D. The trade effects of non-tariff measures and services measures

This section discusses the trade effects of non-tariff measures and services measures in general before focusing on technical barriers to trade (TBT), sanitary and phytosanitary (SPS) measures and domestic regulation in services. It also examines whether regulatory harmonization and/or mutual recognition help to reduce the trade-hindering effects caused by the diversity of TBT/SPS measures and domestic regulation in services.

Contents

Some key facts and findings

- The contribution of non-tariff measures to overall trade restrictiveness is significant, and in some estimates NTMs are far more trade restrictive than tariffs.
- TBT/SPS measures have positive trade effects for more technologically advanced sectors, but negative effects in agricultural sectors.
- There is evidence that TBT/SPS measures have a negative effect on export market diversification.
- The negative effects on trade caused by the diversity of TBT/SPS measures and domestic regulation in services are mitigated by the harmonization and mutual recognition of these measures.

This section examines the trade impact of non-tariff measures. Unlike tariffs, NTMs often vary across countries and sectors, so "ad valorem" equivalents are calculated for NTMs in order to make this comparison. Evidence is then presented on the trade effects of technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures in goods and of equivalent domestic regulation measures in services.[1]

The rationale for focusing on these measures is that, independent of their policy objectives, economic theory offers a mixed picture – both negative and positive – of how these measures affect the volume and direction of trade. For example, standards and technical regulations can raise producer costs – because compliance is more expensive – but reduce consumer costs – because product quality information is more readily available. Trade will increase or fall depending on whether the positive effect on demand is greater than the negative effect on supply.

In order to highlight the differences between non-tariff measures and tariffs, this section also attempts to disentangle the trade effects of these measures by focusing on: (a) the specific channel through which trade is affected (the volume of trade or the decision to export); (b) their specific impact across countries, sectors and firms; and (c) whether the measure itself, or the way it is applied, constitutes the main restriction to trade. This section also considers the degree to which the harmonization or mutual recognition of TBT/SPS measures and domestic regulation in services helps to reduce any trade-inhibiting effects.

1. Estimating the trade effects of NTMs and services measures

A number of studies attempt to quantify the effect of non-tariff measures on international trade. Averaging across countries, they find that NTMs are almost twice as trade restrictive as tariffs. They also find that, in several countries, NTMs actually contribute much more than tariffs to the overall level of trade restrictiveness. These results, however, are based on NTMs data which have not been updated for about ten years. Given the decline in tariff rates since then, the relative contribution of NTMs to overall trade restrictiveness is likely to have increased, perhaps making them even more important than tariffs in most countries.

Furthermore, evidence suggests that the relative contribution of non-tariff measures to the overall level of protection increases with the level of GDP per capita. The trade literature also finds that NTMs in agriculture appear to be more restrictive and widespread than those in the manufacturing sector. In the case of services, while restrictions to trade are generally higher in developing countries than in OECD countries, they do not appear to be systematically associated with a country's level of development. The cross-country pattern of restrictiveness of services measures varies across services sectors. It is worth noting that the methods developed in the literature to estimate these trade effects suffer from a number of limitations which can be traced, in part, to a lack of transparency in the use of NTMs. In addition, they do not address the potential impact of global supply chains.

(a) Magnitude of NTMs as restrictions to trade

Earlier sections of the Report have highlighted that non-tariff measures can take many different forms – quotas, taxes, subsidies, technical regulations etc. In order to facilitate a comparison between the trade effects of these different NTMs, studies analyse the impact of NTMs on international trade by estimating an "ad-valorem tariff equivalent (AVE)", i.e. the level of an ad-valorem tariff that would have an equally trade-restricting effect as the NTM in question. This enables a comparison to be made with tariffs, and is important for any analysis of the welfare implications of various trade policy measures. In the trade literature, the AVE of different NTMs is computed using one of two approaches – the "price gap" or the "econometrics-based method" (See Box D.1).

(i) Do NTMs matter?

