand of literature aims at revealing the restrictive impact of environmental measures by relying on trade equations. The case for aflatoxin residuals is the corner stone of this emerging literature and has been largely documented by the World Bank (Otsuki *et al.* [2000]; Wilson and Otsuki [2001]). These approaches provide valuable input to the debate allowing conclusions to be drawn on the effective impact of environmental measures that significantly reduce international trade for certain sensitive products, notably food products. However, there are still two concerns: first, a potential model miss-specification is associated with the non-inclusion of bilateral tariffs in the estimated equations; second, these studies are restricted to certain products, neglecting a systematic assessment of the potential impact of environmental measures on trade.

The present contribution adopts a new approach in order to systematically shed light on the impact of environmental measures at the border across countries and industries. Our value added consists of covering all notifying countries and all products at the most detailed level (tariff line) and introducing additional explanatory variables into the econometric estimate, in particular, the bilateral (applied) protection at the most detailed level. The first section presents the kind of data that is used and provides definitions. Section 2 is an overview of how far Environmental Resources Management (ERM) have spread throughout international trade, while Section 3 reviews the existing literature on the impact of ERM on trade. In section 4, we present our improved methodology, detailing the results in section 5. Section 6 concludes and stresses further directions of research.

II. Definitions and Scope of the Study

An analysis of the magnitude and structure of environment-related measures notified under the SPS and TBT agreements has been provided in a companion paper (Fontagné, Mimouni and von Kirchbach [2003]); we nevertheless summarize some key findings in the next section. If the current contribution relies on the same database of notifications, the approach adopted is econometric rather than an inventory approach.[3]

Our primary data is derived from COMTRADE, the world's largest trade database maintained by the United Nations, and the United Nations Conference on Trade and Development (UNCTAD) database on trade barriers. The latter is based on notifications by member countries of their SPS and TBT to the WTO.[4] This is clearly a drawback of our analysis, since some measures may not have been notified. However, non-notified measures significantly impacting trade should translate into cases at the WTO.

Six different categories of motivation for enforcing ERM are taken into consideration here, namely: environment, wildlife, plant health, animal health, and human health and human safety. For each measure, information is available regarding the notifying (i.e. importing) country, the product in terms of the Harmonized System code, and the type of measure. UNCTAD distinguishes various types of measures (see Box 1). ERM may fall into all these categories with the exception of price control measures.

Trade data at the 6-digit level of the Harmonized System nomenclature (HS6), for some 5,000 products, is merged with information obtained at the tariff line. Since each HS6 position may group various tariff lines, a notified measure may be applied twice to a given HS position. In addition, different measures can be notified for a given HS6 position by an importer.

There are only 96 countries (the EU is considered one country)[5] notifying SPS and TBTs, even if there are many more countries in the original UNCTAD database. We consider the notifications compiled up to 2001, with the exception of 7 countries that provided highly suspicious records for 2001. For these countries,[6] we use notifications as of 1999 contained in the previous release of the database. With the exception of rare and special crises, SPS and TBT notified by an importer are not directed against a particular exporter; hence, we miss the bilateral dimension eventually associated with such measures.

Results of an Inventory Approach

The frequency of product-specific measures across countries can be a helpful starting point. If a very limited number of countries enforce a given measure on a given category of product, there might be cause to suspect green protectionism. On the contrary, when a sizeable proportion of international trade is affected by a given

regulation for a given product, this might be the response to risks for health or safety; in this case, the measure could favor rather than limit trade flows. "Potentially affected imports" are defined in the following as the value of world imports at the HS6 level that grouping tariff lines on which measures have been notified. "Affected imports", are defined as the value of world imports (in the affected products) by countries notifying these measures.

On the whole, 80% of all products defined at the six-digit level of the Harmonized System are facing a notified ERM in at least one importing country. Using a 40% threshold in terms of potentially affected world imports, there are 516 widely affected products out of the 5,134 products considered here, amounting to a trade value of US$ 665 billion in 2001, among which US$ 408 billion in imports are actually affected. Reciprocally, there are only 1,022 products that do not face any restriction.

There are a significant number of products, particularly food products, widely affected by environmental measures[7]. However, enforcement of environmental measures is not limited to agricultural or fishery products, but is spreading to manufacturing products also (labor intensive products, automobiles, medicaments or telephones in particular).

Technical barriers are the most frequent type of measure, even if the proportion of affected trade is limited: 17% (Table 1). The other types of environmental measures are (in decreasing order of affected trade): authorization, testing, inspecting and quarantine, and prohibition[8]. Eco-labeling, packaging, prior surveillance, quotas, finance measures and monopolistic channels are of minor importance.

Such an inventory approach sheds light on the potentially protectionist nature of the environmental measures, as well as on the sensitivity of importers to certain risks. In the latter case, as it has already been stressed, environmental measures could actually be a hindrance to nature.

Out of 5,134 products considered here, there are 63 sensitive products of the latter type, identified by at least 40 importing countries as embodying an environmental risk, accounting for US$ 75 billion of world imports in 2001. With the exception of chemicals and of pharmaceuticals, only agro-food products are concerned. In contrast, for 1,844 products, only up to five countries enforce an environmental measure. The corresponding restricted trade amounts to US$ 111 billion, out of a total of US$ 1,914 billion in world imports of these products. Such a low ratio points to green protectionism.

Adopting an even more restrictive definition of suspect practices, one can examine situations in which imports in a given product are affected by a measure enforced by a single country. There are 431 products of this type, corresponding to US$ 295 billion imports: only 11% of world imports in these products meet the requested criterions and enter the protected markets. These products are mainly concentrated in labor-intensive industries (Table 2). Topping this list, one finds carpets where the importer enforcing the environmental measure amounts to 54% of world imports. Then come articles of apparel, not knit for which there are 56 affected HS positions corresponding to a 36% degree of restrictiveness. Other categories of seriously affected products refer to specific outcomes, hence the prohibition of ivory in musical instruments affecting 8.5% of world imports of such instruments imposed by a single importer.

III. Econometric Evidence: Existing Literature

For agricultural products, environmental measures at the border can facilitate trade under certain circumstances. However, more generally, there is a suspicion that overly stringent criterion might be used as a disguised trade barrier. In the same way, for labor-intensive products, such as cotton garments or leather, and more generally the labor-intensive industries identified above, there is a concentration of "single country measures" and a possibly negative impact of environmental measures on trade is expected.

This difference in the expected impacts of border measures on trade implies works at the product level or at least using homogeneous categories of goods. The product-specific perspective is actually recommended for practical and theoretical reasons, exposed in detail by Maskus *et al.* [2000]. As mentioned by the authors, aggregation of standard data is problematic since "standards are not simple taxes, nor are the quantitative limits on trade or percentage procurement preferences. (…) The complex nature of regulations in itself makes aggregation questionable. (…) Simple counts of the number of regulations mixes those with significant effect and those with little impact on trade".

Maskus *et al.* [2000] provide a recent survey of the literature and research on measuring the impact of technical barriers on trade. So far, there are a limited number of empirical attempts in the field. Moenius [1999] analyses the impact of all types of standards (environmental as well as technical) on trade for a wide range of products (471 SITC industries) over a 16-year period. He confirmed the positive impact on trade of bilaterally shared standards and also showed that the impact of country-specific standards on trade varies significantly across products, with a negative effect for most agricultural products and a trade promoting effect for manufactured goods. One of the strengths of Moenius' works lies in the effort of gathering data on standards[9] and matching them with trade data. However, the scope of Moenius' work is rather narrowed since his analyses are limited to 12 countries, all of them being OECD members. Another major drawback of Moenius' model is the absence of data on tariffs.

