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The Economics of Non-Tariff Measures: A Primer*

Jaime de Melo, Ben Shepherd

Jaime de Melo, FERDI, CEPR, University of Geneva and Geneva Business School

Ben Shepherd, Principal, Developing Trade Consultants.

Abstract

This paper takes the non-tariff measures (NTMs) codified and collected under the MAST (Multi-Agency Support Team) typology to study their economic effects, concentrating on the effects on prices, quantities and welfare. To this end, NTMs are categorized into six groups (tariff-like measures, quantitative restrictions, subsidies, rules of origin, frictional barriers to trade and standard-like measures). The effects of NTMs in each of these groups are then studied, relying on a partial equilibrium model under perfect competition where a diagrammatic presentation is mostly used to describe the effects of each category of NTM on prices, quantities produced, quantities traded, and welfare. The paper then reviews several case studies for developing countries, focusing both on the methodology used and on results.

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* A shorter version of this paper appeared as chapter 4 in Non-Tariff Measures: Economic Assessment and Policy Measures published by the UNCTAD secretariat. References to other chapters are here: https://drive.google.com/file/d/1VJiZVcFZZ7b_1zEdfvidrkW25rslLR1H/view?usp=sharing

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1. Introduction

As tariff rates of protection have dropped all around the world, in developing and developed countries alike, other regulatory measures that have effects on trade have come to the fore in analytical and policy work. Non-tariff measures (NTMs) is a broad term that encompasses all such regulations. Concretely, NTMs can be defined as "policy measures other than ordinary tariffs that can potentially have effects on international trade in goods, changing quantities traded, or prices, or both" (UNCTAD, 2015). For regulators, the key issue is not "rolling back" NTMs in the way that successive rounds of trade liberalization have diminished the discriminatory effects of tariffs, but rather it is how to design efficient and effective regulations. This involves designing measures that achieve important regulatory and public policy objectives, like environmental and social protection, at minimum economic cost, which includes minimal distortion to international trade.

Although there are important similarities in the economic effects of tariffs and NTMs – and indeed much analysis of NTMs relies on so-called "tariff equivalents" – there are also important differences in areas like transparency, market conditions and government revenue. It is therefore important that analysts and policymakers have a sound basis on which to understand the economic effects of NTMs, and work towards designing them in a manner that, while consistent with their underlying purpose, reduces unintentional economic costs.

This chapter presents a primer of the economics of selected NTMs, focusing on their impacts on quantities traded, prices and welfare. The analysis is to be accessible to analysts with some economics background, but not necessarily with a strong specialization in international trade. Key concepts are introduced, and the analysis is gradually elaborated and brought closer to real world examples with discussion of studies that have estimated these effects.

A prior question is how should one categorize NTMs. The definition given above is a very broad one, ranging from traditional quotas to behind-the-border regulatory measures. As part of an ongoing project to update TRAINS (Trade Analysis and Information System), the key international database on NTMs, UNCTAD and its partners have developed a typology of NTMs which covers the main categories of non-tariff policies that affect trade. The measures are codified and collected in the MAST (Multi-Agency Support Team) typology (see the description in Melo and Nicita (2018b)).

In chapter 2, Hoekman and Nicita describe how the NTMs classified under the MAST typology translate into World Trade Organization (WTO) agreements and associated rules. Here the focus is on the broad categories of measures covered in MAST.

With this in mind, the diverse range of measures catalogued by UNCTAD and its partners can be grouped into categories of measures where the underlying economics is sufficiently similar that they can be considered together for analytical purposes. Each one of the following groups of NTMs share common characteristics:

1. Tariff-like measures, such as contingent protection (anti-dumping and duty-based safeguards).
2. Quantitative restrictions (quotas and quantity-based safeguards).
3. Subsidies (production and export).
4. Rules of origin.
5. Frictional barriers to trade (poorly performing trade facilitation).
6. Standard-like measures (sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs)).

This chapter covers at some length measures falling into groups 1–4. Frictional barriers to trade and standard-like (mostly fixed cost) measures (groups 5 and 6) are covered more succinctly. Though important, frictional barriers are not directly included in the UNCTAD MAST classification but are the focus of the recent Trade Facilitation Agreement (TFA), the first multilateral agreement since the creation of WTO, which came into force in early 2017. Standard-like measures which cover fixed cost measures (group 6) are covered at length by Beghin and Xiong (2017) in chapter 5.

NTMs impose three types of costs that have different incidence on trade flows, domestic market structure and welfare. *Enforcement costs* relate to the resources that private companies must expend to show that they comply with the measure in question (e.g. processing paperwork). *Process adaptation costs* relate to capital requirements to meet the NTM standard (e.g. more expensive equipment to produce bacteria-free milk). The third is *sourcing costs*, which are generated by the switch from low-grade intermediates to higher-grade ones in order to meet the NTM standard (e.g. the change in steel product specification to meet a new standard). The first two are essentially fixed costs that affect mostly small firms while the third are variable costs that affect all firms equally. As pointed out by Cadot et al. (2015), fixed costs matter more for market structure and variable costs matter more for aggregate trade flows. Process adaptation costs and enforcement costs may lead small firms to exit the market, resulting in an increase in concentration that can translate into greater market power by remaining firms, especially in low-income countries that typically already have a concentrated industrial sector. Finally, anti-dumping and safeguard measures raise directly the price of affected imports.

The chapter proceeds as follows. Section 2 illustrates the effects of each of the six macro-groups of NTMs identified above. The focus of the analysis is on price and quantity effects, particularly on the effects of the NTM measures on trade, on domestic prices and efficiency (or welfare) since it is through variations in trade volumes and prices that these NTMs are assessed in the applications described in part II of this book. Sections 3 and 4 report on case studies representative of the categories above, with those relating to standard-like measures being covered in the examples discussed in chapter 5. Section 5 concludes and discusses the policy implications of the chapter's analysis.

2. Economic analysis of non-tariff measures

This section gives an overview of the economics of NTMs. By their nature, NTMs affect the prices of traded goods, or quantities traded, or both and have an effect on welfare. Some NTMs, like anti-dumping duties (ADDs) and quotas, are primarily trade-related, but many others, like SPS measures and TBTs, are not – they seek to achieve some primarily domestic regulatory objective, such as protection of consumers or the environment. As shown here, these NTMs also have trade effects. Whereas traditional arguments for trade liberalization in the context of tariffs emphasize the need to reduce distortions in international markets by removing trade protection, the issue with many NTMs is somewhat different. In a context of regulatory sovereignty and differing national preferences, it is typically not appropriate to press countries to eliminate NTMs that pursue important domestic regulatory objectives. Rather, the emphasis is on reducing the often unintended costs—including implicit discrimination between domestic and foreign suppliers -- of such measures for exporting countries. Good regulatory practice encourages policymakers to achieve regulatory objectives using measures that impose minimum economic costs. In analysing the costs and benefits of NTMs, it is important to have an eye to the way in which these measures interact with international trade, which is the key point analysed in the following subsections.

2.1. Tariff-like non-tariff measures

Economists frequently use "tariff equivalents" as a shorthand to capture the price and quantity effects of NTMs. The basic idea is that once the price and quantity effects are known, it is possible to identify a tariff that would have equivalent effects. However, as shown below, the equivalence frequently does not stand up to scrutiny, particularly when issues like fixed costs and market dynamics are considered. Nonetheless, some NTMs do behave substantially like tariffs, so we start with this case and consider these NTMs through the lens of the standard tariff analysis.

The clearest example of such a measure is the type of contingent protection known as ADDs. In essence, this WTO legal measure allows a country to impose additional duties on exports from a trading partner if certain conditions are met, essentially that the goods are being sold below "normal" price (i.e. average costs). An example is steel, which has been the target of many ADDs. Many complications arise in the calculation of "normal" price. This is why ADD decisions are frequently litigated before national courts, and also before WTO Dispute Panels and the Appellate Body. For present purposes, the important point is that ADDs are essentially additional tariffs applied to a trading partner's exports. ADDs are temporary and are usually applied on a discriminatory basis, often to a partner with a significant market share in the importing market as analyzed by Bloningen and Bown (2003). Although they are technically NTMs, ADDs can be usefully analysed through the lens of the standard tariff analysis.

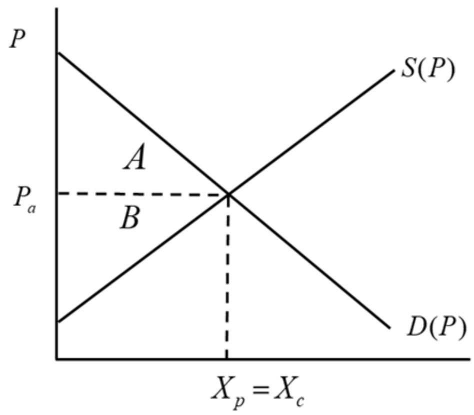


Figure1 : AutarkyEquilibrium

Figures 1–3 illustrate the ADD case, presenting the partial-equilibrium demand-supply framework to be used throughout the remainder of the section. Unless indicated otherwise, production takes place under perfect competition. Domestically produced steel and steel imports are homogeneous or perfect substitutes (i.e. they are the "same" so that domestic and imported steel can be represented on the same graph). Suppose then that India is the country imposing an ADD on steel. The starting point for the economy is in figure 1. Borders are completely closed, and domestic supply needs to match domestic demand for the market to clear. The market clearing price is P_A (for autarky price), where the supply and demand curves intersect. The consumer (producer) surplus is given by area A (B), respectively and, under the additional assumption that there are no externalities in the market for steel, the industry-wide total surplus (areas (A+B)) is maximized.