Using data for 91 countries, Kee et al. (2009) evaluate the trade impact of non-tariff measures econometrically for each of 4,575 six-digit categories of the Harmonized System (HS) of classifying goods where at least one country imposes what they categorize as either a "core NTM" (defined as including price control measures, quantitative restrictions, monopolistic measures, anti-dumping and countervailing measures and technical regulations) or "agricultural domestic support".[2]

They estimate the average AVE of core NTMs for the entire sample at 12 per cent. When weighted by imports, this number falls to 10 per cent. The numbers are much higher – 45 per cent and 32 per cent respectively – if the averages are calculated only for tariff lines affected by core NTMs.[3] In contrast, the simple and import-weighted averages of AVEs of agricultural domestic support are much smaller (generally below 1 per cent). According to the authors, this is because a small number of products are affected by agricultural domestic support in most countries. The importance of NTMs is reinforced by available firm survey evidence. For example, a recent survey on non-tariff trade costs between Arab countries revealed an average AVE of 6 per cent (Hoekman and Zarrouk, 2009).

Estimates of the trade impact of non-tariff measures are largely consistent with the AVEs computed. Hoekman and Nicita (2011) find that reducing the AVE of NTMs by half, from around 10 per cent to 5 per cent, would

Box D.1: **Methodology used for estimating the AVE of NTMs**

Price gap method

Non-tariff measures increase the price paid by consumers.[4] The basic strategy of the "price gap" method involves a comparison of prices before and after the NTM mark-up, where this difference is expressed as a tariff equivalent. Making this comparison, however, is not straightforward. Many factors unrelated to NTMs also affect costs and prices at different points in the supply chain. For instance, the "free-on-board" (f.o.b.) price at the point of export includes the cost of transport to the point of export as well as the costs of loading the goods, while the "cost-insurance-freight" (c.i.f.) price also includes the cost of international transport and insurance. Furthermore, the price after border procedures includes any tariffs charged on the product. Finally, wholesale and retail prices include internal transport costs and distribution margins. These factors must be removed from the observed price difference before the mark-up can be attributed to non-tariff measures (Ferrantino, 2006).

However, different NTMs occur at different points in the supply chain, which means that the price impact of a particular NTM can only be identified by comparing two prices at the relevant stages in the production and distribution process. For example, customs procedures affect the difference between the c.i.f. price and the landed duty-paid price. In sum, it is possible but not straightforward to measure and compare the restrictiveness of different types of NTMs (Ferrantino, 2012).

Econometrics-based method

An alternative to the direct "price gap" method described above is to estimate the impact of non-tariff measures on either price or quantity (trade flows) using econometric models. Estimating the "quantity impact" is particularly useful because data on trade flows are more easily available at a disaggregated level. Moreover, when the NTM is absolutely prohibitive, no prices are observed, or when the product is highly differentiated, prices are not particularly informative (Ferrantino, 2012).

In much of the trade literature, the AVEs of non-tariff measures are estimated through "gravity equations". These are econometric models of trade which acquire their name from the similarities to Newton's theory of gravitation. They predict that the value of trade between any two countries will be positively related to the size of their economies and inversely related to the distance (and other measures of trade costs) between them. In order to estimate the effect of policies such as tariffs and NTMs on trade, gravity equations include measures, which capture these policy factors, as explanatory variables.

$$ln(VALUEOFIMPORTS) = a + b_1 ln(1 + TARIFF) + b_2 NTM + cX$$

where "X" is a set of variables that may also affect trade flows. It typically includes GDP, distance and other trade costs. When precise data are lacking, the presence of NTMs is captured by a dummy variable, which assumes a value of one when the NTM in question applies and zero otherwise.

The gravity model of trade enables an estimation of the predicted value of trade between a country pair with and without the non-tariff measures. The effect of the NTM on trade is estimated as the difference between the two values. A similar calculation can be made for the effect of a tariff compared with no tariff. The AVE of the NTM can then be derived by comparing these two predicted differences. More specifically, the AVE of the NTM is a tariff that has the same effect on the value of trade.