Aside from the work of Moenius, the majority of the empirical studies in the field are restricted to a limited number of products. For example, Wilson and Otsuki [2002] analyze the impact of one SPS (the maximum residue limit of the pesticide chlorpyrifos) on banana trade from 19 developing countries towards 12 countries. They found a significant negative impact of the increase in regulatory stringency regarding pesticides on banana trade. Using a similar methodology, Wilson and Otsuki [2001] estimated the effect of aflatoxin standards on trade for three product groups (cereals, dried and preserved fruits, and nuts), using a sample of 31 exporting countries and 15 importing countries. They found that adopting a worldwide standard for aflatoxin B1 would significantly increase the nut and cereal trade among the countries under review. They also found that aflatoxin B1 standards in importing countries have a negative impact on the trade flows of cereals and nuts, while for dried and preserved fruits, there seems to be no effect of standards on trade. Analyzing the same products, but restricting the analysis to eight African exporting countries and to the EU import market, Otsuki *et al.* [2000] found a significant negative impact on African exports to the EU of both cereals dried fruits and nuts.

In all the above mentioning studies, an econometric model of the gravity-type form such as in (1) is used.

$$\log X_{ij} = \alpha_0 + \alpha_1 \cdot \log Y_i + \alpha_2 \cdot \log Y_j + \alpha_3 \cdot \log SPS_j + \alpha_4 \cdot \log Dist_{ij} + \alpha_5 \cdot Border_{ij} + \alpha_6 \cdot Culture_{ij} + \beta_1 \cdot DTA_{1ij} + ... + \beta_n \cdot DTAn_{ij} + e_{ij} \quad (1)$$

where:

i : the exporting country

j: the importing country

X_{ij} : trade from country *i* to country *j*

Y_i : GDP per capita of country i

SPS_j : sanitary standards (e.g. maximum level of pesticides)

D_{ij}: distance between *i* and *j*

DTA1, …, DTAn : trade agreements dummy variables

$Border_{ij}$: *i* and *j* are neighboring countries (=1) or not (=0)

$Culture_{ij}$: bilateral dummies of common culture (common language, colonial history)

e_{ij} : error term

Alternative specifications include both GDP and population data, similarity in sanitary standards (concordance measure between SPS_i and SPS_j) and alternative production factors (such as rainfall for banana).

In all these models, there is one major missing variable, the bilateral tariff faced by the exporting country *i* in the market *j* for each commodity group under study. In the absence of true *ad valorem* tariffs, the authors use trade agreement dummy variables (*DTA1,…,DTAn* in equation 1). Unfortunately, these dummy variables of regional agreements not only capture the sole impact of tariff on trade, but also may capture similarities in technical regulations and phytosanitary standards, since countries belonging to a same trade block -say Southern Common Market (MERCOSUR)- usually share more standards than two countries belonging to two different trade blocks -say MERCOSUR and the West African Economic and Monetary Union (WAEMU)-. In addition, these variables are usually correlated with the border dummy variable (countries in a regional agreement are usually very close to each other) and cultural factors (share of a common colonial past, like WAEMU).

Therefore, our major improvement is to include tariff data and possibly specific duties (for example $ 0.2 per kilo), tariff quotas and anti-dumping duties in the empirical analysis. That would allow a *comparative analysis* of the impact of tariffs and ERM on trade.

Finally, before presenting our model, it is worth mentioning Krissoff *et al.*'s [1997] research on the effect of phytosanitary requirements for American apples in Japan, South Korea and Mexico. Their methodology is based on a comparative analysis of monthly market prices of apples in the target markets. The tariff rates are also taken into account in the calculations. This methodology allows the calculation of a tariff-rate equivalent for phytosanitary requirements, estimated at up to 58% in the case of the Japanese market. The method has certain drawbacks, mentioned by the authors, since the study did not take into account preferences for domestic apples and the difference

in quality. Nevertheless, such methodology allows the comparison of the impact of two specific types of barriers: tariffs and SPS. It is, however, only applicable to homogeneous goods (such as bananas, apples).

IV. A New Approach, Based on Notifications and Including Bilateral Tariffs

The objective of this section is to analyze the impact of ERM on trade for a wide range of products, including sensitive products and products most likely affected by green protectionism. On the contrary as already stressed, for sensitive products there should not be any negative impact on trade, since most importing countries notify ERM. Ganslandt and Markusen [2001] argue for instance that SPS would facilitate trade of products potentially dangerous for the environment, since trade of such products would not happen without any control ensuring their innocuousness.

For each product group *s*, we analyze the impact of ERM on exports from LDCs, developing countries and OECD countries.

Our methodology is quite similar to Wilson and Otsuki [2002] and Wilson and Otsuki [2001]. Our major improvement, as compared to their works, consists in the inclusion of bilateral tariff data in our model, allowing the distinction between the impact of tariffs and ERM on trade.

In addition, we will analyze both sensitive (many notifying countries) and suspicious (only a few notifying countries) products, and verify whether the impact of ERM on trade is different for these two categories of products.

Our model takes the forms of (2).

$$\log X'_{ij,s} = \alpha_0 + \alpha_1 \cdot \log DiffY_{ij} + \alpha_3 \cdot \log Tele_{ij} + \alpha_4 \cdot \log Dist_{ij} + \alpha_5 \cdot Border_{ij} + \alpha_6 \cdot Culture_{ij} + \alpha_7 \cdot Tariff_{ij,s}$$
$$+ \alpha_8 \cdot Popdens_{ij} + \alpha_9 \cdot Transit_{ij} + MRM_{j,s} \cdot (\alpha_{10} \cdot LDC_i + \alpha_{11} \cdot DC_i + \alpha_{12} \cdot OECD_i) + \mu_{i,s} + \nu_{j,s} + e_{ij,s} \quad (2)$$

where:

$X'_{ij,s}$: size-adjusted trade from country *i* to country *j* ($X'_{ij,s} = X_{ij,s} / Y_i . Y_j$)

Y_i: GDP of country i

Ypc_i: Per capita GDP of country i

$DiffY_{ij}$: *Absolute difference in p*er capita GDP, $Diff_{ij} = |Ypc_i - Ypc_j|$

$Tele_{ij}$: product of telephone densities in countries *i* and *j*

D_{ij}: distance between *i* and *j*

$Border_{ij}$: *i* and *j* are neighboring countries (=1) or not (=0)

$Culture_{ij}$: bilateral dummies of common culture (common language, colonial history)

$Tariff_{ij,s}$: bilateral market access measure (for trade from *i* to *j*)

$Popdens_{ij}$: product of population densities in countries *i* and *j*

$Transit_{ij}$: takes the value 1 if *i* and *j* are neighboring countries and one of the two is landlocked and 0 otherwise

$MRM_{j,s}$: Multilateral ERM imposed by the importing country *j* (based on notification data)

LDC_i : dummy variable, =1 if the exporting country *i* has the LDC status and 0 otherwise

DC_i : dummy variable, =1 if the exporting country *i* is a developing country (but not a LDC) and 0 otherwise

$OECD_i$: dummy variable, =1 if the exporting country *i* belongs to the OECD and 0 otherwise

$m_{i,s}$: fixed effect per exporter

$n_{j,s}$: fixed effect per importer

$e_{ij,s}$: error term

The *fixed effects* per exporter / importer ($m_{i,s}$ and $n_{j,s}$) allow the capture of the so-called "multilateral resistance" term, described notably in Anderson and van Wincoop [2003]. Hence, these fixed effects capture why a country *i* (whatever its size) is specialized in exporting the product group *s* under analysis, all other factors included in the model, being equal.

