
European Union trade and non-tariff measures

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Abstract

Quantification of the trade effects of non-tariff measures (NTMs) has proven to be a major challenge. This paper uses a combination of gravity model estimates of sectoral trade potential, general equilibrium model results on non-tariff protection, and inventory-derived information on the pervasiveness of different types of NTMs to attempt a ranking of NTMs according to their trade impacts. The analysis is centred on the European Union, as trade within the EU is virtually barrier-free since the completion of the Single Market in 1992, while exports from the Union continue to face tariff and non-tariff barriers. This dichotomy between internal and external EU trade is exploited for the derivation of barrier-free extra-EU export potentials, which form the basis for the subsequent determination of tariff equivalents of NTMs. The results from the analysis show that the approach is, in principle, feasible and has the potential to contribute to a better understanding of the trade effects of NTMs. However, conceptional problems of obtaining consistent estimates of export potentials under free trade conditions and data limitations concerning representative information on NTMs across countries and sectors are the cause for a high degree of variability in the findings that do not make it possible at this stage to draw firm conclusions on the ranking of different types of NTMs according to their trade restrictiveness.

Keywords

Export potential, non-tariff barriers, inventory information, trade restrictiveness, tariff equivalents.

1. Background

As industrial tariffs have been reduced to low levels in previous rounds of multilateral trade negotiations, increasing attention has focused on the impacts of domestic policies on international trade and the use of non-tariff measures (NTMs). Policy measures that are implemented to pursue domestic objectives can restrict market access for foreign producers, and sometimes do so to a considerable extent. In order to determine the relative importance of different types of NTMs, and hence to be able to make recommendations on which measures policy makers might want to focus on when considering regulatory and trade policy reform, information on the prevalence of the NTMs' occurrence, their trade effects, and the resulting economic costs is needed. Yet, measuring the incidence of NTMs and their trade restrictiveness has proven to be major challenge (Deardorff and Stern, 1997).

One approach to obtain qualitative and quantitative information on the prevalence of NTMs has been to derive simple statistics, notably frequency indicators, based on inventories and surveys. Examples for analysis using such indicators include Swan, Temple and Shurmer (1996), Roberts and DeRemer (1997), and Moenius (1999). Frequency measures can be useful to provide information on the occurrence of different types of NTMs in a sector or economy. They can provide indications on the most prevalent types of NTMs or the product-groups that are most exposed to NTMs and that might hence warrant further analysis. However, frequency measures do not make it possible to fully capture trade or other economic impacts of NTMs, since NTMs tend to be highly diverse in the way they apply to imports.

This paper combines information on the prevalence of NTMs with results from gravity and general equilibrium models to attempt a ranking of measures according to their trade restrictiveness. A three step approach is thereby pursued. First, predictions of sectoral exports under free trade conditions are derived from a gravity model. The model is calibrated on intra-OECD trade, without explicitly distinguishing between non-EU and EU countries. In the latter, trade in goods is virtually barrier-free since the completion of the Single Market in 1992, while NTMs exist for extra-EU trade. By subsequently applying the derived estimates for the gravity model coefficient to extra-EU trade, predictions on the structure of exports under barrier free conditions are derived.

In the second step, the predicted barrier-free values of sector-specific trade flows are integrated into the Global Trade Analysis Project (GTAP) database. The GTAP computable general equilibrium model is then used to determine the tariff equivalents of existing tariff and non-tariff measures that would replicate empirically observed trade flows. From these overall tariff equivalents, estimates of NTM-related protection are derived by correcting for tariff related protection, as reported in the GTAP database.

Third, sector-specific information from the European Commission's Market Access Database on business complaints about NTMs in different countries is related to corresponding step-two results on overall NTM-related tariff equivalents. The econometric estimates on the contribution of different NTMs to the overall sectoral NTM-protection make it possible to rank different types of NTMs according to their trade impacts.

The remainder of the paper is structured as follows. Section 2 describes the procedure for predicting barrier-free trade flows using a gravity model. Section 3 then presents the analytical framework to estimate tariff equivalents of aggregate NTMs using the GTAP model. These obtained estimates are afterwards related to frequency counts of particular types of NTMs, as discussed in section 4. Finally, section 5 concludes this study.