The trade literature refers to the above as the "direct approach". There is also an "indirect approach" which compares actual trade flows to the trade flows predicted by a hypothetical frictionless benchmark scenario. The deviation of actual from predicted trade flows is taken to be indicative of the impact of NTMs because specific explanatory variables measuring NTMs are not included in the estimated equation. This "indirect approach" is particularly useful if direct measures of trade restrictions are sparse or imprecise, as is often the case for NTMs (Chen and Novy, 2012).

increase trade by 2 to 3 per cent. The role of NTMs in reducing trade is further highlighted by the following examples cited in Andriamananjara et al. (2004). For the apparel sector, prices in the United States, the European Union and Canada were 15 per cent, 66 per cent and 25 per cent higher, respectively, due to the presence of NTMs. In South-East Asia, South Asia and Japan, paper products were 67 per cent, 119 per cent and 199 per cent more expensive respectively due to NTMs, while NTMs on leather shoes raised their prices in Japan by 39 per cent and in Mexico/Central America by 80 per cent.

In the agricultural sector, non-tariff measures on vegetable oils and fats increased their prices in Mexico by 30 per cent, in South East Asia by 49 per cent and in South Africa by 90 per cent, according to Andriamananjara et al. (2004). Analysing bilateral industry-specific trade flows for countries in the European Union, Chen and Novy (2011) find that among the different NTMs, TBT measures are the most important factor. An analysis of the trade effects of TBT/SPS measures, in particular, is presented in Section D.2.

The results described above highlight the importance of non-tariff measures in an absolute sense. But what do the data reveal about the significance of NTMs in restricting trade relative to tariffs? Kee et al. (2009) find that for 55 per cent of tariff lines in their sample subject to core NTMs, the AVE of these core NTMs is higher than the tariff. Similarly, in 36 per cent of tariff lines subject to domestic agricultural support, the AVE of domestic agricultural support is higher than the tariff. Furthermore, aggregating core NTMs and domestic agricultural support across all tariff lines under consideration in an overall trade restrictiveness index, Kee et al. (2009) find that NTMs – averaging across countries – almost double the level of trade restrictiveness imposed by tariffs. In fact, in about half of the countries in the sample, the contribution of NTMs to the overall level of trade restrictiveness is much higher than the contribution of tariffs.

Using two indices of trade restrictiveness that estimate how trade policies affect a country's imports – the tariff trade restrictiveness index (TTRI) and the overall trade restrictiveness index (OTRI), where the latter includes the effect of both tariffs and non-tariff measures – Hoekman and Nicita (2011) find that, averaging across countries, a 10 per cent reduction in the TTRI increases trade volumes by a little more than 2 per cent, while the removal of NTMs increases trade by an additional 1.8 per cent.[5] This discussion illustrates that NTMs are an important restriction on trade, even more important than tariffs in several countries. Measuring restrictiveness faced by exporters in all destination markets, Hoekman and Nicita (2008) compare the market access versions of the TTRI and the OTRI to show that the AVE of NTMs is generally much higher than existing tariffs.[6]

In a recent report, UNCTAD (2012) argues that non-tariff measures contribute much more than tariffs to overall trade restrictiveness. In particular, it finds that NTMs contribute more than twice as much as tariffs to overall market access trade restrictivenes.[7] This result must be viewed with caution because unlike the studies described above (which compare NTMs and tariff data in 2001), the UNCTAD report compares 2001 NTM data with 2010 tariff data – a period over which tariffs have fallen. Hence, the contribution of NTMs to overall trade restrictiveness is likely to have increased, assuming that NTMs did not decline during the same period and that the trade-restricting impact of NTMs did not fall by more than that of tariffs.

In fact, using product-level analysis, a study by Henn and Mcdonald (2011) finds that while trade flows fell by 5 per cent as a result of border measures, such as tariffs, implemented during the recent financial crisis, they fell by 7 per cent as a result of behind-the-border measures (i.e. non-tariff measures). Even within the category of border measures, the authors find that tariffs and other traditional trade policy measures have had a relatively small impact on trade flows, whereas NTMs such as anti-dumping duties have had a substantial effect.