Next, consider free trade assuming that India has a comparative disadvantage in steel, that is, that India is a net importer of steel. To keep it simple, assume that India faces an infinitely elastic supply of steel exports (or excess supply), ES*, for the range of steel imports it is likely to import) at the world price $P_W = \bar{P}^* < P_a$.[1] Trade now allows the decoupling of production and consumption decisions. Figure 2 illustrates this new equilibrium. Figure 2(a) shows the equilibrium in the standard demand-supply diagram and figure 2(b) in a diagram that focuses directly on quantities traded, here steel imports determined by the intersection of the import demand (or excess demand) curve for steel (ED) and the world export supply curve (ES*) for steel.[2] When the focus is on the trade effects of NTMs, figure 2(b) is a compact way of illustrating the effects of an NTM on prices and welfare of a departure from free trade. Here, free trade in steel has the following three effects: (i) the price of steel on the domestic market falls to Pw, quantity produced falls to X_F and quantity consumed increases to X_C; (ii) quantity traded (here imports) increase from zero to M_F; (iii) welfare (as measured by the sum of producer and consumer surplus) increases by area cdf in figure

[1] Throughout, an asterisk on a variable indicates that the variable relates to the foreign country or the rest of the world, so ES (ED) indicates the domestic export supply (import demand) curve and ES* (ED*) the foreign exports supply (import demand) curve. A bar on a variable indicates that the value of the variable is fixed (exogenous).

[2] By construction ED is the difference between demand and supply for steel at each price so areas aeb and cdf are equal. A similar construction is used to derive the export supply curve in figure 4 below.

2b(= area abe in figure 2a). There are no welfare effects for the rest of the world as the price of steel in world markets remains unchanged. Because the country is small – which means that it cannot improve its terms of trade and hence welfare by restricting trade – free trade maximizes economic surplus.

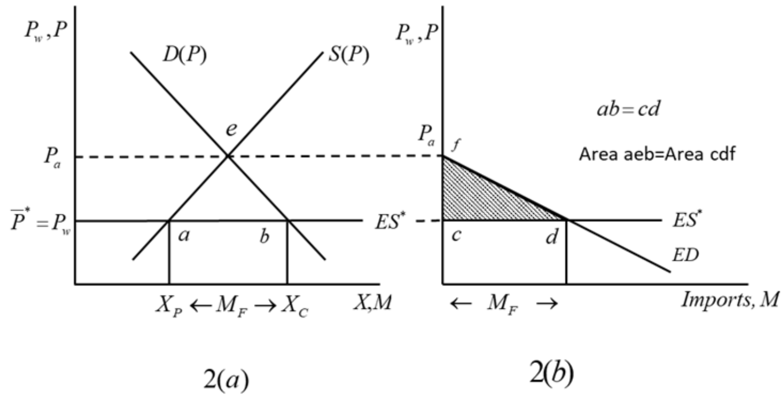


Figure 2 : Free Trade Equilibrium

Figure 3 shows the application of an ADD. Although ADDs are most often imposed on particular suppliers, start with the case when the ADD is non-discriminatory, which makes it akin to a safeguard measure, although we leave aside the complex issues of WTO law that arise in terms of the triggering and use of these different NTMs. The figure shows that the tariff at rate T drives a wedge between the world market price and the domestic market price, which is now raised by the amount of the tariff since domestic producers can still be competitive at the rate P_W+T. The safeguard accomplishes the double objective of stimulating domestic production and reducing imports of steel from M_F to M_T. The government receives an amount B and the gains from trade shown in figure 3(b) are reduced from area A+B+C to area A+B with a deadweight efficiency loss equal to area C (=C_1 + C_2 in figure 3a).

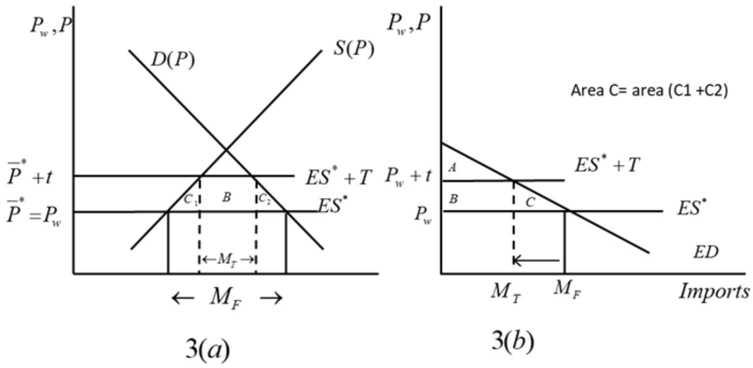


Figure 3 : A Nondiscriminatory Safeguard (Small Country case)

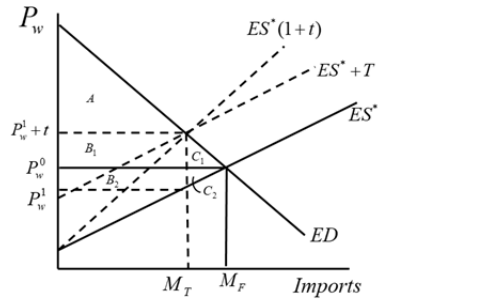


Figure 4 : A Targeted Safeguard (Large Country)

The more realistic case in which the safeguard measure is targeted to a specific foreign supplier is shown in figure 4. In this case, it is likely that the country applying the safeguard has market power, that is, the foreign supply curve of imports, ES*, is upward sloping. In this case, in addition to the price and quantity effects shown in figure 3, part of the costs of the NTM are borne by the foreign supplier. As before, the safeguard at the ad valorem rate t (or equivalently at the specific rate T) reduces imports (and increases domestic supply – not shown), raises government revenue and produces an efficiency loss because of the wedge between the domestic price and the world price. However, now there is an effect on exporters. First, part (B2) of the government revenue comes out of the pocket of foreign exporters. Second, the efficiency loss is also shared between nationals imposing the NTM (C1) and in part by the foreigners (C2). In this case, because of the improvement in the terms of trade ($P_W^0 \longrightarrow P_W^1$), the effect of the NTM on welfare is ambiguous for the country applying the NTM (welfare for partners always falls). Welfare goes (up) [down] if area ($B_2 > C_1$) [$B_2 < C_1$]. This example is important in the analysis of the effects of NTMs because it illustrates the possibility of spillovers of national measures on foreigners even in the simple case of perfect competition.

To sum up: producers benefit (or are compensated if there is dumping) as they produce more at a higher price and have a clear incentive to "make a case" that there is dumping. Consumers, on the other hand, lose, because they purchase less at a higher price. Since they are less well organized than producers, consumers are less likely to oppose the safeguard.[3] Foreign exporters will also lose in the likely (and realistic) case when the safeguard duty is targeted to specific partners because the price they receive falls. Finally, the government gains some revenue from the tariff. Note that when the country has market power, then part of the efficiency loss is paid by foreigners who also transfer resources to the government in the form of tariff revenue.

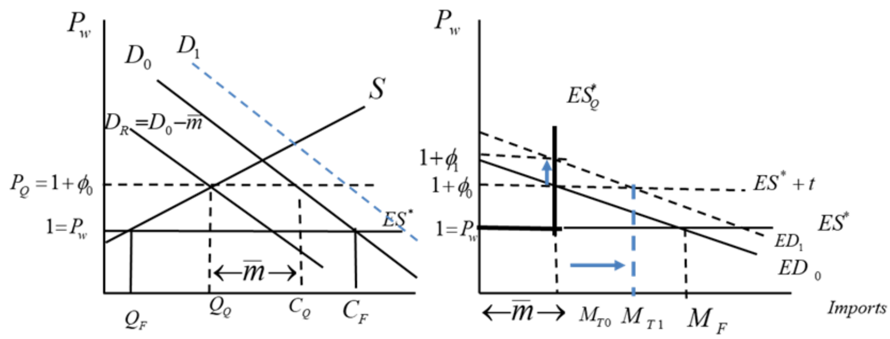
2.2. Quantitative restrictions

Quantitative restrictions (QRs) limit directly the amount of a good that can be imported legally so the outcome is less uncertain than under a tariff-like measure since its effect on imports is independent of demand and supply elasticities. As discussed in chapter 2, QRs, including "voluntary export restraints", are prohibited under General Agreement on Tariffs and Trade (GATT) Article XI, even though case law has made it clear that domestic regulations imposed at the border (e.g. imports of asbestos-containing materials) are allowed. Figure 5(a) illustrates the effects of a quota restricting imports to quantity $\overline{m}$. With the quota, domestic suppliers face the residual demand curve D_R=D-$\overline{m}$ and the equilibrium is (P_Q, C_Q). As in the case of the safeguard, relative to

[3] Steel is an intermediate input (e.g. for the automobile industry). Then, especially if the safeguard is applied on a non-discriminatory basis, the automobile industry is likely to get organized and oppose the measure or to request that it can continue to buy steel at the world price.

the no-NTM case, domestic production increases and consumption falls. As before, in figure 5(a), steel is assumed to be supplied under the small country assumption (i.e. at a fixed world price). As shown in the figure, the quota is then equivalent to a tariff on imports at rate Φ, which would also raise the domestic price to $P_Q= P_W +\Phi=P_W +T=1+\Phi$ (by choice of units for P_W).