2. Prediction of barrier-free trade flows

The basic thrust of the following analysis is to compare actual trade flows and potential trade under barrier-free conditions in order to determine the amount of trade that is suppressed by protectionist measures and subsequently to estimate the degree of trade restrictiveness of different types of barriers. The first step in the investigation consists of the derivation of estimates of export potentials under free trade conditions. The analysis is thereby centred on the European Union, as trade within the EU is virtually barrier-free since the completion of the Single Market in 1992, while exports from the Union continue to face tariff and non-tariff barriers. This dichotomy between internal and external EU trade is exploited for the derivation of predictions on the structure of extra-EU exports under barrier-free conditions.

2.1 Gravity model

Gravity models have been widely used in international economics to analyse and predict trade flows. Similar to the law of gravity in physics, the gravity approach suggests that the volume of trade between two countries depends positively on their economic size, and negatively on the distance between them. Refinements of the approach take specific features of the bilateral country relation into account, like existence of a shared language or common membership in a free trade agreement, which are typically represented through "dummy" variables.

Recently, gravity models have received new theoretical justification, as summarised by Evenett and Keller (1998). In particular, Helpman and Krugman (1985) demonstrated that the basic gravity equation can be derived from a trade model with differentiated goods, and Deardorff (1998) showed that

the gravity equation is consistent with the Heckscher-Ohlin theory of international trade. This consistency with different trade models has increased the confidence of analysts in using this tool for prediction of potential trade flows.

Gravity models are generally used for economy-wide analysis, even though some research has been carried out at the industry level. For example, Bergstrand (1989) derived a gravity equation for a multi-industry world that allows for intra-industry trade, and Lejour, Mooij, and Nahujs (2001) use sector-specific gravity estimates in their analysis of the prospective eastern enlargement of the EU. Sector-based gravity models face the problem that a country might not have a comparative advantage in narrowly defined sectors and that, hence, there might be no intra-industry trade. To put it more prosaically, neither small nor big countries or regions at the arctic circle will export tropical fruit.

However, if sufficiently broad definitions of sectors are taken, the potential for intra-industry trade increases and the problems of using sectoral gravity models mentioned above are attenuated. In this study, eight large goods-sectors (agriculture, mining, food, textiles and leather, wood and paper, chemicals, metals and minerals, machinery) are distinguished and considered in the gravity model analysis. In particular, eight sector-specific gravity models are estimated for exports from Germany, the biggest economy in the EU, to other EU and non-EU countries.

The model takes the following form:

$$(1) \quad EXP_{i,j} = f(VA_{i,j}, DIST_j, OVERSEAS_j) ;$$

where $EXP_{i,j}$ stands for the natural logarithm of German goods exports from sector i to country j , $VA_{i,j}$ for the natural logarithm of value added of sector i in country j , $DIST_j$ for the square root of distance between Germany and the destination country, and $OVERSEAS_j$ for a dummy variable that takes the value of one if transport from Germany to the destination country requires overseas transport and zero otherwise.

2.2 Data

Sector-specific data on bilateral trade is available from the GTAP-5 database. This database contains information on exports and imports for 66 regions and 57 sectors. Of the 30 OECD member countries, 26 countries are represented as individual country-regions, while Iceland and Norway form part of an EFTA aggregate, and the Czech Republic and Slovakia are grouped together with other central European countries. The GTAP information on the value of exports from Germany to 25 other individually represented OECD countries is used in this study.

Concerning sectors, the 57 GTAP units were aggregated into ten sectors, of which eight are goods-producing ones. The correspondence with the GTAP Sectoral Classification is given in Annex table 1. The data for the dependent variable is presented in Table 1.

Table 1. Goods exports from Germany to selected countries, 1997 (Million USD)