(ii) NTMs: variation across countries and sectors

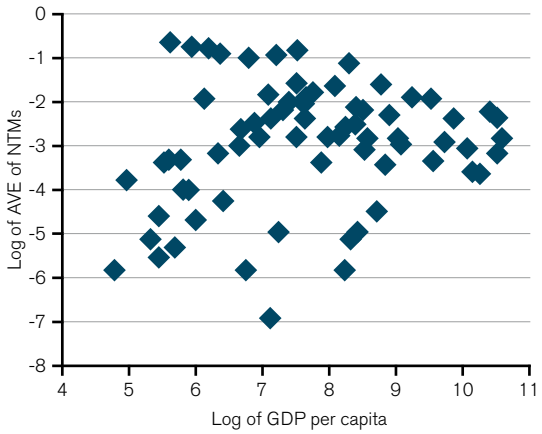
Kee et al. (2009) find that the variation in the AVEs of non-tariff measures across countries is large. For example, the simple average AVE of core NTMs varies from almost 0 to 51 per cent, and from 0 to 39 per cent when import-weighted. The AVEs for domestic support are generally below 1 per cent. The countries with the highest average AVE of core NTMs are all low-income African countries, including Algeria, Côte d'Ivoire, Morocco, Nigeria, Tanzania, and Sudan. Several middle-income countries, such as Brazil, Malaysia, Mexico and Uruguay, also have relatively high AVEs of core NTMs.[8] The countries with the highest AVEs of agricultural domestic support are EU members.[9]

According to Kee et al. (2009), when considering both core non-tariff measures and agricultural domestic support, the AVEs of NTMs increases with GDP per capita, although some middle-income countries seem to have the highest AVEs of NTMs. However, Figure D.1 shows that there is no discernible relationship between the AVE of NTMs and the level of GDP per capita across countries. This is confirmed by regression analysis which shows that the association between the AVE of NTMs and the level of GDP per capita is not statistically significantly different from zero.[10]

At the same time, Hoekman and Nicita (2008) find that tariffs are negatively associated with a country's level of income per capita. This evidence, combined with the result in Figure D.1, suggests that the contribution of NTMs to the overall level of protection is likely to increase with the level of GDP per capita, i.e. as countries become richer, the trade restrictiveness of NTMs relative to tariffs increases. The findings of UNCTAD (2012), which show that NTMs are relatively more restrictive in high- and middle-income countries support this interpretation.

The work by Kee et al. (2009) also reports significant variation in the AVEs of non-tariff measures across tariff lines, amounting to an average level of 27 per cent for agricultural products compared with 10 per cent for

Figure D.1: **AVEs of NTMs and economic development**



Source: Author's estimates based on data from Kee et al. (2009)

manufactured goods. The greater trade-restricting impact of NTMs for agricultural goods relative to manufactured products is reinforced by the results of Hoekman and Nicita (2008). They also show that the restrictiveness of NTMs for agricultural trade is especially important in developed economies.

However, using data for 2001 to estimate the trade effect of non-tariff measures on prices directly in an econometric model, Andriamananjara et al. (2004) find almost no statistically significant impact for the agricultural sector.[11] The authors explain that this may be attributable to the definition of NTMs used in the study, which includes import quotas, prohibitions, non-automatic licensing, voluntary export restraints, environmental standards and SPS measures, but excludes tariff-rate quotas. The latter are likely to be the economically binding constraints on agricultural trade.[12]

Andriamananjara et al. (2004) identify apparel as the sector with the largest number of significant NTMs. They estimate a simple average AVE of NTMs of 73 per cent across countries. The corresponding estimate in Kee et al. (2009) is 39 per cent. The higher order of magnitude in Andriamananjara et al. (2004) may be explained by the fact that they exclude products for which they found a very small impact of NTMs on imports or domestic prices. Andriamananjara et al. (2004) identify paper products, leather products, and vegetable oils and fats as other sectors with multiple significant NTMs.