If a quota is generally the preferred instrument to meet an import target, it has three effects that distinguish it from a tariff-like measure. First, in the case of a QR, in most cases there is no government revenue (unless the licenses to import are auctioned off by the government). Under a QR imposed unilaterally, it is the (lucky) domestic importers that obtain the rents. And if the quota is negotiated bilaterally between two countries (as was the case under the voluntary export restraints that were de facto allowed prior to the establishment of WTO), then the rents accrue to the exporting country. Second, dynamically, whereas an increase in demand results in an increase in imports under a tariff, under a quota, an increase in demand results in a higher domestic price. This is shown in figure 5(b), where the increase in demand from $ED_0$to ED_1 results in an increase in imports from M_{T0} to M_{T1} under a tariff at rate t=Φ, but to an increase in the domestic price from $P_Q= 1+\Phi_0$ to $P_Q= 1+\Phi_1$.



(a) Quota $\overline{m}$: Static equivalenc e (b)Quota m: Dynamic non-equivalence

Figure 5: Limited tariff-quota equivalence in perfect competition

Third, and most importantly, a quantity-based NTM that ends up restricting imports gives market power to domestic producers. In effect, a QR, and many standard-like NTMs that create barriers to entry, affect market structure by restricting competition. In the realistic setting of an industry populated by small and large firms, small firms are likely to exit, giving more market power to large firms, both at home and abroad.

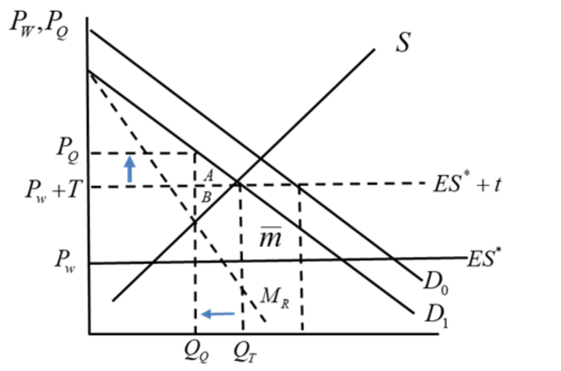


Figure 6 : Non - equivalence in Monopoly

Figure 6 illustrates the simpler case where the domestic steel industry is a monopoly. The figure contrasts the effect of the tariff at rate t which restricts imports by $\overline{m}$ and the quota which restricts imports by the same amount. With the tariff, the domestic price rises to P_W +T while with the quota (which also restricts imports by the same amount), the domestic price is higher. In effect, under a tariff-like NTM, the monopolist cannot exercise market power. With the QR, the monopolist chooses the price-quantity pair (P_Q, Q_Q) which maximizes his profits (i.e. the monopolist chooses the price-quantity pair that equates marginal revenue and marginal costs). It can be shown that the extra efficiency cost of a quota that restricts imports by the same amount as a tariff is the sum of areas A+B in figure 6.

These effects illustrated for the domestic monopoly case also hold under competitive assumptions when domestically produced goods and imports are imperfect substitutes as the same mechanisms are at work. For example, under monopolistic competition with differentiated products, a quota gives market power to domestic firms as they face a less elastic demand curve (as in the case depicted in figure 6). In sum, the important conclusion of the analysis of NTMs that restrict quantities directly is that they give market power to domestic producers. In effect, quantitative restrictions insulate the domestic market from competitive pressures of the world market and have a greater efficiency cost than tariff-like NTMs and frictional barriers (to be discussed later), both of which provide a lesser degree of insulation from the world market.

2.3. Subsidies

Subsidies are considered to be NTMs because they have trade effects.[4] This conclusion stands whether the subsidy involved is specifically related to trade (like an export subsidy) or is aimed at the domestic market (like a production subsidy). At the same time, it is generally accepted from the theory of the second best that subsidies are welfare-superior to tariff-like NTMs when the objective is to increase production (as in figure 3).[5] This is because tariff-like NTMs, which are effectively production subsidies coupled with consumption taxes (with both at the same rate), are more distortionary because they also affect consumption decisions which are optimal in the absence of the measure. However, this well-known result, which may hold in high-income countries, requires that raising taxes (by other means) to finance the subsidies do not result in additional costs to raise the required revenue. This is rarely the case in low-income countries. This is the reason why production subsidies are rarely used in low-income countries.

[4] See Hoekman and Nicita (2018) for a detailed discussion of the WTO Agreement on Subsidies and Countervailing Measures.

[5] The theory of the second best develops the efficiency implications of interventions (policies or measures like standards) in situations where the economy is not operating optimally at the time when the intervention is put in place.

Production subsidies. Production subsidies are closely related to domestic regulatory objectives. Usually, subsidies are justified when there are positive externalities in the market. The most prominent case is a subsidy for research and development (R&D) activities. This is to compensate companies that engage in R&D who do not recuperate the full expenditures they incur as some gains are passed on to other companies through spillovers (i.e. externalities). In this case of a positive externality, marginal social costs (MCs) are less than marginal private costs (MCp) and an appropriately chosen subsidy to R&D will close the gap between private and social and marginal costs. If a production subsidy to remove the externality is introduced from a situation of free trade, production will increase and imports will fall, so the gains from trade will be reduced (and could be negative relative to no trade if the subsidy does not entirely correct the externality). Figure 7 illustrates the possibilities.

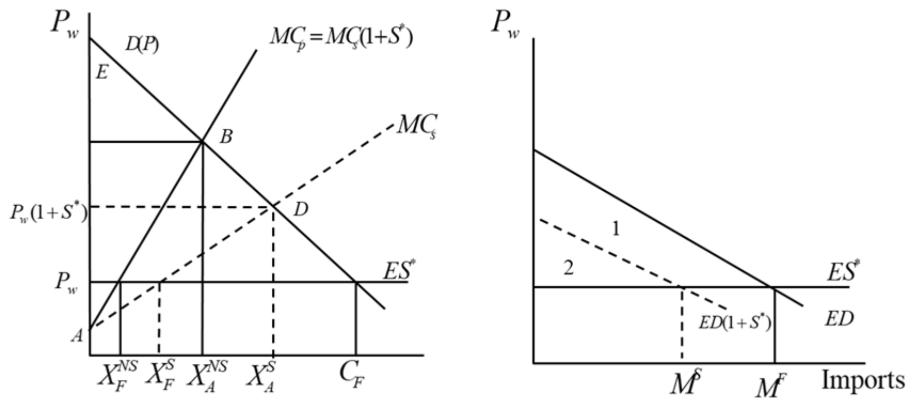


Figure7: A ProductionSubsidy for R & D

If the economy cannot engage in trade, with no production subsidy, production is at X_A^{NS} with surplus equal to area AEB. Applying the optimal R&D subsidy at rate (1+s*) – which equates MCs and MCp – would increase economy-wide surplus from area AEB to area AED in figure 7(a). With free trade and no subsidy to production, production is at X_F^{NS} and consumption at C_F. Then, the gain from trade (relative to no trade and no subsidy, i.e. relative to area AEB in figure 7(a)) is given by area 1+2 in figure 7(b). So trade gives rise to a gain when the R&D subsidy is not applied but applying the subsidy can raise the gains further. Note that the subsidy to production does not affect consumption, which remains at C_F in figure 7(a). A production subsidy applied at rate (1+s*), that just corrects the R&D externality reduces the gain from trade to area 2 starting from the situation of no-trade with the optimal R&D (i.e. area AED). However, it can be shown that for s<s*, the efficiency loss from less R&D is greater than the gain from trade and the opposite if s>s*.

This case illustrates that the gains from trade are ambiguous in the presence of a negative externality that is not completely internalized. Likewise, if the externality is over-corrected, it may be better not to deal with the externality. These remarks also apply to standard-like NTMs mentioned below and in the case of a trade-related externality in figure 11. Note, however, that if the subsidy, s_0, is small, then gains from trade are still large and the loss from not applying the optimal subsidy, s*, is small so trade is welfare-increasing. As with all externalities, measuring their extent is a formidable challenge and it is difficult to ascertain their effects, especially in terms of welfare.