	Agriculture	Mining	Food	Textiles & Leather	Wood & Paper	Chemicals	Metals & Minerals	Machinery	All goods
Austria	471	49	1059	2020	2177	3739	2378	12851	24743
Belgium	317	230	1234	1023	1424	4545	3183	14844	26800
Denmark	159	12	762	391	494	1219	820	4450	8307
Finland	47	40	108	163	116	672	446	2821	4413
France	345	96	2605	1583	2565	7809	4320	29242	48564
Greece	83	4	311	321	147	571	165	1683	3283
Ireland	16	2	49	115	64	468	114	1401	2229
Italy	438	51	2745	1604	1218	6077	4149	19481	35763
Luxembourg	14	7	55	46	64	205	142	662	1194
Netherlands	937	158	2446	1470	1975	4808	3297	12563	27654
Portugal	24	4	115	551	117	676	381	3108	4975
Spain	171	21	546	575	561	2937	1420	11611	17841
Sweden	140	321	316	247	353	1559	976	7495	11406
United Kingdom	178	34	1367	1378	1649	5685	3030	26324	39645
Australia	3	1	38	79	109	608	157	2203	3199
Canada	10	2	85	101	86	529	348	3092	4253
Hungary	40	6	110	546	273	811	388	4258	6433
Japan	82	6	318	328	227	2587	447	7872	11868
Korea	18	2	59	91	77	857	426	3683	5213
Mexico	10	0	76	45	53	457	286	2259	3186
New Zealand	1	0	8	13	36	97	24	322	501
Poland	160	13	462	1314	643	1952	809	5788	11139
Switzerland	167	125	443	1660	2016	4307	1893	10638	21249
Turkey	29	5	51	476	198	1140	600	5026	7525
USA	84	27	653	723	734	6695	2778	28974	40668
Other	797	136	4706	5030	3486	15352	7267	62056	98829
TOTAL	4740	1354	20725	21891	20863	76360	40242	284704	470878

Source: GTAP-5 database.

Data on sectoral value-added in OECD countries is available from OECD (2000). In order to have comparable data across all the 25 countries in the sample, a three-year average for 1993-95 was used to represent the relative size of the eight goods sectors in the respective economies. Concerning the distance variable, information on the direct route (“as the crow flies”) between Berlin and the respective country capital was obtained from the internet site “www.indo.com/distance”.

2.3 Gravity model results

Eight separate versions of equation (1), one for each of the eight sectors, were estimated using ordinary least squares. The estimation results are presented in Table 2. It turns out that the coefficients on the value added and distance variables have the expected sign and are significantly different from zero, at least at the 95 per cent significance level, in most cases.

Table 2. Gravity model estimation result

	Agriculture	Mining	Food	Textiles & Leather	Wood & Paper	Chemicals	Metals & Minerals	Machinery
Constant	0.65 (0.55)	3.24** (2.84)	0.80 (0.62)	2.65*** (2.92)	2.86** (2.12)	2.01** (2.08)	2.05** (2.08)	4.23*** (4.64)
Value added	0.69*** (5.55)	0.26* (1.96)	0.74*** (5.83)	0.57*** (5.81)	0.46*** (3.58)	0.67*** (7.27)	0.70*** (6.88)	0.52*** (6.70)
Distance	-0.06*** (-5.37)	-0.05** (-2.53)	-0.04*** (-3.01)	-0.02* (-1.88)	-0.01 (-0.86)	-0.01 (-0.78)	-0.03*** (-2.88)	-0.00 (-0.45)
Overseas (Dummy)	1.09 (1.25)	0.52 (0.33)	0.16 (0.16)	-0.98 (-1.16)	-1.11 (-0.89)	-1.14 (-1.45)	-0.02 (-0.03)	-1.02 (-1.21)
R ²	0.84	0.59	0.78	0.78	0.60	0.79	0.82	0.77

Note: The superscripts ***, ** and * indicate that the coefficient is significantly different from zero at the 1, 5 and 10 per cent level, respectively. The *t*-statistics are given in parentheses.

Source: Author.

In equation (1), no variable representing EU membership was included, even though it can be expected that trade relationships between Germany and other EU-members are more intensive than those between Germany and non-EU countries, as there are no tariff and non-tariff barriers to trade within the Union. The coefficients in Table 2, hence, correspond to averages that will tend to underrepresent trade with EU countries, but overrepresent exports with non-EU countries. In other words, the gravity equation (1) pretends that barriers in non-EU countries against German exports are lower than they are in reality. The coefficients can, therefore, be used to predict the structure of German exports to non-EU countries under freer average trade conditions.

Ideally, one might have attempted to estimate the gravity equation for EU members only and then use the resulting coefficients to predict trade with non-EU countries under trading conditions similar to those in the Single European Market. However, such an endeavour would have amounted to an out-of-sample prediction for both the value-added and the distance variables. The estimation procedure used avoids this problem, but is capable to predict merely a situation of freer rather than free trade. To bridge this gap, the sectoral export predictions are normalised, such that the predicted values in all countries are at least as high as the observed exports. These predicted trade flows are then used in the following step of the analysis that derives tariff equivalents for NTMs.