We also added the *absolute difference in per capita income* ($DiffY_{ij}$) to test for the Linder hypothesis, i.e. countries with similar levels of per capita income will have similar tastes, will produce similar but differentiated products and trade more among themselves. A negative sign is then expected for differentiated products (mainly manufactured goods) while for homogeneous products, such as tomatoes or bananas, a positive sign is expected. Countries with differences in GDP will tend to trade more than countries[10] with similar levels of development.

Based on the findings of Loungani, Mody and Razin [2002], who investigated alternative ways of modeling transaction and transport costs, we included a variable ($Tele_{ij}$) that captures the role of the informational infrastructure. The variable of *bilateral telephone densities* is measured as the product of telephone lines per capita in the two countries.[11] The source for the data is the World Bank's World Development Indicators.

The distance and border variables are defined classically. The transit variable has been added in order to possibly capture transit trade between a landlocked country and its neighbors, for example between Senegal and Mali or Uganda and Kenya.

The common culture variable ranges from 0 to 1 and takes into account both common national languages (official or not), as well as links established during the colonial period. For each country, we have distinguished main and secondary languages. Secondary languages may not be official and include languages spoken by large communities of immigrants, such as Turkish immigrants in Germany and Latin-American immigrants in the US. This allows us to capture to some extent the influence of diaspora on trade. One country may have up to three main languages and three secondary languages. Malaysia has, for instance, two main languages, Mandarin and Malay, and two secondary languages, English and Hindi. The variable can take four values: 0, 0.25, 0.5 and 1. It takes the value 1 if the two countries share a common main language or if country *i* (or *j*) was a former colony of country *j* (or *i*). It takes the value 0.5 if the two countries, share a common language, that is a main language in one country but a secondary language in the other (*j* or *i*). It takes the value 0.25 if the two countries share a common second main language.

The total area of the country is also taken into account as a proxy for the internal distance. Big countries will tend to trade more with themselves than smaller

countries would. The source of the data is the World Bank's World Development Indicators. Since area may be correlated with ERM (large countries will usually impose more ERM), we have opted for the product of the *population densities* (population divided by area) as an alternative to population and land area.

Finally, we describe in detail the two trade barrier variables, tariffs and ERM.

The $Tariff_{ij,s}$ variable in (2) actually contains more information than *ad valorem* tariffs. It is a variable of *bilateral measure of market access*, extracted from the Market Access Map (*MAcMap*) database. This very sophisticated measure includes not only applied tariffs, but also specific duties (for example $ 0.2 per kilo), tariff quotas and anti-dumping duties. All these barriers are converted into an *ad valorem* equivalent and summarized in one measure. This measure is computed initially at the tariff line level. It is also possible to calculate average bilateral measures at more aggregated levels (here at the 4-digit level of the HS), for sectors or even for the entire economy. *MAcMap* takes into account all preferential regimes for each importing country versus all its partner countries. In addition, an original aggregation methodology, based on country grouping, is used in order to limit the effect of endogenous aggregation bias.[12] It is worth mentioning that the methodology has one major implication at the product level: data may not be available for all pairs of countries and for all goods since there are some goods (say mobile phones) that are not exported by certain categories of countries (e.g. LDCs). In *MAcMap,* those records are deliberately not included in the database.

The *multilateral environment-related measure* component included in (2) aims at capturing the impact of ERM on trade. We however consider different impacts on exports from LDCs, developing countries (excluding LDCs) and OECD member countries. Examining the similarities (or concordances) in ERM between the countries *i* and *j*, would be of high interest, since two countries equally sensitive to environmental issues should trade more, all other factors being equal. However, it has not been possible here simply because we have a relatively small sample of notifying countries in the database. That would reduce our country sample from 114x61 possible pairs to 61x61 and would not allow analyses of the separate impact of ERM on exports from LDCs, since only a few LDCs report their ERM to the WTO.

Developing countries are considered here as non-OECD countries. For example if country *c* is a developing country, but without having LDC status, the impact equals $MRM_{j,s} \cdot a_{11}$. The multilateral ERM term, $MRM_{j,s}$, is based on the database referred to above, namely the notifications by countries of their SPS and TBT to the WTO, stored in the TRAINS database.

We did not take into account the different categories of importing country motivations for ERM, described earlier, but we simply *count* the number of HS items (defined at the 6 digit level of the HS) notified by the importer and divide it by the maximum number of product items belonging to the product category (defined here at the 4-digit level of the HS).

More precisely, the variable $MRM_{j,s}$ measures the proportion of product items notified by the importer within a product category, which varies between 0% (no notifications) and 100% (all products notified). For example, regarding insecticides, fungicides, herbicides packaged for retail sale (HS 3808), there are 5 product items with codes HS3808 (380810 insecticides, 380820 fungicides, 380830 herbicides, 380840 disinfectants and 380890 pesticides, nes). Argentina notifies ERM for two of them and the corresponding $MRM_{j,s}$ equals 40% (2 / 5).

Naturally, this measure is not very accurate: other product-specific measures such as the maximum allowed level of pesticides for banana is more precise. Nevertheless, our measure is one of the only ways in which data can be used to compare results across a range of heterogeneous products, provided the wide spectrum of measures enforced in the various sectors. Our objective is not to analyze any ERM-to-trade elasticity for a specific product, but to analyze the type of impact of ERM on trade (positive, negative, none) for a wide range of products and to compare it to the tariff-to-trade impact.

Table 3 illustrates some of the bilateral variables used in the analysis for a selected range of products imported by Argentina. For example, we can see that MERCOSUR countries benefit from duty-free exemptions for all the listed products. The applied tariff rate to third countries is particularly high, usually around 13%. Meat products are often notified while for frozen fish, only one product item out of 24 has been notified, illustrating the non-systematic character of notifications.

The *dependent variable* is imports (reported by the importing country) averaged over the 2000-2001 period in order to reduce both business-cycle fluctuations and irregular variations in trade statistics. The source of the data is the COMTRADE database.

The *product groups* are defined at the 4-digit level of the HS. This choice actually represents a compromise between the 2-digit level of the HS, which includes too many different products and therefore creates an aggregation problem (see Maskus et al., 2001), and the 6-digit level of the HS, which may be problematic due to the different revisions of the HS.[13] The list of 61 selected product groups is shown in Appendix 1. We have selected the products primarily on the basis of the number of notifying countries and the value of world imports in 2001. For the number of notifying countries, we have tried to select primarily sensitive products (defined here as having at least 40 notifying countries) while also considering several other less sensitive product groups. Among the latter, we have only considered product groups notified by at least 2 countries, leaving the products with a single notifying country aside. In this section, for the sake of clearer analysis, we will define three categories of products, the "sensitive" products, notified by at least 40 countries, the "suspicious" products, with less than 11 notifying countries and the remaining products, with between 11 and 39 notifying countries. This latter category includes a large share of processed food. For the second criteria, we have selected product groups representing a significant share of world trade, e.g. 0.05% of world trade of all goods, or around US$ 2.5 billion.