Export subsidies. While export subsidies are prohibited by the GATT whereas export taxes are not covered by the GATT, export subsidies have similar effects to production subsidies. Under the usual assumption that there is no externality, the subsidy – which raises the price received by exporters in domestic currency by the amount of the subsidy – increases domestic production and exports from E_F to E_S and reduces domestic consumption (see figure 8(a)). In figure 8b, relative to free trade, private sector surplus increases from area A to area A+B but the subsidy costs area B+C to the Treasury so the net effect of the subsidy is a welfare loss of area C. This case illustrates again that introducing an NTM from a free-trade situation reduces welfare if free trade is optimal, which is the case under perfect competition for a price-taking economy. However, often this is not the case in developing countries and a case can be made to set up export promotion agencies. However, it has proven difficult to establish that, in practice, export promotion agencies are welfare improving for the countries establishing them as it is difficult to control for confounding factors that also affect exports.[6]

In effect, the subsidy increases domestic production and exports, which translates automatically into increased import pressure for partner countries. For consumers, the price rises, and the quantity consumed correspondingly falls. If the country has power in the world market for the products it exports (e.g. the case for some exporters of agricultural products – not shown here), the foreign demand curve ED* will be downward sloping and the welfare loss will be greater because the subsidy will lower the world price and the export subsidy transfers part of domestic surplus overseas.

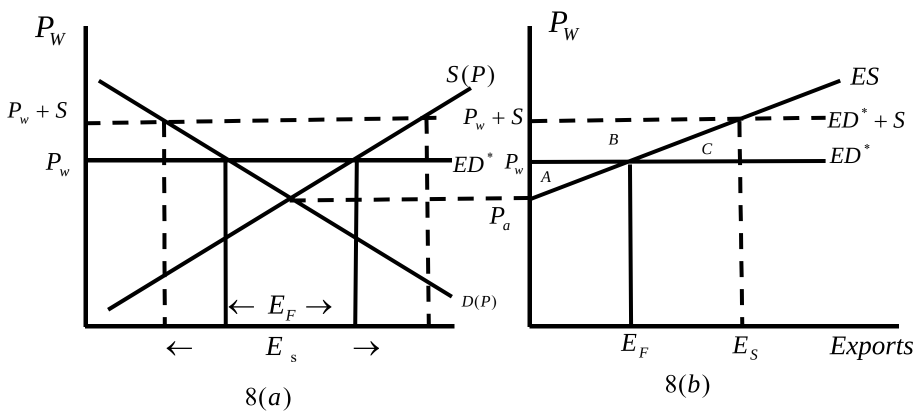


Figure 8 : An Export Subsidy

[6] Subsidies to export would be justified if there are costs to establishment in foreign markets that are not taken into account by firms. If this is owing to lack of information, the superior policy would be to subsidize information (i.e. set up an export promotion agency). See Olarreaga et al. (2016) and Melo and Olarreaga (2017).

In the case analysed in figure 8, which may apply mostly for agriculture products, the export subsidy is unambiguously negative for the domestic economy: the gains for producers are more than outweighed by the losses to consumers, and the additional burden on government revenue can be exacerbated by a terms-of-trade loss if the country has market power in the world market. Export subsidies are highly trade distorting, and, as discussed by Hoekman and Nicita in chapter 2, subsidies are strictly regulated within the international trade law system.

2.4. Rules of origin

There are two types of rules of origin (RoO): non-preferential, which are covered at WTO by the Agreement on Rules of Origin, and preferential RoO. As clarified by Hoekman and Nicta in chapter 2, non-preferential RoO (e.g. labelling under food and health measures) are decided unilaterally while preferential RoO are negotiated among members of a preferential trade agreement (PTA). Both types of RoO have effects on trade. Non-preferential RoO determine conditions of market access. Preferential RoO determine conditions for imported goods from a PTA partner to benefit from the preferential status (i.e. to pay less than the most-favored nation (MFN) tariff). RoO are a particularly interesting form of NTM to study because they illustrate the panoply of effects encountered with NTMs: raising production costs; differential effects across countries and across firms; market structure effects affecting rent pass-through associated with preferences; and extent of diversification across partners and products.

For preferential RoO, in most cases, preferential access results in the country paying no duties when exporting to the partner if they satisfy market access requirements detailed in the RoO. This is the case when partners belong to a free trade agreement (FTA), where members trade at zero tariffs within the bloc but maintain their own MFN tariff with non-partners. Then, firms in FTA members benefit from the rent that would otherwise accrue to the partner government as tariff revenue.

In an FTA, preferential RoO have the objective of preventing preferential treatment being extended to producers outside the bloc. RoO prevent trade deflection, which would otherwise occur if goods entered the FTA area via the partner with the low tariff to be subsequently sold at a higher price in the high-tariff members. For FTAs among developing countries, RoO are also justified as having the objective of encouraging the emergence of integrated industrial clusters in partner countries. This is because RoO favour linkages between PTA partners by forcing partner firms to source inputs from partners, as shown in figure 9. RoO can then be viewed as an integral part of an industrial strategy in the zone where an important objective is to overcome the small size of domestic markets.

Among NTMs, RoO are typically complex. Establishing origin of a product usually takes place at the Harmonized System (HS) six-digit level and typically involves the combination of regime-wide rules that apply to all products (e.g. a “de mininis” rule stipulating the maximum percentage of non-originating materials that can be used without affecting the origin of the final product, the applicable certification method, different cumulation rules among partners, etc.) and a plethora of product-specific rules of origin (PSRO) devised to overcome the fact that the HS was not designed to define the origin of goods. For example, the European Union's pan-Euro-Mediterranean preferential rules of origin (PEM Convention) has over 500 PSRO and all United States PTAs also have a large number of PSRO. Rarely do preferential RoO boil down to a simple rule. The Association of South-East Asian Nations (ASEAN) is the exception where only two criteria are used: wholly obtained for agricultural products and the choice between a change of tariff classification (CTC) and a 40 per cent local content for other products.[7]

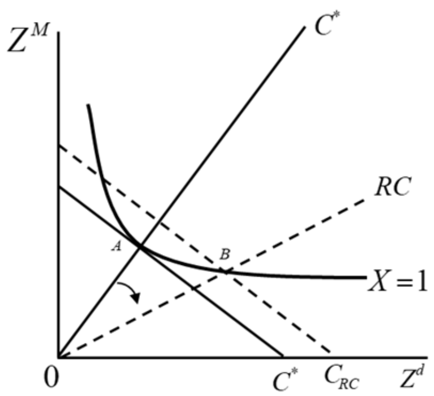


Figure 9 : A regional Content Rule

The effects of a PSRO in terms of costs are illustrated in figure 9, which shows an isoquant for producing a shirt with value-added (capital and labour) and intermediates. Value-added and intermediates are used in fixed proportions but intermediates originating in the preferential area (Z^d) and MFN intermediates (Z^M) can be substituted along the isoquant. For a price-taking firm, the optimal cost-minimizing mix of intermediates to produce X=1 is depicted by C* with unit cost OC*. With a technical requirement or a content requirement forcing the firm to shift its sourcing mix towards originating intermediates at C_{RC}, production is at B. Forcing firms to increase sourcing of intermediates from FTA partners raises their unit costs from OC* to OC_{RC}, resulting in a distortionary cost. In terms of the distinction between fixed and variable cost NTMs, this constraint represents an increase in variable cost, affecting all firms equally.

In addition to these distortionary costs (C^D), one must factor in administrative costs (C^A) and the possibility that there is rent sharing (μ) because the pass-through of the higher price from not paying the tariff in the destination market is incomplete as part of the rent is kept by importers in the destination country. Equation (1) breaks down firm unit costs into two components: undistorted costs (C_i^0) and compliance costs (C_i^R) that include both the distortionary and the administrative components:

$$C_i = C_i^0 + C_i^D + C_i^A + \mu_i = C_i^0 + C_i^R \qquad (1)$$

Take the yarn-forward rule (also known as triple-transformation rule) to illustrate the effects of a PSRO. The rule requires that the following tasks (cotton→ yarn→ textiles→ assembly (clothing)) be carried out with originating materials (i.e. materials coming from FTA members). Suppose then that a 45 per cent VC is required for a shirt produced in Mexico not to pay the United States MFN of

[7] Typically, the menu of PSRO includes a combination of a CTC, technical requirements (TECH), sometimes modified by exceptions, minimum regional content (RC) either in physical or value content (VC) terms). Estevadeordal et al. (2008) give an exhaustive description of RoO across PTAs and Donner Abreu (2016) gives an update for preferential PTAs.

12 per cent on shirts imported in the United States. (If the Mexican shirt producer exports under MFN he foregoes the possibility of earning up to 12 per cent more on his shirt but can continue to source intermediates (i.e. yarn and textiles) optimally at, say, 30 per cent).[8] Depending on the cost structures of North American Free Trade Agreement (NAFTA) partners (here Canada) and those of suppliers in the outside world, the VC can result in one of four effects. First, a relocation of yarn and fabric to Mexico from, say, Cambodia. Second, yarn and fabric may now be switched to another bloc supplier, for example Canada. Third, preferences might be denied altogether because Canada's cost may be higher than those of an outside supplier, say China. Fourth, it could be that the United States shirt producer is now competitive and sources his fabric from the outside supplier, China. When NTMs are non-discriminatory because they apply to all producers alike, these sourcing effects would not be observed although they cannot be excluded because industries are populated by firms with different compliance costs.