3. Deriving tariff equivalents of non-tariff measures (NTMs)

There are a number of direct and indirect approaches for estimating tariff equivalents of non-tariff measures (Deardorff and Stern, 1997). Given the lack of comprehensive assessments of the incidence of different types of non-tariff measures and their trade impacts, indirect approaches have frequently been used. One such approach consists of comparing hypothetical trade volumes in the absence of non-tariff barriers with actual trade flows. The difference between predicted and actual trade is then taken as indicative of existing trade barriers and is converted into price or cost equivalents.

For example, Francois and Hoekman (1999) use a gravity model of bilateral services trade between the USA and its major trading partners. They compute tariff equivalents for restrictions in business and financial services as well as construction services by taking the deviation from predicted imports as an indication of barriers to trade. Estimates of tariff equivalents are then derived from a constant elasticity import demand function.

Using a similar approach, Lejour, de Mooij, and Nahuis (2001) estimate the tariff equivalents of trade restricting measures in the context of exploring the economic consequences of eliminating non-tariff measures between central and eastern European countries and the EU. They use a general equilibrium model to determine the tariff equivalents of non-tariff measures that are taken to account for the difference between potential free-trade flows derived from a gravity model and actual goods trade.

3.1 Methodology and data

The analysis in this paper largely follows Lejour *et al.* Using information from the GTAP-5 database, a set of ten sectors, including eight goods-sectors (see Annex table 1), was specified. Concerning the set of countries in the modelling analysis, Germany and eight of its most important trading partners outside the EU (Australia, Canada, Hungary, Japan, Korea, Poland, Mexico, USA) were represented as individual countries. All other countries were aggregated into a “Rest of the World” bloc.

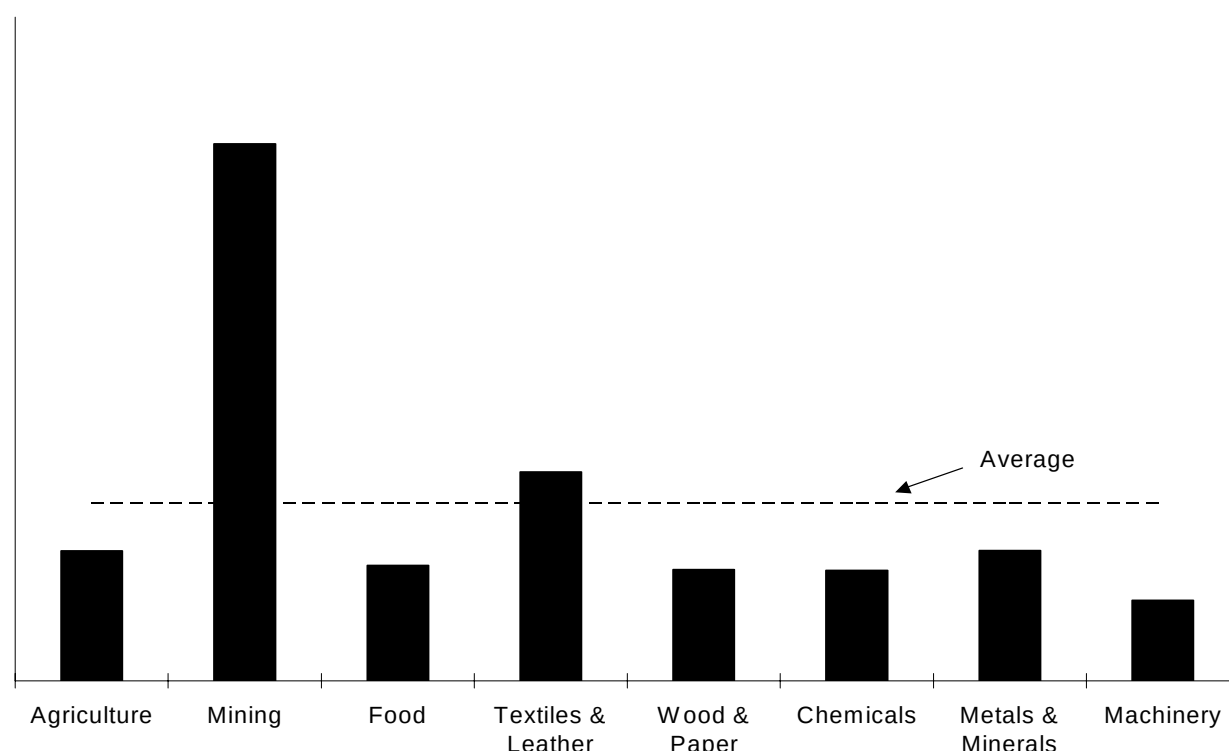
The GTAP-5 database contains information on actual trade flows and actual tariff protection, but only limited data on non-tariff measures. Hence, scenario analysis that removes tariff protection does not fully simulate a free trade situation, since the non-tariff protection that is not covered in the database would implicitly remain in place. However, if estimates on potential trade flows under free trade conditions, such as those derived from gravity models, are integrated into the database, the GTAP model can be used to calculate overall tariff and non-tariff protection in the base situation. Using a general equilibrium model has thereby the advantage of making it possible to take linkages across sectors and countries into account.