Our *country sample* includes 114 exporting countries and 61 importing countries, listed in Appendix 2. On the importing side, we have included countries that report both their trade, tariff and SPS data. In addition, we have excluded EU importing countries from the sample, since, as mentioned in a previous section, the number of notifications by the EU seems to be underestimated in the database.

On the exporting side, the sample is larger since trade, tariff and SPS data are based on the importer's statistics. For the sake of robustness, we have applied additional selection criteria for our sample of exporting countries. We have for example excluded significant re-exporters, such as Hong-Kong, Panama and Singapore, as well as oil exporters, such as Algeria and Saudi Arabia, from our sample. Very small territories, such as Saint Lucia or Samoa, as well as countries affected by severe conflicts (Afghanistan, Iraq, Somalia, Sierra Leone) have also been discarded.

With 114 by 61 countries, we have a maximum of around 6,900 observations of country-pairs, for 61 product groups. In practice, there are fewer observations than stated

above, since bilateral market access data is not included for all products and for all country pairs, as mentioned earlier, some records being intentionally not included in the database.

A summary of our findings is provided in Table 4. We find 4 product groups for which environmental measures have facilitated trade in sensitive products and eight additional groups of suspicious products for which this is the case. In contrast, a negative impact has been found for respectively six and one groups of products. These results, which will be detailed in the next section, confirm the ambiguous nature of the effects of environmental measures on trade.

V. Detailed Results

We estimate equation (2) applying random-effect Tobit left censoring estimation to account for country-pairs with zero exports between them. In the Appendix, we report the number of zero (censored) and non-zero observations (uncensored) for each product group under analysis. Applying this estimation technique significantly modifies the parameter estimates as compared to ordinary least squares. Surprisingly, this technique is not used systematically in the previous studies. As mentioned by Greene [2000], "conventional regression methods fail to account for the difference between limit (zero) observations and non limit (continuous) observations" and consequently parameter estimates are too heavily influenced by non-zero observations. The censored regression model or Tobit model is for example used to model household expenditures on various commodity groups.

When comparing the impact of tariffs and ERM on trade for all the selected products, we can say that in general, tariffs matter more than ERM. This is particularly true for agricultural products, where tariffs are still very high and a majority of countries notify ERM in our sample. For tomatoes, a quite homogeneous commodity that can be produced almost in any country in the world, the tariff elasticity is estimated at -1.8, while there seems to be no impact of ERM on trade.

There are, however, a few exceptions such as medicaments, for which the impact on tariff changes on trade seems to be low while ERM seem to matter. Indeed for medicaments, the tariff rates are very low[14] and there seems to be a positive effect of ERM on trade.

Regarding sensitive products, we can see there is, generally speaking, no predominance of positive effects over negative effects. We can also see that in general, the different country groups (LDC, DC, OECD) are similarly affected by ERM. In addition, we can observe for these sensitive products, that tariffs matter more than ERM in many cases, such as for rice, food preparations, tomatoes, cheese, crustaceans, frozen fish or bovine meat. For citrus, a quite homogeneous good, the trade-to-tariff elasticity is around -1.7, indicating that decreasing tariffs by 10% would increase trade by 17%.

The positive impact of ERM on trade seems to be observed for medicament mixtures, chemicals for retail sale (3808) and concentrated milk. Oppositely, the negative effects of ERM on trade are observed for swine meat, cut flowers, vegetables nes (LDC and DC are affected only), wheat and meslin (DC are affected only) and pastries (DC). Interestingly, the results are different for the three cereals analyzed here: wheat, maize and rice. Rice trade flows are the most affected by tariff barriers, while wheat exports from DC seem to be restricted by ERM. Wilson and Otsuki [2001] have observed a negative impact of ERM on cereals, taken as a whole.

For the so-called suspicious products (with less than 11 notifying countries), protectionism effects cannot be observed for the list of products we have analyzed. Instead, we have a predominance of statistically non-significant effects (neither positive, nor negative) of ERM on trade. In addition, ERM seem to have positive effects on garments trade. The latter results should be interpreted with care since quantitative restrictions on trade in garments are not captured by the model, hence potentially distorting the results. The USA and Argentina are the main countries notifying ERM for garments. The results for sensitive and suspicious goods are summarized in Table 4.

For the remaining products, our estimates indicate a predominance of the negative effects of ERM on trade for processed food, such as sugar or chocolate. For beverages, such as wine, beer and juices, the situation is even worse, since exporters from LDC and DC are particularly more affected than exporters from OECD countries, for which we even observe positive impacts of ERM on exports. For example, for fruit juices, both tariffs (elasticity of -1.17) and ERM are obstacles to trade and exporters from OECD countries tend to benefit from ERM, at the expense of exporters from DC and LDC.

Detailed results of the econometric estimate are provided in Appendix 3.

For preserved fruits, the results are rather mitigated, with no effects for OECD exporters, a negative effect for DC and a slightly positive effect for LDC. In comparison, Wilson and Otsuki [2001] observed no statistically significant effect of aflatoxin standards on trade in preserved fruits.

Concerning non-food items, the results are more mixed, with a predominance of positive effects of ERM on trade for cigarettes, petro-chemicals, electronics and machinery. The most striking results concern bovine/equine leather, for which a negative impact on trade is observed for all groups of exporting countries. This product deserves a closer look.

Table 5 illustrates the notifying countries, their trade and tariff data concerning leather products. With the exception of Belarus, Canada and Papua New Guinea, all the notifying countries belong to the Middle East or Latin America. The most protectionist countries are Egypt and Tunisia, with tariffs peaking up to more than 35% applied to some partner countries. Egypt is by far a net exporter of leather. The other net exporters listed in the table include Colombia, Paraguay and Uruguay, which applied a reasonable maximum tariff rate, in the range of 12% to 15%. Belarus and Canada along with Tunisia are by far net importers. In addition, Belarus and Canada impose low tariff duties, as opposed to Tunisia and Egypt.

Finally, Jordan, Ecuador and Peru are not big leather traders (neither importers or exporters). Table 5 also includes figures on cattle stocks in 2002 in each country, completing the picture. While cattle is rather limited in Jordan, in Ecuador and Peru there is a significant amount of cattle, indicating that consumption and production of bovine leather is more domestically oriented in these countries.

In total, while it is difficult to assert any protectionist motivation of ERM for bovine leather, the tariff, trade and cattle data in Table 5 suggest that some countries may have been tempted to use ERM in order to protect their market.

As displayed in Table 6, our results largely confirm the findings of recent studies, with a predominance of negative impacts of ERM on trade for fresh and processed food. While in the case of the majority of manufactured products under analysis, an insignificant or positive effect of ERM on trade is observed. However, there are some exceptions, such as milk cream, for which ERM would have a trade-facilitating effect. Lastly, we

identified a strong negative impact of ERM on leather trade. Our analysis suggests that some of the 13 countries notifying ERM for leather were tempted to use these measures to protect their market.

VI. Conclusion

This paper proposes a systematic assessment of environmental trade barriers, using all environmental-related notifications to the WTO for 2001 and international trade data at the 6-digit level of the HS. The impact of ERM on trade has been analyzed for 161 product groups, using an econometric model.

To conclude the analysis, it is worth mentioning the limitations of our approach and proposing directions for further research.