An important observation from the data of countries that report utilization of preferences, u, is that they are not always high even when preferential margins (usually equal to the MFN tariff rate) exceed 4-5 per cent (see utilization rates and preferential margins reported in table 1a). This observation can be easily explained by considering a Mexican firm that could export a shirt to the United States either under NAFTA preferences at a zero tariff rate or under MFN status. Under MFN, the firm obtains the MFN price of p in the United States for a profit of: $\pi = p - C$. If the firm sells under NAFTA it obtains a higher price, $p + \mu t$ (with incomplete pass-through if $\mu<1$ because of aggressive purchasers – see section 4.1 below) but it has to satisfy the PSRO for shirts (the triple transformation rule described above). This raises its costs by C^R, and its restricted profits are given by: $\pi^R = p + \mu t - C - C^R$. The firm will choose to export under preferential status if $\pi^R \geq \pi$, that is, if obtaining certification is not too costly and he does not face too powerful buyers that capture a part of the rent, that is, if $t \geq t/\mu$. Thus the probability of utilizing preferences is expected to rise with the preference margin and to fall with the restrictiveness of the PSRO which includes a fixed cost (certification) and a distortionary cost (variable cost).

In sum, preferential RoO work to offset the benefits of the multilateral trading system. Although ROOs are legitimate with the WTO system due to its inclusion of free trade agreements—which need to be able to discriminate among origins—unduly restrictive ROOs can alter trade patterns, and impose costs on consumers and using industries. Favouring intra-industry linkages between PTA partners forces firms to source inputs from high-cost producers, raising variable production costs. Downstream producers, who would typically oppose RoO, may not do so as it is the price to pay to be able to sell inefficient final goods in the zone. Also, certification costs are not necessary under MFN trade. These are fixed costs which weigh more heavily for small firms. RoO also affect locational decisions of investors. And perhaps most importantly, RoO meet the political-economy goal of extending protection to both intra-PTA input and final goods producers. Not surprisingly, it is often said that PTAs amount to giving with one hand (i.e. preferences) and taking away with the

[8] These figures are approximately those facing Mexican exporters of apparel to the United States (see Cadot et al. (2005).

other (i.e. strict RoO) as it has been amply documented that the higher the preference margin, the stricter are the associated RoO requirements (see table 1b below).

2.5. Frictional barriers

Frictional barriers include a wide range of policies and procedures that drive a wedge between prices on the world market and prices on the domestic market, but do not directly generate government revenue or rents, and so are different in welfare terms from those discussed above. A key example is poor trade facilitation: when countries make it difficult, costly and time-consuming to move goods across borders, they add to the costs of exporting and importing, and those costs are passed on to consumers. Some frictional barriers are associated with regulatory goals, although the example of poor trade facilitation shows that this is not always the case. The most common case is that a frictional barrier represents a suboptimal regulatory response to a genuinely important issue. For instance, requiring that goods be retested for conformity with standards in a redundant way adds to the cost of foreign goods, and is intended to protect domestic consumers from sub-par goods; however, it does not necessarily advance that objective in the lowest-cost way if testing in other countries is of a similar standard.

These types of barriers, although not included in the TRAINS classification, are important types of NTMs because they are directly related to the TFA, which aims to improve the efficiency of moving goods across borders.[9] Organizations like UNCTAD and the World Bank, as well as the World Customs Organization, are active in working with member countries to improve border clearance procedures and reduce these kinds of costs. The key analytical concept here is trade costs, namely, the full set of factors that drive a wedge between producer and consumer prices in international trade transactions. Lowering trade costs has become a key objective of the international community. The Asia-Pacific Economic Cooperation, for example, set two trade facilitation targets of reducing trade costs by 5 per cent in five years (Shepherd, 2016a). More recently, the Group of 20 has agreed to monitor progress on trade as a means of implementing the United Nations Sustainable Development Goals, in part by tracking progress on trade costs using the World Bank – UNESCAP Trade Cost Database (Arvis et al., 2015).

By making assumptions about the time-cost of trade, it is possible to translate many frictional barriers into informative tariff equivalents. For example, Hummels and Schaur (2013), using data on United States imports by maritime mode of transport from multiple sources, estimate that each day in transit is equivalent to an ad valorem tariff of 0.6 to 2.1 per cent. Importantly, many of the features of the tariff analysis in figure 3 carry over to the case of frictional barriers, where by frictional barriers one must understand barriers that can be reduced or eliminated. The net result is that the price on the domestic market goes up and domestic production rises, but consumption falls and imports correspondingly fall.

[9] In chapter 2, Hoekman and Nicita discuss in some detail the "bundle" of measures that should be taken to facilitate trade.

There is an important difference with the tariff case, however, when it comes to welfare. In the tariff case, an increase in government revenue from the tariff partially offsets the loss to consumers from higher prices and lower quantities consumed and traded. In the case of a frictional barrier, this gives rise to pure economic loss: economic resources are consumed by the frictional barrier, and they are simply lost to the economy, giving no benefit to any economic actor (this is why they are sometimes called dissipative barriers). In terms of figure 3(b), area C represents the welfare cost of a safeguard while areas B+C are the corresponding losses with a frictional barrier that gives the same effects on prices and quantities. The take-away is that reform of NTMs that can be considered to be frictional barriers is of particular importance from the standpoint of economic performance.

2.6. Standard-like measures

The final set of NTMs we consider are standard-like measures that affect firms' fixed costs of production. Thus far, under the perfect competition assumption underlying the graphical analysis, firms are assumed to produce under constant return to scale with variable production costs. These simple trade models provide insights into the effects of policies like the NTMs discussed above.

However, not all NTMs have effects that can easily be understood within this paradigm. Product standards like SPS measures and TBTs require producers to redesign products to meet specifications in importing markets. The cost of redesign is paid once, and the firm can then produce as many conforming goods as it wishes, based on market conditions. These types of costs are referred to as fixed costs. Fixed cost measures like product standards often further important regulatory objectives. For instance, a requirement that agricultural products contain no more than a given level of chemical residues (known as Maximum Residue Limit (MRL) is a product standard that protects public health. Similarly, RoO requirements typically have a fixed cost element. Fixed-cost type standards can also be aimed at environmental protection or consumer safety.

NTMs that create fixed-cost effects for producers and exporters need to be analysed in a fundamentally different way. Recent advances in trade theory linked with seminal work by Melitz (2003) highlight the importance of NTMs like product standards (SPS and TBT measures) that affect the fixed costs of entering a market.[10] According to these models, firms in an economy have different levels of underlying productivity. Only the most productive firms can export, because doing so requires payment of a fixed cost to enter the foreign market, for instance due to the need to adapt a product to meet local standards. If the fixed cost of compliance increases, some firms are forced out of the export market and fall back on the domestic market. Exports fall not only at the intensive margin (exports per firm) but also at the extensive margin (number of firms exporting). Importantly, if every firm makes a slightly different product variety, increasing the fixed costs of market entry in this way reduces the range of products a country can export – so foreign SPS and

[10] In their contribution, Ferraz et al.(2018) study the trade effects of NTMs on bilateral trade at the product level and interpret their results in terms of the Helpman Melitz and Rubenstein (2008) model, which distinguishes the extensive and intensive margin of trade.

TBT measures can affect the level of export diversification among partners. Standard-like NTMs are discussed further by Beghin and Xiong (2017) in chapter 5.

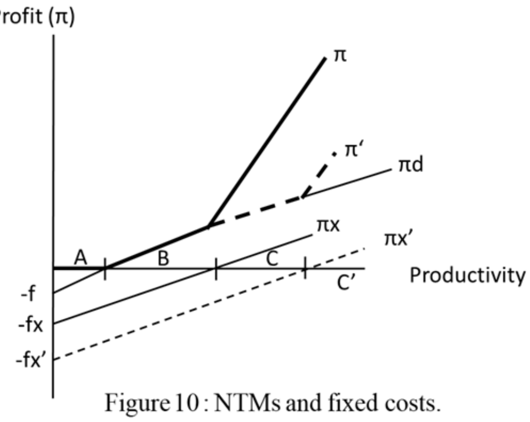


Figure 10 : NTMs and fixed costs.

Source: Adapted from Melitz and Reading (2014)

Figure 10 shows the effect of NTMs that affect fixed costs in the Melitz (2003) framework. The horizontal axis shows productivity, while the vertical axis shows profit. Firms will engage in an activity, either selling to the domestic market or selling to foreign markets, only if they can at least break even. As a result, the initial equilibrium sorts firms into three types: those that exit without producing (A), because they cannot profitably serve any market; those that produce for the domestic market only (B); and the highest productivity firms, which sell to export markets in addition to the domestic market (C). The profit function (π) is the sum of domestic (πd) and export market profits (πx), taking account of which firms self-select into which activities. As the figure makes clear, the cut-off productivities are linked to the levels of fixed costs associated with each activity (f for domestic sales, and fx for export sales). As a result, imposing an additional NTM that raises the fixed costs of exporting from fx to fx' shifts the productivity cut-off higher, and alters the profit function, as some firms exit the export market, with corresponding losses of trade flows, as well as export variety, as discussed above. In the new equilibrium only firms in zone C' export; the remainder of the firms in zone C fall out of export markets to serve the domestic market only.