The procedure consists of several steps. After integrating the potential export volumes obtained from the gravity model predictions in section 2 into the database, the GTAP model was calibrated to replicate these barrier-free values of sector-specific trade flows. Through this process, the set of parameters reflecting the demand-side preferences that correspond to the potential trade volumes was determined. With this new set of parameters in the demand system and prices adjusted to allow for non-tariff protection, the model was re-calibrated to reproduce the initial trade flow data. As a result of this second calibration, tariff equivalents for overall protection in the German export markets are obtained. By subtracting out the protection from tariffs, which is given in the original GTAP database, tariff equivalents for sector-specific aggregates of non-tariff measures in the eight export markets were derived.

3.2 Results

A comparison of average tariff equivalents for aggregate non-tariff protection in eight goods-sectors is presented in Figure 1. The highest non-tariff protection is found in the mining and textiles/leather sectors, while trade impediments from non-tariff measures are least important in the machinery sector. These results should, however, be interpreted with care, as they represent simple averages across countries and are sensitive to estimation errors in the prediction of trade potentials.

Figure 1. Tariff equivalents of aggregate non-tariff protection in selected goods sectors*



*) Simple average of Australia, Canada, Hungary, Japan, Korea, Mexico, Poland, and United States of America.
Source: Authors.

4. Ranking of NTMs

The tariff equivalents derived in section 3 reflect the effects of the aggregate of NTMs in the eight goods-sectors of the eight countries analysed. In order to be able to identify the effects of particular types of NTMs, supplementary information on the relative prevalence of different measures in different countries and sectors is necessary. This type of information can, for example, be obtained from inventories of NTMs. Examples of such listings include publications by governmental authorities in the European Union, Japan, and the United States (CEC, 2000; MITI, 1999; USTR, 1999).

4.1 The EU's Market Access Database of NTMs

The EU's Market Access Database contains an inventory of complaints from businesses concerning non-tariff impediments to their exports. The recorded database entries give indications of the type of barrier, as well as the product category and country in which they were encountered. The scope of NTM complaints is thereby broad, such that they refer not only to measures that apply at the border, but cover also "behind the border barriers", like discriminatory practices in public procurement, investment restrictions, or lack of intellectual property protection. Table 3 summarises the information on the prevalence of NTMs in the eight countries, for which tariff equivalents of aggregate NTM protection had been estimated in sections 2 and 3, by sector and type of NTM.

Table 3. Business complaints about NTMs in selected OECD countries*) by sector and type of NTM

	Agriculture	Mining	Food	Textiles & Leather	Wood & Paper	Chemicals	Metals & Minerals	Machinery	All goods
Para-tariff measures	1	1	7	2	0	0	0	11	24
Price/finance controls	4	1	13	1	1	6	2	2	29
Quantity controls	23	3	22	7	1	21	4	12	93
Technical regulations	25	0	29	6	4	11	4	42	121
Pre-shipment inspection	8	0	22	13	7	6	3	16	76
Govt discrimination	8	1	4	2	0	5	4	38	63
Domestic restrictions	2	0	5	3	0	5	0	7	23
Infringement of IPR	2	0	3	1	0	5	1	5	16
Total	73	6	106	36	13	59	17	133	442

Note: If a complaint mentioned more than one product or barrier, a weight of less than one was assigned to the individual products/barriers, such that the sums of product and barrier observations, respectively, add up to the total number of complaints in the report.

*) The countries covered are Australia, Canada, Hungary, Japan, Korea, Mexico, Poland, and United States of America.

Source: Authors, based on CEC (2000).