We have used the same model specification for all product groups, while the competitiveness factors vary significantly from high-tech sector (machinery) to primary products (agricultural products). Therefore, we suggest analyses of each product group in greater depth, using more sector-specific variables, such as RandD expenditure (hi-tech sectors), FDI inflows (capital-intensive sectors), worker wages (labor-intensive industries), arable land per capita or rainfalls (land-intensive industries) when available. We should particularly concentrate our efforts in product groups displaying a positive tariff-to-trade elasticity, which is undoubtedly an indication of an incomplete or miss-specified model, eight product groups out of 61 in this case. It includes only manufactured products, such as polymers of styrene, articles of iron or steel, synthetic organic coloring matter, electric motors and generators, magnetic tapes, photo-copiers, electric transformers or insecticides for retail sale. This task is quite challenging, since bilateral trade flows of those goods are largely determined by bilateral FDI flows, for which sectoral data is rather scarce.[15]

Measuring the impact of ERM on trade for agricultural products and processed food seems to be much easier. Those product groups are all characterized by negative tariff-to-trade elasticity and in minor cases, such as maize, by a non-significant impact of tariffs on trade. Such product groups still deserve a deeper analysis, for example using more specific data for ERM, such as maximum concentration of pesticide or aflatoxin, when such data is available. For instance, Wilson and Otsuki's [2001 and 2002] analysis on banana, nuts, cereals and preserved fruits, could at low cost be refined by introducing a measure of bilateral tariffs to the model.

Notes

[1] A preliminary version of this paper has been presented at the IADB-CEPII conference in Washington: "Economic Implications of the Doha Development Agenda for Latin America and the Caribbean", Washington DC, 6-7 October 2003. We are indebted to participants for helpful comments. We acknowledge editing assistance by Amy Christopher and Mathieu Sampson. The designations employed and the presentation of material in this paper do not imply the expression of any opinion whatsoever on the part of the International Trade Centre UNCTAD/WTO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

[2] Referred to as Environment Related Measures in the following: ERM.

[3] See Beguin and Bureau [2001] for a survey and classification of approaches.

[4] WTO Members *must* notify non-tariff trade measures. These notifications are recorded and analyzed by UNCTAD in conjunction with the maintenance of UNCTAD's database, TRAINS, on trade barriers.

[5] As far as the European Union is concerned, member countries notify SPS and TBT individually. However, under certain circumstances, the European Commission may itself notify Community regulations. Contradicting this rationale for a reasoning on a country basis, notifications emanating from individual member states are consolidated by the UNCTAD into a hypothetical European level. Hence, one will consider these aggregate notifications and drop intra-EU trade from trade figures (on the ground of the mutual recognition of standards), rather than duplicating "European" notifications for each member state.

[6] Cote d'Ivoire, Egypt, Morocco, Nigeria, Philippines, Sudan and Vietnam.

[7] Bovine meat, fish, ham meat and other animal products such as bones or items for human consumption are concerned, as well as plants, bulbs and cut flowers.

[8] Prohibitions are limited to certain importers and/or countries of origin. This is why the proportion of trade in the 1,327 products affected by prohibition is only 35 percent of world trade of these goods.

[9] Moenius scanned around 300,000 documents on standards encoded in the *Perinorm* database for a dozen countries. *Perinorm* is a bibliographic database dedicated to assist users for standards and technical regulations enquiries. It is the world's leading bibliographic database of national, European and international standards from 18 countries, a total of more than 650,000 records (*http://www.perinorm.com*).

[10] For fresh fruits and vegetables, difference in latitudes can also be used to capture trade complementarities between two countries.

[11] A more accurate measure is the bilateral telephone traffic. This information is however available for a limited number of countries.

[12] A high (low) tariff implies limited (large) imports and its contribution to the overall protection is then reduced (increased). Using national imports as weights leads to an undervaluation of the protection level of a country.

[13] While most of the countries have adopted the 1996 revision of the HS, some countries still report their trade tariff or SPS notification using the original (1988) version of the HS. The 4-digit level of the HS is almost not affected by the use of different revisions.

[14] It is worth mentioning that the significant discrepancies in trade-to-tariff elasticities across the products is largely explained by the differences in tariffs applied for these commodities. Hence, reducing tariffs by 50%, from 50% to 25% would certainly not have the same effect on trade as reducing them from 10% to 5%.

[15] According to UNCTAD's Division on Investment, Technology and Enterprise Development (DITE), FDI flows in the host economy by industry and geographical origin are limited to 15 countries.

Box 1

Types of Environmental Measures at the Border Tracked by UNCTAD

1- Para-tariff measures (customs surcharges, additional charges, internal taxes levied on imports);

2- Price control measures (administrative pricing, VERs, antidumping, countervailing measures);

3- Finance measures (advance payment requirements, multiple exchange rates, transfer delays, etc.);

4- Automatic licensing measures (automatic license, prior surveillance);

5- Quantity control measures (non-automatic licensing including prior authorizations; quotas;

6- Prohibitions, export restraint arrangements, enterprise specific restrictions);

7- Monopolistic measures (single channel for imports, compulsory national services);

8- Technical measures (technical regulations, pre-shipment inspection, special custom formalities, obligation to return used products, obligation on recycling).

Table 1

RESTRICTIVENESS OF SPS AND TBT MEASURES BY TYPE OF MEASURE (2001)

Type of measure	Number of affected products	Affected imports (US$ bn)	Total imports in affected products (US$ bn)	Restrictiveness %
Authorization	3,305	661	3,763	17.6
Monopolistic	7	702	4	16.0
Prohibition	1,327	474	1,299	36.5
Quotas	112	75	147	50.8
Surveillance	622	122	285	42.7
Technical Marketing	928	234	1,130	20.7
Technical Packaging	840	204	481	42.3
Technical Labeling	1,711	292	1,881	15.5
Technical Product Characteristics	3,942	704	4,259	16.5
Technical Testing	2,847	616	3,110	19.8
Finance	21	6	32	18.7

Source: Authors' calculations on the basis of UNSD COMTRADE trade data and UNCTAD data on barriers.

Table 2

RESTRICTIVENESS OF SPS AND TBT MEASURES ENFORCED BY A SINGLE COUNTRY BY SECTOR (2001)

HS group	Designation	Affected imports (US$ mn)	Nb of affected HS6 positions	World imports (US$ mn)	Restrictiveness %
57	Carpets and other textile floor coverings	3	1	6	54.2
62	Articles of apparel, accessories, not knit or crochet	23,214	56	64,323	36.1
61	Articles of apparel, accessories, knit or crochet	7,665	46	22,455	34.1
80	Tin and articles thereof	15	3	170	9.0
92	Musical instruments, parts and accessories	109	10	1,277	8.5
63	Other made textile articles, sets, worn clothing, etc.	217	10	3,619	6.0
52	Cotton	15	6	299	5.2
54	Manmade filaments	8	3	259	3.1
86	Railway, tramway locomotives, rolling stock, equipment	14	5	552	2.5
78	Lead and articles thereof	2	1	84	2.1
69	Ceramic products	51	7	3,843	1.3
56	Wadding, felt, nonwovens, yarns, twine, cordage, etc	42	13	3,615	1.2

Note: calculations made at the 6-digit level of the HS, results aggregated in HS2 groups. World imports refer only to affected products in each HS2 group.
Source: Authors' calculations on the basis of UNSD COMTRADE trade data and UNCTAD data on barriers.