As a final example of NTMs, consider an NTM measure aimed at reducing a detrimental external (e.g. a measure related to an exotic pest brought in with imports). This case developed further by Beghin and Xiong in chapter 5 is illustrated in figure 11drawn from their figure 4. It serves to show that an NTM which reduces the volume of trade, reduces the gains from trade. These losses from lesser trade must then be evaluated against the gains from reducing the externality. This is a typical second-best situation characteristic of many regulatory NTMs. Insofar as the marginal gains from trade falls as the volume of trade increases and the costs of applying NTMs increases with the restrictiveness of the NTM, the optimal policy is not to reduce entirely the externality.

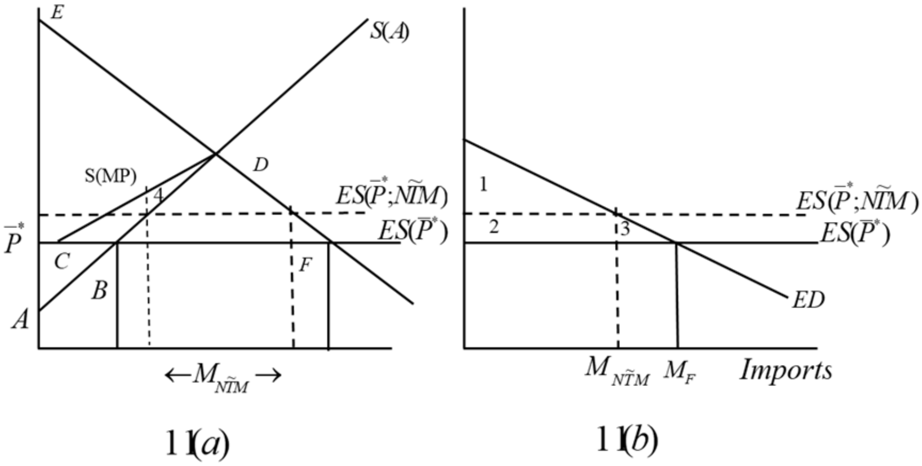


Figure 11 : SPS to correct for an invasive pest linked to imports

Now, domestic supply depends on imports (if there were no trade, domestic supply would be given by *S(A)* in figure 11(a). With the pest, the supply curve *S(MP)* is the kinked line *ABCD*. As drawn, the damage on supply is assumed to be proportional to imports.[11] Under free trade, the maximum damage in *CB* and the segment *CD* shows how welfare is reduced as imports increase. If imports did not carry pests, as before, welfare under autarky would be area *AED* and trade would increase welfare from autarky by area *BDF* in figure 11(a) (equal to area 1+2+3 in figure 11(b)).

An NTM to reduce imports will have two effects: (i) it will reduce the damage caused by the invasive pest: and (ii) it will reduce the gains from trade. The marginal costs caused by the pest and given by the vertical distance between *CD* and *AD* in figure 11(a) increases with imports while the marginal benefits from trade fall as the volume of trade increases. While the best solution would be to reduce pests at origin, exporters may not have the incentive to do so. In that case, the optimal policy would be to choose the NTM at the rate $\widetilde{NTM}$ which equates the marginal gains from trade (which are falling as trade volumes increase) with the marginal gains from reduced pests. Under the assumption that the loss in domestic supply cannot be replaced by imports from a welfare point of view (i.e. the *ED* curve in figure 11(b) is not affected by the damage caused by the pest), the gains from trade are now reduced to area (1) in figure 11(b)[12] and by area 4 in figure 11(a). Because marginal gains are decreasing and marginal costs are increasing, area (1)>area (4) and there is a gain from trade. A higher NTM would eventually lead to autarky with total surplus equal to area *AED* in figure 11(a).[13]

This example illustrates two characteristics of NTMs that usually hold in a trade context. First, the externality should not be entirely corrected. Second, it illustrates again the difficulty of targeting the policy so as to realize some gains from trade. The case study on pest control of Mexican

[11] This is a very simplistic representation of costs. These are likely to be convex rather than linear.

[12] In the case of a tariff, area 2 in figure 11(b) would be a tariff revenue. Here this area a rise in costs due to the NTM and is "dissipative" rather than a rent transfer.

[13] If the measure is a (non-prohibitive) tariff, then area 2 in figure 11(b) would be a rent accruing to the government and hence would represent an increase in welfare.

avocados to the United States of America summarized Beghin and Xiong (2018) shows how to apprehend these effects and illustrates the ambiguity of the effects identified in figure 11.

3. Examples of approaches to assess the effects of non-tariff measures

As a first approach, the partial equilibrium models presented above can be used to quantify the trade impacts of NTMs in terms of prices and quantities once elasticities of supply and demand have been estimated or obtained extraneously. However, the vastness of the NTM category makes it difficult to provide comprehensive economy-wide estimates of economic impacts, a problem that is compounded by the specificity of these effects to individual market conditions. As discussed by Melo and Nicita (2018b) in chapter 3, Kee et al. (2009) estimate the ad valorem equivalent (AVE) of core NTMs, then aggregate tariffs and NTMs into a single consistent measure of trade policy restrictiveness to produce an estimate of the AVE of core NTMs of around 12 per cent, with considerable variation across countries. Their estimate emphasizes that the frontier of trade liberalization is now very much in the area of NTMs.

In the remainder of this section, and in the next, we review examples of studies that have assessed the effects of NTM measures on trade discussed above. We focus on studies covering ADDs, frictional barriers to trade and RoO, covering only marginally contributions dealing with standard-like measures as these are covered at greater length in the chapter by Beghin and Xiong (2018).

3.1. Anti-dumping duties

The effects of ADDs have been studied at the aggregate and at the micro level. Intuitively, it might be expected that these measures, which are increasingly used by developing and developed countries alike, might have large-scale trade effects. However, they are typically quite closely targeted in terms of products, and are time bound, which limits their effects. Indeed, Egger and Nelson (2011) use a structural (theory-consistent) gravity model to show that ADDs as one type of NTM have indeed impacted traded quantities negatively, but that the size of the effect is relatively modest. It is important to go beneath aggregate results like these, however, to look at the effects of ADDs at a micro level. Outside the gravity context, Besedes and Prusa (2017) find that ADDs in fact have substantial chilling effects on trade at a highly disaggregated level, which suggests that detailed analysis may be required to uncover the full trade effects of NTMs.

Vandenbussche and Viegelahn (2013) conduct a detailed analysis of the trade impacts of Indian ADD measures imposed against China. Since India started using ADDs in 1991, it has initiated almost a quarter of all cases in relation to imports originating in China. The authors use monthly data on trade values and quantities between China and India to estimate the following equation:

$$X_{it} = \exp\left(a + b_1 ADD_{1,it} + b_2 ADD_{2,it} + \cdots + b_n ADD_{n,it} + f_i + f_t\right) \quad (2)$$

Where X is exports from China to India in product i at time t, and the ADD variables are dummies for the imposition of ADD 1, 2, etc., months after it has been imposed. The f terms are fixed effects for products and time periods. To account for zeros in bilateral trade, which can be frequent at a disaggregated level, they estimate using the Poisson pseudo-maximum likelihood estimator, which is now used commonly in log-linear models like the gravity model (Santos-Silva and Tenreyro, 2006). The reason for adding the differently timed dummies for ADD imposition is to track possible dynamic effects, which complicate the comparative static analysis presented above.

Using this framework, the authors find that Indian ADD measures reduce the value of Chinese imports by around 15 per cent, and that the effect is non-linear through time, which is indicative of complexities in the market effects of ADDs beyond what is accounted for in simple models. The effect on quantities traded is even greater, at around 25 per cent, with similar evidence of complex time dynamics in play. One possible explanation for the difference in the size of the value and quantity effects is that the imposition of ADDs incentivizes Chinese exporters to raise their prices – one type of anticompetitive effect of this type of NTM. Another, is that ADD might alter quality or variety of products.

Although this chapter focuses on the effects of NTMs, it is also worthwhile to mention the substantial literature on endogenous trade policy and its implications for NTMs, including ADDs. Whereas many NTMs, such as standards, may be the result of legitimate social concerns embodied in possibly suboptimal regulations, an ADD is typically the result of pressure for protection from affected industries. Bown (2008) confirms that this is the case using data on ADDs for a wide range of developing countries. He models the choice whether or not to undertake an ADD investigation in an industry, and whether or not ADDs are in fact imposed, in terms of variables capturing the legal requirements for ADD in the WTO agreements, macroeconomic shocks, and their political weight as proxied by their size relative to industrial output. Concretely, he finds that larger industries that are subject to substantial import competition are more likely to pursue an ADD investigation and receive protection, a dynamic that is consistent with endogenous trade policy.