(b) Methodological limitations: A problem of transparency

The previous section outlined the existing empirical literature which quantifies the impact of non-tariff measures on trade by estimating an ad-valorem equivalent. It should be noted that the use of AVEs – and the choice to model the effects of NTMs as a negative tax for subsidies, and as a tariff for trade-restricting NTMs – can be misleading at times. For example, the equivalence between tariffs and quotas breaks down in the presence of market uncertainty. Furthermore, the AVE of NTMs does not capture any relevant fixed costs, such as those associated with meeting certain technical regulations. Beyond these limitations, quantification is a challenging exercise. The methods developed in the literature suffer from a number of limitations.

(i) Price gap method

A comparison of two prices to infer the trade effect of a non-tariff measure is indicative of the lack of transparency associated with the use of NTMs. Unfortunately, given insufficient data on different prices, even the estimation of a price gap is far from straightforward.

The appropriate prices to compare when measuring the price gap attributable to most non-tariff measures are the invoice (c.i.f.) price of the imported good and the price of the domestic alternative (Deardorff and Stern, 1998). However, in reality, the observable domestic price of a good typically does not distinguish between domestic products and imports. It means that the actual comparison is between the invoice (c.i.f.) price and the price of the good in the domestic market, whether produced at home or imported. This is problematic for two reasons.

First, at a certain level of aggregation, goods that are imported into a country are seldom identical to "like" goods produced domestically. The two may be poor substitutes for each other – for example, because of quality differences. Secondly, even if the domestic and imported good are perfect substitutes, the price gap may be suppressed to the extent that the imports of the same good from other countries are subject to a non-tariff measure.

An additional issue relates to the choice of domestic prices to use in computing the price gap. Many studies use retail price data simply because they are easier to observe than prices at other stages of the supply chain. Retail price data contain transport, wholesale and retail margins. Although these can potentially be separated out, they introduce considerable uncertainty in the identification of the NTM mark-up.[13] It is also difficult to net out the price increase due to consumers' willingness to pay for higher quality.

Furthermore, once a price gap is calculated for a particular good in a particular market, it provides a single measure of the trade effect of non-tariff measures. So when there is a single, transparent NTM, the tariff equivalent reflects the effect of that policy. However, in the case of multiple NTMs, the single price gap or tariff equivalent reflects the cumulative effects of all NTMs that are present in the market. This makes

it difficult to ascertain the percentage of the price increase that is attributable to each of the separate NTMs. It may be that there is one NTM which, when removed, eliminates most of the distortion. If so, the price gap would largely reflect the effect of this particular NTM.

Conversely, it may also be true that the removal of a non-tariff measure does not permit market access. In this case, the "true" tariff equivalent of a single policy change may in fact be zero even when the measured tariff equivalent of all NTMs jointly may be quite large (Ferrantino, 2012). Finally, the price gap method is only suitable for analysing NTMs of a single importing country for a few products of particular interest. The data requirements to address NTMs across multiple countries and products can be unmanageable.

(ii) Econometrics-based method

A notable advantage of econometric analysis, relative to the "price gap" method, is that it can be used to study the trade effects of multiple non-tariff measures across multiple industries and countries simultaneously. In addition, the relative abundance of data on trade flows makes it particularly attractive for analytical purposes. However, the econometrics-based methods have certain shortcomings as well.

First, given the lack of transparency, observing non-tariff measures precisely is difficult. Hence, a dummy variable which equals one if the measure is present is unlikely to capture several NTMs. Using the difference between actual and predicted imports as a measure of NTMs is also problematic because it may capture factors other than trade policies.

Secondly, like the "price gap" method, this approach cannot disentangle the individual effects of a single non-tariff measure when multiple NTMs are present in a market. In many cases, however, only one NTM – or a small number of NTMs – is applied to any given good. Cross-country variation in the application of NTMs can then potentially be used to disentangle their trade effects (Carrère and De Melo, 2009). Thirdly, the results obtained are likely to be sensitive to the details of the econometric techniques used.