Table 3

Example of Data for Argentina's Imports

Product group	Exporting country	Export value to Argentina 2000-2001 (US$ th.)	Ad-valorem applied tariff (%)	Number of product items (HS6)	Number of notified product items (HS6)	Proportion of notified product items (HS6) (%)
0102 Live bovine animals	URY	2,572	0.0	2	1	50
	CHL	333	4.5	2	1	50
0201 Meat of bovine animals, fresh or chilled	URY	10,942	0.0	3	2	67
	AUS	0	14.0	3	2	67
	DNK	0	12.5	3	2	67
0203 Meat of swine, fresh, chilled or frozen	BRA	54,419	0.0	6	3	50
	CHL	6,172	12.5	6	3	50
0303 Fish, frozen, whole	BRA	1,179	0.0	24	1	4
	CHL	1,028	12.5	24	1	4
0306 Crustaceans	ECU	1,240	12.5	10	5	50
0406 Cheese and curd	URY	8,690	0.0	5	2	40
	BRA	4,517	0.0	5	2	40

Table 4

Summary Results for Sensitive and Suspicious Goods

	Sensitive (19 product groups)	Suspicious (15 product groups)
Positive effect of ERM on trade	4 product groups: milk concentrated, insecticides etc. for retail sale, maize (LDC), medicament mixtures (DC and OECD).	8 product groups: polymers of styrene (OECD), plastic sheets (DC), t-shirts, pullovers (LDC andDC), men's suits, women's suits, linen (LDC and OECD), television parts (DC).
Negative effect of ERM on trade	6 product groups, flowers, biscuits (DC), wheat (DC), citrus (LDC), vegetables (LDC and DC), swine meat (DC and OECD).	One product group: Ballpoint pencil.
No effect	9 product groups: bovine meat and live, frozen fish, crustaceans, cheese, tomatoes, rice, soya, food preparations nes.	6 product groups: articles of iron and steel nes, electric accumulator, magnetic tapes, photo-copiers, lamps, articles for funfair.

Note: unless specified between brackets the effect is statistically significant across all categories of exporting countries (LDC, DC and OECD).

Table 5

COUNTRIES IMPOSING ERM ON LEATHER
(HS code 4104, leather of bovine/equine animal)

Region	Importing country	Higher applied bilateral tariff (%)	% of notified product items	Cattle stock in 2002 head th (*)	Net exports (US$ m)	Exports (US$ m)	Imports (US$ m)	Leading source of import	Imports from this source (US$m)	Import duties faced by this Country (%)
Other	Belarus	5.0	100	4,084	-11.9	25.7	37.6	RUS	17.4	0.1
	Canada	2.5	100	13,699	-147.3	40.4	187.6	ITA	83.2	2.2
	Papua New Guinea	11.0	100	89	n.a.	n.a.	n.a.	ARG	0.0	11.0
Latin America	Colombia	15.0	100	27,000	53.2	60.4	7.2	USA	2.9	8.7
	Ecuador	15.0	100	5,578	-0.7	1.3	2.1	COL	1.1	0.1
	Guatemala	10.0	100	2,540	-4.4	1.9	6.4	NIC	1.9	0.1
	Peru	12.0	100	4,950	1.4	2.4	1.0	BOL	0.4	0.1
	Paraguay	12.0	100	9,900	52.0	53.5	1.6	BRA	0.6	8.5
	Uruguay	12.5	100	11,670	161.8	228.4	66.7	ARG	37.1	0.1
Arab countries	Egypt	30.0	100	3,810	48.6	50.0	1.4	ITA	0.3	20.8
	Jordan	0.1	100	68	-0.1	0.0	0.1	EGY	0.0	0.1
	Tunisia	35.8	100	760	-79.3	9.6	88.9	ITA	32.9	9.1

Note: (*) the source is the FAO.
Sources: ITC estimates based 2001 data from COMTRADE and MAcMap.

Table 6

ECONOMETRIC IMPACT OF ERM ON TRADE, SUMMARY OF FINDINGS

Studies	Products and measures covered	Products with a negative impact of ERM on trade	Products with a positive impact of ERM on trade
This study	161 product groups/all ERM notified to the WTO	Cut flowers, swine meat, vegetables, citrus, sugar, juices, wine, animal feed preparation, leather	Milk cream, medicaments, insecticides, acyclic alcohols, electric motors, transformers, insulated cable
Wilson and Otsuki [2002]	Banana / pesticide concentration	Banana	
Wilson and Otsuki [2001]	Cereals, dried fruits, nuts/ aflatoxin standards	Cereals, nuts	
Krissoff et al. [1997]	Apples in a few markets/ pesticide standards	Apples	

Appendix 1: Selected product groups

HS code	Label	Number of countries which notified at least one product (*)	Notified by the EU	Nb of product items	World imports in 2001 (US$ million)
3004	Medicament mixtures (not 3002, 3005, 3006), put in dosage	61		8	59,988
0102	Live bovine animals	58	yes	2	3,691
0201	Meat of bovine animals, fresh or chilled	52	yes	3	7,871
0203	Meat of swine, fresh, chilled or frozen	52	yes	6	9,893
1006	Rice	50		4	4,736
0402	Milk and cream, concentrated or sweetened	49		5	5,065
0603	Cut flowers and flower buds for bouquets, fresh or dried	49	yes	2	4,011
0303	Fish, frozen, whole	48	yes	24	8,538
0306	Crustaceans	48		10	12,333
0709	Vegetables nes, fresh or chilled	48		9	4,274
0805	Citrus fruit, fresh or dried	48		5	4,763
1001	Wheat and meslin	48		2	10,446
0702	Tomatoes	46		1	2,939
1005	Maize (corn)	46		2	7,723
1201	Soya beans, whether or not broken	44		1	9,133
3808	Insecticides, fungicides, herbicides packaged for retail sale	43		5	9,123
2106	Food preparations, nes	42		2	7,901
0406	Cheese and curd	40		5	8,777
1905	Bread, biscuits, wafers, cakes and pastries	40	yes	5	6,791
1701	Cane or beet sugar and chemically pure sucrose, in solid form	39		4	6,896
2008	Preserved fruits nes	39		12	4,066
1806	Chocolate and other food preparations containing cocoa	38		5	6,153
2005	Prepared or preserved vegetables nes (excl. frozen)	38		10	3,372
2009	Fruit & vegetable juices, unfermented	38		10	5,577

HS code	Label	Number of countries which notified at least one product (*)	Notified by the EU	Nb of product items	World imports in 2001 (US$ million)
1511	Palm oil & its fraction	37		2	2,825
2309	Animal food preparations, nes	33	yes	2	6,812
3102	Mineral or chemical fertilizers, nitrogenous	31		10	4,855
2204	Wine of fresh grapes	28		4	12,365
2203	Beer made from malt	24		1	4,520
2902	Cyclic hydrocarbons	21	yes	12	7,146
3402	Organic surface-active agents, washing & clean preparations, nes	21		6	7,808
8418	Refrigerator, freezer, etc	20		11	11,863
2402	Cigars, cheroots, cigarillos & cigarettes	19		3	10,781
2905	Acyclic alcohols and their derivatives	16		20	7,875
4011	New pneumatic tires, of rubber	15		7	20,102
5201	Cotton, not carded or combed	15		1	6,638
3923	Plastic packing goods or closures stoppers, lids, caps, closures, plastic containers etc.	13		7	14,745
4104	Leather of bovine/equine animal, other than leather of hd 4108/4109	13	yes	6	10,155
6403	Footwear, upper of leather	13	yes	9	26,183
8501	Electric motors and generators (excluding generating sets)	13		14	17,321
8504	Electric transformer, static converter (for example rectifiers)	13		11	31,776
8521	Video recording or reproducing apparatus	13		2	16,748
8544	Insulated wire/cable	13		10	33,630
3204	Synthetic organic coloring matter & preparations	12		10	8,515
8527	Reception app for radio-telephony/radio-broadcasting	12		8	20,544
8408	Diesel or semi-diesel engines	11		3	12,130