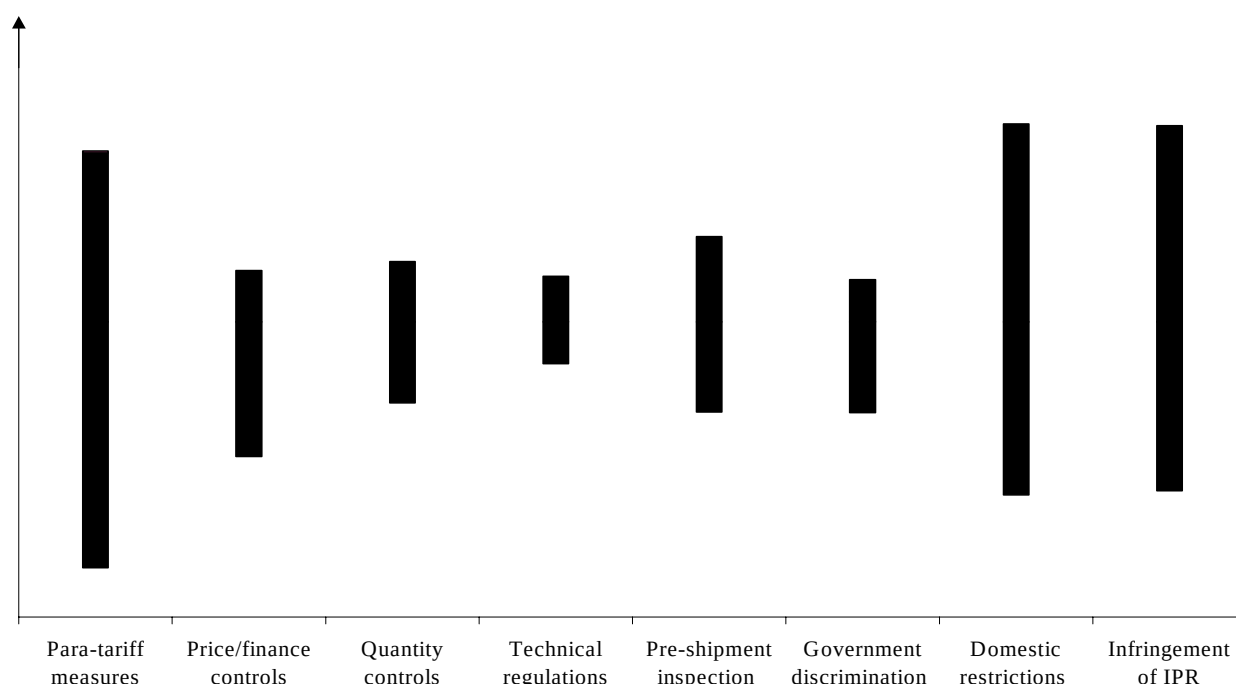
There are a total of 442 entries in the EU database that concern business complaints about eight major types of NTMs in the eight goods-sector of the eight selected OECD countries. The largest number of NTM complaints was registered in the machinery and food sectors. Concerning different types of NTMs, technical regulations and quantity control measures were most often cited.

4.2 Linking derived aggregate NTM-tariff equivalents to observed NTMs

Combining the estimates of country and sector-specific tariff equivalents of aggregate NTMs with the country and sector-specific observations on the prevalence of the eight different types of NTMs makes it possible to obtain indications on the relative trade restrictiveness of different measure-types. In particular, pooling the data on the tariff equivalents of aggregate NTMs and regressing it on the prevalence of different NTM-types in the different sectors and countries results in estimates of the tariff equivalents of particular NTM-types. A summary of findings from such a regression are shown in Figure 2.

The regression results show large standard errors, so that confidence intervals rather than point estimates are displayed. These confidence intervals are broad and overlapping between NTM-types, so that no clear ranking emerges. One reason for this large variability in the results could be that individual NTMs in a particular NTM-group have trade impacts that vary considerably.

Figure 2. Tariff equivalents of different types of non-tariff measures* (in per cent)



*) Confidence intervals covering 95 per cent of all cases.

Source: Authors.

Another reason might be that the data set on the prevalence of NTMs might not be comprehensive enough or not fully representative, as the reports were produced for other purposes than analysis of non-tariff barriers. Moreover, it is not clear whether business complaints were always registered in a comprehensive and consistent manner, even though there might be no obvious biases apparent. Finally, some business complaints might originate more from a subjective feeling of commercial injury than from unjustified or discriminatory regulation.