(iii) Global supply chains

The measurement exercises discussed in the previous sub-section do not explicitly address the advent of international production networks. They assume a linear supply chain in which a single good is moved from place to place without being transformed. However, with the location of different stages of production in different countries, it takes many more cross-border transactions to provide a single unit of a final good than before. This is particularly true for manufactured goods with multiple components, such as electronics and motor vehicles.

Consider the global supply chain of producing a computer disk drive as discussed in Hiratsuka (2005) and Baldwin (2008). The disk drive is assembled in Thailand, which acts as the hub of the supply network, using 43 components from ten other countries in addition to 11 components produced in Thailand. Hence, there are at least ten moves across international borders, and perhaps more, depending on the extent to which shipments can be bundled. Furthermore, since the disk drive will be shipped to the location of final computer assembly (e.g. China), where the other major computer components are gathered, the number of cross-border moves multiplies even further.

Importantly, in a global supply chain that requires semi-finished goods to move back and forth across international borders more than once, the effects of non-tariff measures (and other trade costs) are compounded. This implies that the effect of a marginal increase in trade costs is much larger than would be the case if there were a single international transaction. Box D.2 illustrates this argument with a numerical example. In addition, the price increase at each step would include not only the monetary costs of moving along the supply chain, but the costs associated with the waiting time as well (Ferrantino, 2012).

(c) Services measures

The methodology employed to assess the trade impact of services measures follows that used in goods. In addition, the trade literature also develops an approach based on the construction of Services Trade Restrictiveness Indices (STRIs).[14] A number of studies use these indices to estimate the price effects of services measures (controlling for all relevant industry and economy-wide determinants of economic performance of firms) for several services sectors across a large sample of countries (McGuire, 2008; Francois and Hoekman, 2010).

(i) Empirical estimates

For a sample of 78 countries across four services sectors, Walsh (2006) finds an average tariff equivalent of 72 per cent for services measures.[15] Analysing data for 11 services sectors[16] across 63 countries, Guillin (2011) finds a much lower average tariff equivalent of around 40 per cent. A comparison of these estimates, however, is not very meaningful because different studies use different data samples and different parameters in the econometric specification.

In general, it appears that restrictions to services trade are higher in developing countries than in OECD countries (Walsh, 2006; Francois et al., 2003; Fontagné et al., 2010). At the same time, trade restrictions in services do not appear to be systematically associated with a country's level of development. For example, the work of the Australian Productivity Commission shows that some OECD

Box D.2: Cumulation of trade costs in a global supply chain

Suppose that the total value-added necessary to produce a product is equal to one. The product is produced in stages in *"n"* countries, each of which adds *(1/n)* to the total value of the product. After production, the product is exported to a final destination, so that it is moved *"n"* times altogether. Let the cost of a non-tariff measure on moving the product from one country to another equal *"t"* on an ad-valorem basis. Hence, at each stage, the cost *"t"* is charged on the entire value of the product produced up to that point, including previous trade costs. The total cost of the product (produced in *n* stages) when delivered to the final consumer is represented by *c(n)*, so that:

$$c(1) = (1+t)$$
$$c(2) = \left(\frac{1}{2}\right)(1+t)^2 + \left(\frac{1}{2}\right)(1+t)$$
$$c(3) = \left(\frac{1}{3}\right)(1+t)^3 + \left(\frac{1}{3}\right)(1+t)^2 + \left(\frac{1}{3}\right)(1+t)$$
$$c(n) = \sum_{1=1}^{n} \frac{1}{n}(1+t)^i$$

Suppose that the AVE of an NTM at each stage is 10 per cent, i.e. *"t"* = 0.1 and *c(1)* = 1.1. As the global supply chain is fragmented further, trade costs compound fairly quickly: *c(5)* = 1.343 (an AVE of 34.3 per cent) and *c(10)* = 1.753 (an AVE of 75.3 per cent). Moreover, marginal increases in trade costs are compounded. For instance, if the AVE of NTMs *"t"* increases from 0.1 to 0.2, a doubling at each stage of the supply chain, trade costs along the supply chain more than double, with more compounding for more fragmented supply chains: *c(5)* = 1.786 and *c(10)* = 3.115.

countries have restrictions comparable with the averages prevailing in major developing economies.