Appendix 1 (continued)

HS code	Label	Number of countries which notified at least one product (*)	Notified by the EU	Nb of product items	World imports in 2001 (US$ million)
8529	Part suitable for use solely/princ with televisions, recpt app	10		2	27,562
9405	Lamps & lighting fittings nes; signs, nameplates illuminated	10		9	12,287
9504	Articles for funfair, table/parlour games & auto bowling alley equipment	10	yes	5	11,922
8507	Electric accumulator	9		6	9,563
7326	Articles of iron or steel nes	6		4	13,250
8523	Prepared unrecorded media for sound record (tapes)	6		5	9,885
3903	Polymers of styrene, in primary forms	5		5	9,838
9009	Photo-copying & thermo-copying apparatus	5		6	12,640
3920	Other plates, sheets, film, foil, tape, strip of plastics etc.	4		20	16,147
6109	T-shirts, singlets and other vests, knitted or crocheted	4		2	11,913
9608	Ballpoint pencil; markers & writing instr. (o/t head N° 96.09)	4		9	3,113
6302	Bed, table, toilet and kitchen linens	3		17	6,373
6110	Jerseys, pullovers, cardigans, etc, knitted or crocheted	2		4	28,194
6203	Men's suits, jackets, trousers etc & shorts	2		15	21,435
6204	Women's suits, jackets, dresses skirts etc & shorts	2		25	27,299

Note: (*) out of 81 countries and territories included in the whole database.

Appendix 2: List of countries in our estimation sample

List of exporting countries	List of importing countries
Albania, Argentina, Armenia, Australia*, Austria*, Bangladesh, Barbados, Belarus, Belize, Belgium*, Benin, Bosnia Herzegovina, Bolivia, Brazil, Bulgaria, Burkina Faso, Cambodia, Canada*, Chile, China, Cote d'Ivoire, Cameroon, Colombia, Costa Rica, Croatia, Cuba, Cyprus, Czech Rep*, Denmark*, Dominican Rep, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Fiji, Finland*, France*, Georgia, Germany*, Ghana, Guinea, Greece*, Guatemala, Guyana, Honduras, Haiti, Hungary*, Indonesia, India, Ireland*, Iceland*, Israel, Italy*, Jamaica, Jordan, Japan*, Kenya, Kyrgyzstan, Korea Rep.*, Korea DR, Lao P.D.R, Lebanon, Lithuania, Latvia, Mali, Malta, Madagascar, Mexico*, Myanmar, Mongolia, Morocco, Rep. Moldova, Mozambique, Mauritania, Mauritius, Malawi, Malaysia, Niger, Nicaragua, Netherlands*, Norway*, Nepal, New Zealand*, Pakistan , Peru, Philippines, Poland*, Portugal*, Paraguay, Romania, Russian Fed, Senegal, Suriname, Slovakia*, Slovenia, Spain*, Sri Lanka, Sweden*, Switzerland*, Seychelles, Togo, Thailand, Tunisia, Turkey*, Tanzania, Uganda, UK*, Ukraine, Uruguay, USA*, Uzbekistan, Vietnam, Zimbabwe	Albania, Argentina, Australia, Bahrain, Belarus, Bolivia, Brazil, Canada, Switzerland, Chile, China, Cameroon, Colombia, Costa Rica, Algeria, Ecuador, Egypt, Estonia, Gabon, Ghana, Guatemala, Hungary, Indonesia, India, Iceland, Jordan, Japan, Kazakstan, Lebanon, Sri Lanka, Lithuania, Latvia, Morocco, Rep. Moldova, Mexico, Mozambique, Mauritius, Malaysia, Nicaragua, Netherlands, Nepal, New Zealand, Oman, Peru, Philippines, Papua N. Guinea, Poland, Paraguay, Romania, Russian Fed, Saudi Arabia, Senegal, Singapore, Thailand, Tunisia, Turkey, Uganda, Uruguay, USA, Venezuela, Zambia

Note for exporting countries: LDCs are underlined, * for OECD countries.

Appendix 3: Results by product groups

HS code	Label	Nb of observations	Nb of uncensored values (trade <> 0)	Nb of censored values (trade = 0)	R2 (a)	Tariff elasticity (*)	ERM LDC (b)	ERM DC (b)	ERM OECD (b)	Linder effect (b)	Number of countries which notified at least one product (c)
Sensitive products											
0102	Live bovine animals	2,322	192	2,130	0.47	-1.35	ns	ns	ns	ns	58
0201	Meat of bovine animals, fresh or chilled	2,240	227	2,013	0.44	-1.98	ns	ns	ns	+	52
0203	Meat of swine, fresh, chilled or frozen	2,862	374	2,488	0.31	* -0.09	ns	-	- -	-	52
0303	Fish, frozen, whole	5,058	1,143	3,915	0.34	-0.41	ns	ns	ns	ns	48
0306	Crustaceans	3,981	783	3,198	0.36	-0.44	ns	ns	ns	+ +	48
0402	Milk and cream, concentrated or sweetened	4,415	1,036	3,379	0.45	-0.98	ns	+ +	+ +	+ +	49
0406	Cheese and curd	3,584	848	2,736	0.45	-0.66	ns	ns	ns	ns	40
0603	Cut flowers	2,733	518	2,215	0.46	-0.83	-	-	-	+ +	49
0702	Tomatoes	2,599	240	2,359	0.47	-1.82	ns	ns	ns	ns	46
0709	Vegetables nes, fresh or chilled	3,530	576	2,954	0.39	-1.13	-	- -	ns	+ +	48
0805	Citrus fruit, fresh or dried	3,714	593	3,121	0.41	-1.69	-	ns	ns	-	48
1001	Wheat and meslin	2,841	392	2,449	0.41	*-0.29	ns	- -	ns	ns	48
1005	Maize (corn)	3,390	513	2,877	0.5	* -0.05	+	ns	ns	- -	46
1006	Rice	3,652	631	3,021	0.47	-0.74	ns	ns	ns	+	50
1201	Soya beans, whether or not broken	2,446	261	2,185	0.44	* -0.31	ns	ns	ns	ns	44
1905	Bread, biscuits, wafers, cakes and pastries	4,882	1,370	3,512	0.45	-1.60	ns	-	ns	ns	40
2106	Food preparations, nes	4,834	1,629	3,205	0.49	-0.63	ns	ns	ns	+ +	42
3004	Medicament mixtures	5,861	2,205	3,656	0.58	* -0.09	ns	+	+ +	- -	61
3808	Insecticides, fungicides, herbicides packaged for retail sale	5,070	1,663	3,407	0.5	0.16	+	+	+ +	-	43

(Continued)