3.2. Frictional barriers

Another area in which gravity models have found rich application is frictional barriers, especially trade facilitation. In a widely cited paper, Djankov et al. (2010) use data from the World Bank's Doing Business project to show that the time it takes to move goods across the border – one aspect of trade facilitation – impacts negatively on trade flows. They use a gravity model that controls for a variety of unobservable effects, and take great care to ensure that their effects are properly identified. Concretely, they find that increasing trade time by one day reduces trade value by around 1 per cent. Subsequent work using different methodologies and data sets has largely confirmed that result. For instance, Saslavsky and Shepherd (2014) show that improved logistics and trade facilitation performance is associated with increased trade values, and that the effect is more pronounced for movements of intermediate, as opposed to final, goods. In the context of the WTO TFA, Moïse and Sorescu (2012) use the Organisation for Economic Co-operation and

Development (OECD) Trade Facilitation Indicators (TFI), which capture the main targets for improvements in customs provisions in the agreement, to show that improvements in trade facilitation are associated with higher bilateral trade values. Melo and Wagner (2016) classify countries in groups (landlocked, least developed country (LDC), etc.) and also use the OECD TFI values to estimate the reduction in time spent in customs if countries were to improve their TFI values towards the frontier of their respective group. Using a duration model proposed by Hillberry and Zhang (2015), they estimate that a successful implementation of the TFA, defined as moving halfway towards the frontier value of the TFI for a respective country grouping, could reduce trade costs of imports for LDCs by as much as 2.5 per cent and by 4.5 per cent for landlocked LDCs.

Another strand of the literature looks at the capacity of trade facilitation measures to affect firms' fixed costs, with consequent impacts on market entry and product variety in trade. Dennis and Shepherd (2011) show that a variety of trade facilitation variables from the Doing Business project are associated with export diversification outcomes across a wide range of developing countries. They put forward a theoretical framework that is consistent with these results, which adds weight to the finding. In a companion paper, Shepherd (2010) shows that improved trade facilitation is also associated with entering a wider range of overseas markets, in addition to an expansion in the range of products exported. These findings were recently extended by Beverelli et al. (2015), who used the OECD TFIs in an effort to identify the potential export diversification effects of the TFA. They also conduct a range of additional robustness checks, and find that the core result – that trade facilitation is associated with greater export diversification – stands.

4. Other measures

4.1. Rules of origin

Chapter 3 discusses the shortcomings of data sources on NTMs. As is the case with most NTMs, to assess the effects of RoO, the devil is in the detail. Ideally one needs data on utilization rates combined with a detailed description of the rules, including the myriad PSRO. For a start, only three countries (Australia, Canada and the United States) and the European Union regularly report utilization of preferences. Next comes the description of the PSRO, which usually come in binary form except for value-content rules. To illustrate how one can capture the effects of PSRO, we report on case studies of NAFTA, the largest FTA in the world, focusing on Mexico, and on the African Growth and Opportunity Act (AGOA), an example of non-reciprocal preferences where a quasi-natural experiment helped to identify the costs of RoO in textiles and apparel (T&A). Two case studies are on T&A, an important export for developing countries where the preferential margin is high (11 per cent for the European Union and the United States).

For the NAFTA case study, the key was combining an ordinal restrictiveness index (R-index) of PSRO at the HS-6 level developed by Estevadeordal (2000) with utilization rates. The index ranges from r=1 (CTC at the item level, CI, which is not very restrictive as it is likely to be easy to satisfy) to r=7

(CTC at the chapter level (CC) – which is far more difficult to satisfy through transformation of the product – augmented by a technical requirement TECH).[14] This observation rule was subsequently applied to PANEURO, which describes the PSRO applied by the European Union to all PTAs. Table 1 shows two clear patterns from applying this R-index for NAFTA and European Union PTAs. First, utilization rates of preferences increase with the preference margin, τ, (table 1a). Second, HS-6 products with tariff peaks have, on average, higher R-index values (table 1b), a pattern that suggests political-economy factors at play. Together, these patterns give credence to the observation rule used to construct the R-index.

Table 1a: Preference margins, utilization rates and R-index

	Preference margin		
Preferencial trade agreement	$\tau \geq 4$ percent [a]	$\tau \geq 8$ percent [a]	$\tau \geq 12$ percent [a]
North American Free Trade Agreement [b]	87.0 (1,239)	86.0 (558)	82.8 (287)
GSP [c]	50.2 (1,297)	52.5 (91)	66.2 (44)
Cotonou Agreement [c]	92.5 (1,627)	94.3 (892)	96.4 (566)

Note: Averages are unweighted. Numbers in parentheses are the number of tariff line.

[a] $\tau_i = (t_i^{MFN} - t_i^{PREF})/(1 + t_i^{PREF})$ is the preference margin.

[b] Computed at the six-digit Harmonized System tariff-line level with 2001 data.

[c] Computed at the eight-digit Harmonized System tariff-line level with 2004 data for 92 countries (GSP) and 37 countries (Cotonou Agreement) qualifying for preferential market access.

Source: Melo and Cadot (2007, tables 3)

Table 1b: Tariff Peaks and the R-index (All goods)

	Restrictiveness-index value	
	NAFTA	*PANEURO*
Tariff peaks [a]	6.2 (257)	5.2 (780)
Low tariffs [b]	4.8 (1,432)	3.9 (3,241)
Total number of tariff lines	3,555	4,961

Note: Numbers in parentheses are numbers of tariff lines. Restrictiveness indexes are unweighted.

a Tariff lines whose tariffs exceed three times the MFN average.

b Tariff lines whose tariffs are less than one-third of the MFN average.

Source: Melo and Cadot (2007, tables 3 and 4)

Starting from the discussion of utilization rates in section 2.4 and the pattern of utilization rates, u_i, and the R-index values in table 1a, Carrère and Melo (2006) assumed that utilization rates were a function of the spread between preferential margins and costs (3a) and that costs were linked to R-index values as in (3b):

$$u_i = f(\tau_i - c_i) \ ; \ f'(.) > 0 \ ; \quad \text{(3a)} \quad c_i = \beta' RoO_i \qquad \text{(3b)}$$

[14] The logical rule is that in terms of restrictiveness CC>CH>CSH>CI, i.e. that a CTC at the item (HS-8 level) is less restrictive than at the subheading (CSH) level and so on. Also, that multiple requirements are more restrictive than single requirements.

By substitution of (3b) in (3a), they estimated (4a), which allowed them to retrieve estimates of the costs of the NAFTA PSRO in (4b) where hats indicate estimated values.

$$u_i = \lambda_0 + \alpha\tau_i + \theta RoO_i + v_i \;\; (4a) \quad \Rightarrow \quad \widehat{c_i} = \left(\frac{\widehat{\theta}}{\widehat{\alpha}}\right) RoO_i + v_i \qquad (4b)$$

Estimates at the HS-6 level on a cross section at HS-6 for 2001 and 2004 yielded a plausible pattern of cost estimates by broad category of activities – intermediates, final goods, T&A – (preferences rates, followed by cost estimates in brackets): intermediate goods [5.3 per cent,2.0 per cent]; final goods [6.1 per cent,4.2 per cent]; T&A [11.8 per cent,13.0 per cent]. When compliance costs were classified by type of RoO, the revealed preference criterion used by Estevadeordal to rank costs was satisfied: CC<RVC<TECH.[15]

Even though these estimates are plausible, the ranking of RoO when these have multiple criteria (e.g. CTC + TECH vs. CTC +VC) are hardly evidence-based. This index cannot account for firm heterogeneity, nor can it take into account that negotiation took place over both tariff-preference phase-in and RoO even if many RoO were inherited from the earlier Canada-United States FTA.

In further work on the effects of the NAFTA RoO on exports of Mexican T&A to the United States at the HS-8 level, Cadot et al. (2005) estimated the pass-through of preferences directly from the two requirements (CC and TECH) in the T&A sector. They regressed the percentage difference between NAFTA and MFN prices at the HS-6 level on NAFTA preferences for identical Mexican goods exported to the United States under MFN and NAFTA regimes. In the absence of RoO and holding constant the price of textiles sold by US firms to Mexican T&A producers, the pass-through was estimated at 80 per cent, while with the two RoO requirements, the pass-through was reduced to 50 per cent once RoO were introduced in the estimation.[16] The question then was whether this rent dissipation was just the reflection of dissipative barriers caused by RoO or whether they created rents elsewhere as, for example, if Mexican producers purchasing United States textiles could not capture part of the rents as did United States purchasers of apparel. Cadot et al. then estimated the pass-through of preferences for United States intermediates exported to Mexico. When the sample was restricted to intermediates, they detected no pass-through (and only a small pass-through for the entire sample). In total, a third of the estimated rise in the border price of Mexican T&A products was found to compensate for the cost of complying with the NAFTA RoO and NAFTA was found to have raised the price of United States intermediate goods exported to Mexico by 12 per cent with downstream RoO accounting for a third of that increase. As a result of RoO, welfare gains for Mexican exporters of preferential access to the United States market were estimated to have been approximately halved.

[15] Carrère and Melo also coupled these costs estimates with utilization rates to disentangle the administrative cost component from total compliance costs to conclude that administrative costs amounted to about 2 per cent of the border price.

[16] Without RoO, an X percentage point reduction in tariffs below MFN tariffs results in an increase of Mexican producer prices by 0.8X percentage points and so a decrease of United States consumer prices of 0.2X percentage points or a 20 per cent pass-through.