5. Conclusions

This paper used a combination of gravity model estimates of sectoral trade potential, general equilibrium model results on non-tariff protection, and inventory-based information on the pervasiveness of different types of NTMs to attempt a ranking of NTMs according to their trade impacts. The approach seems, in principle, to be feasible and has the potential to contribute to a better understanding of the trade effects of NTMs. However, conceptional problems of obtaining consistent estimates of export potentials at the sectoral level, and data limitations concerning representative information on NTMs across countries and sectors contributed to the high degree of variability in the findings that did not make it possible at this stage to draw firm conclusions on the ranking of different types of NTMs according to their trade restrictiveness. For example, further work on gravity model estimates has the potential to improve the trade flow predictions presented in this study and, in turn, the derivation of tariff equivalents for NTMs and their ranking according to trade impacts.

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Annex Table 2: Sectors defined by reference to the GTAP Sectoral Classification (GSC2)

Sectors	GSC2 number	GSC2 description
Agriculture	1	Paddy rice
	2	Wheat
	3	Cereal grains not elsewhere covered
	4	Vegetables, fruit, nuts
	5	Oil seeds
	6	Sugar cane, sugar beet
	7	Plant-based fibers
	8	Crops not elsewhere covered
	9	Bovine cattle, sheep and goats, horses
	10	Animal products not elsewhere covered
	11	Raw milk
	12	Wool, silk-worm cocoons
	13	Forestry
	14	Fishing
Mining	15	Coal
	16	Oil
	17	Gas
	18	Minerals not elsewhere covered
Food	19	Bovine meat products
	20	Meat products not elsewhere covered
	21	Vegetable oils and fats
	22	Dairy products
	23	Processed rice
	24	Sugar
	25	Food products not elsewhere covered
	26	Beverages and tobacco products
Textiles and leather	27	Textiles
	28	Wearing apparel
	29	Leather products
Wood and paper	30	Wood products
	31	Paper products, publishing
Chemicals	32	Petroleum, coal products
	33	Chemical, rubber, plastic products
Basic metals and non-metallic minerals	34	Mineral products not elsewhere covered
	35	Ferrous metals
	36	Metals not elsewhere covered
Machinery	37	Metal products
	38	Motor vehicles and parts
	39	Transport equipment not elsewhere covered
	40	Electronic equipment
	41	Machinery and equipment not elsewhere covered
Other manufacturing and utilities	42	Manufactures not elsewhere covered
	43	Electricity
	44	Gas manufacture, distribution
	45	Water
Services	46	Construction
	47	Trade
	48	Transport not elsewhere covered
	49	Water transport
	50	Air transport
	51	Communication
	52	Financial services not elsewhere covered
	53	Insurance
	54	Business services not elsewhere covered
	55	Recreational and other services
	56	Public Administration, Defense, Education, Health
	57	Dwellings

Source: Authors.

Annex Table2: NTMs defined by reference to UNCTAD's classification of Trade Control Measures

NTM Category	UNCTAD Code	UNCTAD classification
Para-tariff measures	2100	Customs surcharges
	2200	Additional charges
	2300	Internal taxes and charges levied on imports
	2400	Decreed customs valuation
Price and finance controls	3100	Administrative price fixing
	3200	Voluntary export price restraint
	3300	Variable charges
	3400	Anti-dumping measures
	3500	Countervailing measures
	4100	Advance payment requirements
	4200	Multiple exchange rates
	4300	Restrictive official foreign exchange allocation
	4500	Regulations concerning terms of payment for imports
Quantity controls	4600	Transfer delays/queuing
	5100	Automatic licence
	5200	Import monitoring
	6100	Non-automatic licensing
	6200	Quotas
	6300	Prohibitions
	6600	Export restraint arrangements
	6700	Enterprise-specific restrictions
	7100	Single channel for imports
Technical regulations	7200	Compulsory national services
	8100	Technical regulations
Pre-shipment inspection	8200	Pre-shipment inspection
	8300	Special customs formalities
Government discrimination	n.a.	Discrimination in public procurement
	n.a.	Discrimination in government assistance
Domestic restrictions	n.a.	Restrictions on investment
	n.a.	Restrictions on distribution
	n.a.	Restrictions on transport
Infringement of IPR	n.a.	Infringement of intellectual property rights

Note: n.a.: not applicable.

Source: Authors, based on UNCTAD (2000).