HS code	Label	Nb of observations	Nb of uncensored values (trade <> 0)	Nb of censored values (trade = 0)	R2 (a)	Tariff elasticity (*)	ERM LDC (b)	ERM DC (b)	ERM OECD (b)	Linder effect (b)	Number of countries which notified at least one product (c)
Other products											
1511	Palm oil & its fraction	2,654	331	2,323	0.56	-0.73	ns	ns	ns	ns	37
1701	Cane or beet sugar, in solid form	4,300	711	3,589	0.37	-0.87	ns	-	-	-	39
1806	Chocolate and other food preparations containing cocoa	4,285	1,232	3,053	0.48	-0.72	ns	-	ns	-	38
2005	Prepared or preserved vegetables nes	3,963	992	2,971	0.44	-1.08	ns	ns	ns	ns	38
2008	Preserved fruits nes	4,042	1,149	2,893	0.44	-0.37	+	- -	ns	ns	39
2009	Fruit & vegetable juices, unfermented	4,699	1,263	3,436	0.38	-1.17	ns	- -	- -	+	38
2203	Beer made from malt	3,785	773	3,012	0.42	-0.37	ns	-	ns	+	24
2204	Wine of fresh grapes	3,671	935	2,736	0.44	-0.65	ns	-	- -	+ +	28
2309	Animal feed preparations, nes	4,572	1,239	3,333	0.42	-0.48	- -	-	-	ns	33
2402	Cigars, cheroots, cigarillos & cigarettes	3,565	712	2,853	0.38	-0.69	ns	ns	++	+ +	19
2902	Cyclic hydrocarbons	3,425	671	2,754	0.4	* -0.01	ns	ns	+ +	ns	21
2905	Acyclic alcohols and their derivatives	4,105	1,058	3,047	0.46	* 0.11	ns	+	+ +	ns	16
3102	Mineral or chemical fertilizers, nitrogenous	4,140	879	3,261	0.37	-0.49	ns	- -	ns	-	31
3204	Synthetic organic coloring matter & preparations	4,396	1,414	2,982	0.48	0.40	ns	ns	ns	ns	12
3402	Organic surface-active agents, washing & clean preparations, nes	5,038	1,492	3,546	0.52	*0.03	ns	ns	ns	- -	21
3923	Plastic packing goods or closures stoppers, lids, caps, closures, plastic containers etc.	5,400	2,020	3,380	0.53	-0.15	ns	ns	ns	ns	13
4011	New pneumatic tires, of rubber	4,910	1,960	2,950	0.53	-0.31	ns	-	ns	- -	15
4104	Leather of bovine/equine animal, other than leather of hd 4108/4109	4,722	1,044	3,678	0.37	-0.90	-	- -	- -	- -	13

(Continued)

HS code	Label	Nb of observations	Nb of uncensored values (trade <> 0)	Nb of censored values (trade = 0)	R2 (a)	Tariff elasticity (*)	ERM LDC (b)	ERM DC (b)	ERM OECD (b)	Linder effect (b)	Number of countries which notified at least one product (c)
Other products											
5201	Cotton, not carded or combed	4,756	711	4,045	0.39	-0.47	ns	ns	ns	ns	15
6403	Footwear, upper of leather	4,607	1,569	3,038	0.48	-0.57	ns	ns	ns	+	13
8408	Diesel or semi-diesel engines	3,930	1,126	2,804	0.49	* 0.14	ns	ns	ns	- -	11
8418	Refrigerator, freezer, etc	4,837	1,812	3,025	0.56	* 0.03	ns	ns	ns	ns	20
8501	Electric motors and generators (excluding generating sets)	4,619	1,700	2,919	0.51	0.30	ns	+	+	ns	13
8504	Electric transformer, static converter (for example rectifiers)	5,034	2,100	2,934	0.52	0.15	ns	+ +	ns	+ +	13
8521	Video recording or reproducing apparatus	3,043	1,046	1,997	0.53	-0.37	ns	ns	ns	ns	13
8527	Reception app for radio-telephony/radio-broadcasting	3,732	1,268	2,464	0.52	-0.33	ns	ns	+	ns	12
8544	Insulated wire/cable	5,018	1,885	3,133	0.54	* -0.06	ns	+	+	+ +	13
Suspicious products											
3903	Polymers of styrene, in primary forms	4,183	1,017	3,166	0.48	0.64	ns	ns	+	- -	5
3920	Other plates, sheets, film, foil, tape, strip of plastics etc.	4,950	1,729	3,221	0.53	* 0.04	ns	++	ns	- -	4
6109	T-shirts, singlets and other vests, knitted or crocheted	4,589	1,628	2,961	0.47	-0.54	+ +	+ +	+ +	+ +	4
6110	Jerseys, pullovers, cardigans, etc, knitted or crocheted	4,355	1,509	2,846	0.48	-0.33	+ +	+ +	ns	+ +	2
6203	Men's suits, jackets, trousers etc & shorts	5,022	1,790	3,232	0.48	-0.59	+ +	+ +	+	+ +	2
6204	Women's suits, jackets, dresses skirts etc& shorts	4,697	1,760	2,937	0.49	-0.42	+ +	+ +	+ +	+ +	2
6302	Bed, table, toilet and kitchen linens	4,190	1,320	2,870	0.45	-0.55	+ +	ns	+	+ +	3
7326	Articles of iron or steel nes	5,001	1,861	3,140	0.51	0.41	ns	ns	ns	++	6

(Continued)

HS code	Label	Nb of observations	Nb of uncensored values (trade <> 0)	Nb of censored values (trade = 0)	R2 (a)	Tariff elasticity (*)	ERM LDC (b)	ERM DC (b)	ERM OECD (b)	Linder effect (b)	Number of countries which notified at least one product (c)
Suspicious products											
7326	Articles of iron or steel nes	5,001	1,861	3,140	0.51	0.41	ns	ns	ns	++	6
8507	Electric accumulator	4,552	1,506	3,046	0.53	* -0.07	ns	ns	ns	- -	9
8523	Prepared unrecorded media for sound record (tapes)	3,235	1,125	2,110	0.49	0.20	ns	ns	ns	ns	6
8529	Part suitable for use solely/princ with televisions, recpt app	4,434	1,756	2,678	0.52	-0.14	ns	+ +	ns	+ +	10
9009	Photo-copying & thermo-copying apparatus	3,361	1,136	2,225	0.51	0.17	ns	ns	ns	ns	5
9405	Lamps & lighting fittings nes; signs, nameplates illuminated	4,605	1,783	2,822	0.52	-0.16	ns	ns	ns	+ +	10
9504	Articles for funfair, table/parlour games&auto bowling alley equipment	3,440	1,056	2,384	0.46	-0.37	ns	ns	ns	ns	10
9608	Ballpoint pencil; markers & writing instr. (o/t headg no 96.09)	3,613	1,209	2,404	0.52	-0.17	ns	ns	-	ns	4

Notes: (a) The R2 statistics is not computable for Tobit models. We provide here, for indicative purpose, the R2 statistics calculated using a classical regression model.
(b) ns: statistically non significantly different from 0 (10% significance probability).
++: positive impact (1% significance probability).
+: positive impact (10% significance probability).
- -: negative impact (1% significance probability).
-: negative impact (10% significance probability).
(c) Out of 81 countries and territories included in the whole database.
(*): * if not statistically significant (5% significance probability)

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