Furthermore, Gootiiz and Mattoo (2009b) find that although high-income countries are quite open overall, there is much more variation in the restrictiveness of services trade in developing countries. The authors show that some low-income countries in Asia and Africa are relatively open. So too are some middle-income countries in Latin America, Africa and Eastern Europe. In contrast, some of the most restrictive services measures are found in the fast-growing economies of Asia as well as in the Middle East. Other studies also find the emerging economies in Asia to have relatively protectionist services measures (Walsh, 2006; Park, 2002; McGuire, 2008).

It appears that variations in the restrictiveness of services measures across countries may depend on the particular sector under consideration. For instance, Indonesia's tariff equivalent in business services appears to be lower than that in more developed countries, such as Japan and the Republic of Korea, but higher in construction services (Park, 2002; Guillin, 2011). Similarly, analysing members of Asia Pacific Economic Cooperation (APEC) in 1997, McGuire (2008) found that while the United States was among the least restricted markets in telecommunications services, it was among the most highly restricted in maritime services. At the same time, middle-income economies in South America were found to have relatively high restrictiveness index scores for financial services, but were among the least restricted markets in distribution, telecommunications and professional services.

According to a set of studies, averaging across countries, transport and business services appear to be the most open sectors, with an average tariff equivalent of 21 per cent and 28 per cent respectively for services measures. The most protected is construction services, with an average tariff equivalent of 58 per cent (Park, 2002; Fontagné et al., 2010; Guillin, 2011). In a different study, however, foreign direct investment (an important mode of trade in services) in transport services is among the most restricted, while that in construction services is the least restricted (UNCTAD, 2006). The contradictory results suggest that the accuracy and reliability of the aforementioned estimates of the restrictiveness of services measures may be questionable. This lack of precision and consistency may be attributable to a number of methodological limitations.

(ii) Methodological limitations

In analysing the trade-restricting effect of services measures, an estimated AVE must take into account the possible substitution between different modes of supply when one particular mode is affected. For instance, there may be a switch from mode 3 trade (a foreign company setting up subsidiaries or branches to provide services in another country) to mode 2 trade (consumers or firms making use of a service in another country) in higher education services as a result of restrictive services measures affecting the former (Dee, 2010). Such intermodal substitution is likely in the case of insurance services as well (from mode 3 to mode 1, services supplied from one country to another).

In order to derive a meaningful AVE, other policy interventions that affect the trade-restricting impact of

a services measure also need to be taken into account. For example, in the case of international air services, firms may respond to ownership limits imposed by the withholding clauses in air services agreements (affecting mode 3 trade) by negotiating code-sharing arrangements. Moreover, if mode 3 is the predominant mode of trade (as it is for telecommunications, for example), high fixed costs of market entry/establishment would not even be captured by the concept of a "tariff equivalent".

In addition, the methodological limitations associated with analysing the trade effects of non-tariff measures are also applicable to services measures. For example, given the lack of transparency, it is difficult to observe precisely different services measures. Attributing the difference between actual and predicted imports (derived from an econometric estimation) to the impact of services measures highlights this problem. Furthermore, there may be multiple restraints on trade in services, and it may not be clear which are economically binding and which are not. Representing these NTMs as an AVE can thus be misleading for this reason as well. The use of subjective criteria to weigh the relative importance of diverse measures when constructing STRIs also illustrates the methodological difficulties involved in estimating the price effects of services measures.