Conconi et al. (2016) go further by estimating the trade diversion effects of RoO on intermediates in NAFTA by an exhaustive recording of each RoO in NAFTA (over 700,000 for all products and over 600,000 when considering only intermediates). They then estimated the effects of the count of these RoO on purchases of intermediates from non-members using a difference-in-differences between 1990 (before NAFTA) and 2003 (when NAFTA preferences and RoO were in full effect). Difference-in-differences estimation controls for time-invariant unobservable product characteristics. They estimate that RoO on final products reduced imports of intermediates from third countries by about 30 percentage points and conclude that FTAs like NAFTA may violate multilateral trade rules by increasing the level of protection against non-members.

The second example is from AGOA. Melo and Portugal-Perez (2014) exploit the quasi-experimental situation provided by a "Special Rule" (SR) for RoO accorded by the United States to a group of 22 African countries shortly after they benefited from duty-free access for T&A in both the United States and European Union markets where the preference margin was 11 per cent for the United States and 12 per cent for the European Union. The SR involved replacing the triple transformation rule by a single transformation rule (fabric from any source) in T&A. During the period studied, the European Union maintained the double transformation rule (yarn→ textiles→ clothing) implying that yarn and textiles had to be originating from the EU or an EBA country. Panel estimates for T&A at the HS-4 level over 1996–2004 suggest that the surge in T&A from AGOA beneficiaries to the United States was largely attributable to the SR. They estimated an increase in exports of 168 per cent for the top seven beneficiaries attributable to the SR, about four times as much as the growth effect from the initial preferential access of 11 per cent without the SR. They also documented that the SR broadened the varieties of apparel exported by AGOA beneficiaries. These results suggest that RoO impact trade costs both in terms of variable costs (intensive margin) and fixed costs (extensive margin).[17]

These case studies point towards several lessons. First, as mentioned in chapter 3, in practice, NTMs typically involve a complex set of measures that are hard to capture by indicators that can then be used to estimate the effects of NTMs on outcomes of interest (e.g. utilization of preferences, trade diversion from non-members, costs of implementation). Second, detailed documentation beyond frequency and coverage ratios are needed to capture these effects, and, as illustrated above, several approaches are needed to get a more comprehensive overall picture. Third, in practice, NTMs may go well beyond their initial stated purpose (in the case of NAFTA to prevent trade deflection), suggesting that they may be captured by interest groups. Clearly, efficiency and political-economy considerations are highly significant from a policy point of view. Taken together, these estimates highlight the need to design relatively liberal RoO if trade agreements are to guarantee effective market access.

[17] Keck and Lendle (2012) report high utilization of preferences in United States PTAs for small preferential margins while Abreu (2013) reports results from an ASEAN study that shows low rates of utilization.

4.2. Non-tariff measures in services

Although the focus of this chapter is on NTMs that affect goods markets, it is important to refer to work on NTMs in services, if only because services are important inputs in goods production and increasingly goods trade embodies services. In services markets, essentially all trade-restrictive measures can be likened to NTMs as there are no border tax (tariff) equivalents. Similar analytical issues arise in terms of cataloguing measures, developing indicators of restrictiveness and identifying policy effects on performance and trade.

Early contributions to the literature on barriers to services trade focused on cataloguing policy restrictions and producing summary indices (trade restrictiveness indices). The Australian Productivity Commission, in a series of papers covering different sectors, set in place a basic approach that was followed by later researchers. To address the crucial question of economic impacts, regression models were used to relate services trade restrictiveness to measures of firm performance. For instance, Dihel and Shepherd (2007) constructed estimates of trade restrictiveness broken down by the General Agreement on Trade in Services mode of supply, covering banking, insurance, telecommunications (fixed and mobile), engineering and distribution in selected countries. For each sector, they calculated price-cost margins for each firm using accounting data, and related those measures to the trade restrictiveness indices and control variables. Interpretation is not simple, however. In line with the Productivity Commission's work, some indices have an estimated positive coefficient, while others have a negative one. Given that the dependent variable is the price-cost margin, a positive result is interpreted as showing that the trade measures captured by the index primarily increase rents for firms that are established in the local economy, irrespective of their country of ownership. Conversely, negative results are indicative of trade measures that increase the real resource costs of doing business for firms that are established in the local economy. Both types of effects are negative for the local economy, but reform has different welfare implications in terms of the release of economic resources versus transfers from one group to another. Regulatory measures affecting services trade can therefore have complex effects depending on their precise nature, with the gains from reform being similarly diverse.

There is now a substantial body of work looking at the links between liberalization of services policies and the productivity of downstream firms in developing and transition economies (e.g. Arnold et al. (2016) for India). Hoekman and Shepherd (2017) extend this literature by looking at the impact of trade measures affecting services on exports of manufactured goods, not just firm productivity. The rationale is that services are important inputs into the production and export of goods, so it should be possible to identify an effect running from services policies to the export of goods. At the firm level, the link between services productivity and downstream manufacturing exports is statistically significant, but quantitatively small. The likely reason is that the available data do not contain much detail on services inputs used by manufacturing firms, and many categories are simply left out. At the aggregate country level, a gravity model suggests that services trade policies can have large effects on goods exports. Using policy data collected by the

World Bank and a gravity model of trade in manufactured goods, the authors estimate that a 10 per cent reduction in the restrictiveness of services policies is associated with a nearly 5 per cent increase in manufactured goods exports, even after controlling for tariffs and NTMs that directly affect goods trade.

At an analytical level, the approaches used to estimate the economic impacts of trade measures in services are closely related to the analysis of NTMs in goods markets presented here. The effects of trade-related policies in goods and services are also connected in a more substantive way, however, owing to the increasingly strong interlinkages between goods and services markets. The OECD-WTO TiVA (Trade in Value Added) database suggests that for included non-OECD countries, about 31 per cent of the value of gross exports of manufactured goods was in fact accounted for by embodied services value added in 2011; for OECD countries, the corresponding figure was nearly 37 per cent. For a sample of 61 firms focusing on trade in services related to environmental goods in mostly OECD countries, Sauvage and Timiliotis (2017) find that services trade restrictions are associated with a lower export performance. The ongoing increase in embodied services exports, known as servicification, is an important dynamic for developing countries, and emphasizes the need to understand the linkages between NTMs in goods markets and NTM-like measures in services markets, both of which affect final export development outcomes.

5. Conclusions and policy implications

This chapter has reviewed the economic analysis of the main categories of NTMs, focusing on their effects on prices, quantities and welfare. The analysis proceeded from a categorization of NTMs in six broad categories.

Although tariffs are well understood by economists and their effects can be modelled relatively easily because of their transparency, it is now NTMs that are typically the binding constraint on developing country exports. The point is all the more true for LDCs, which often benefit from duty-free and quota-free access to the main Northern markets, but must still comply with NTMs such as standards. NTMs come in many varieties, and modelling their impacts is ultimately a relatively complex and data-intensive exercise compared with tariffs. This chapter has presented some general frameworks that are useful for understanding the types of effects that are in play, but quantifying them requires detailed information on the exact content of a measure, supply and demand parameters, and market structure, to name just a few. UNCTAD and its partners have done valuable work in terms of updating and extending the TRAINS database, but it will be important going forward to ensure that more countries are included in the database so that the impact of NTMs can be more fully assessed. In particular, the literature to date has focused on NTMs in Northern countries, but with the rise of South–South trade, particularly with the BRICS countries (Brazil, Russian Federation, India, China and South Africa), we will need to know what the impacts of NTMs are in those markets as well.

Another area where additional work would be welcome is in the use of firm-level data. There is tremendous scope for firm-level empirical analysis to produce convincing estimates of the impacts of trade-related policies, including NTMs. Yet informative, cross-country work is inevitably plagued by the difficulty of controlling for all confounding influences. Firm-level data makes it possible to take better account of external influences at the sector or country level. In addition, the detailed nature of firm-level data enables researchers to identify a wider range of effects, beyond the aggregate impact on trade values. A paper that shows the way forward is Fontagné et al. (2015). The authors use data on specific trade concerns raised in the WTO Committee on Sanitary and Phytosanitary Measures as a measure of the constraints imposed by SPS measures (health and quarantine standards) in importing countries. They then examine the effect of these concerns on French exporting firms, and can identify impacts at a fine level of detail: firm participation in exporting, export values and pricing strategies. Given that NTMs can have important effects on market structure and firm strategy, this kind of approach is a promising avenue towards a better understanding of the economic effects of the full range of NTMs, not just product standards.

Although there is clearly still a strong case for producing summary measures of NTM prevalence and restrictiveness as done in the case studies in part II of this book, they need to be accompanied by a renewed analytical focus on the problem of identification that help to weed out confounding factors when examining the effects of NTMs on prices, market structure, trade and welfare. Applied trade policy is replete with examples of interesting and important questions that are difficult to answer owing to the problems inherent in achieving identification. NTMs are no exception. The discussion in this primer offers a number of examples and some directions for further research. As tariffs are likely to remain at low levels, or to continue to fall in much of the developing world, the problem of better understanding the effects of NTMs, positive (correcting externalities), and negative (raising costs), becomes all the more urgent.

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Contact
www.ferdi.fr
contact@ferdi.fr
+33 (0)4 73 17 75 30