Finally, AVEs of services measures calculated using services trade flows do not take into account the indirect effects that these measures have on trade in goods. Such effects are likely to be strong because of the complementarities between goods and services (see Box D.3). For example, a services measure that restricts trade and competition in transport and logistics services has a negative impact on merchandise trade. However, this is not taken into consideration when AVEs of services measures are calculated using services trade flows only. The role that services trade plays in global supply chains makes this an important problem (see Section B.3).[17]

Box D.3: **Complementarities between trade in services and trade in goods**

Evidence suggests that export competitiveness in manufacturing sectors, such as machinery, motor vehicles, chemicals and electric equipment, is positively associated with inward foreign direct investment and imports of business services (Francois and Woerz, 2008) and negatively affected by regulations that hinder such trade (Nordås, 2010). Such complementarity between trade in services and trade in goods may be explained by various mechanisms.

A first mechanism is constituted by transport and logistics links. Transport and travel services account for about half of cross-border trade in services and are the most important direct services input to international trade in goods. For instance, Yeung et al. (2012) find that Chinese manufacturing firms that make use of third-party logistics suppliers (largely from Hong Kong, China) tend to perform better in export markets than firms that do logistics in-house or purchase them locally. Evidence also suggests that measures that restrict trade and competition in transport and logistics services have a negative impact on merchandise trade performance. Market power in the shipping industry, for example, raises trade costs, particularly for developing countries (Hummels et al., 2009).

Secondly, goods and services are often bundled in final markets. After-sales services, for instance, are important for a host of durable goods such as cars. Aviation engines, printers, vending machines, and other equipment are also increasingly rented or leased with a services contract. Another recent trend is to consider goods mainly as a services platform. Mobile telephones, for instance, are often sold for a nominal amount on the condition that customers sign up for a fixed-period service contract. When goods and services are complementary or bundled, services measures strongly affect the traded good in question as well (Lodefalk, 2010). Evidence suggests that manufacturing firms in Sweden and the United Kingdom (and also mining and oil companies in the United Kingdom) are vigorous traders in services, and that the services share of their total revenue has increased over time (Lodefalk, 2010; Breinlich and Criscuolo, 2011).

Thirdly, the complementarity between trade in goods and trade in services is increased further by the role of intermediaries (retailers and wholesalers) in international trade.[18] Bernard et al. (2010) find that 35 per cent of US exporters are wholesalers, accounting for 10 per cent of the value of US exports. Similarly, more than 25 per cent of Italian exporters are intermediaries, accounting for 10 per cent of the value of Italian exports.[19] Intermediaries, such as leading multinational retailers tend to source their products directly from manufacturers or farmers, and typically have a centralized sourcing unit servicing all sales outlets, globally or regionally. Hence, they tend to contribute to increased trade in consumer goods between their home country and the host countries of their affiliates.[20]

Market concentration in a sector comprising intermediaries may also affect merchandise trade. For example, in the event of trade opening, retailers with significant market power may fail to pass reduced trade costs on to consumers (Francois and Wooton, 2010). At the same time, regulatory heterogeneity (such as differences in product standards, labelling and recycling requirements) may impose considerable costs on retailers by requiring them to modify products for each destination.[21]

2. Disentangling trade effects of TBT/SPS measures and domestic regulation in services

This section focuses on TBT/SPS measures and equivalent domestic regulation in services, and reviews what we know about their effects on trade flows. One reason to focus on this sub-set of measures is that economic theory does not provide simple predictions as to their trade effects. Assessing their effects is therefore an empirical issue. In contrast, economic theory provides clear guidance as to the trade effects of other non-tariff measures – for example, import quotas reduce imports, export duties reduce exports, while export subsidies increase exports.

Another specific characteristic of these measures is that they are commonly regarded as having an important fixed-cost component, which significantly differentiates them from tariffs. For example, to adapt a product to new technical requirements may require an initial investment independent of the level of exports. The presence of a fixed cost to enter a market may, however, have effects on trade that are different from a tariff, and this aspect deserves attention.

In particular, this sub-section examines how TBT/SPS measures and domestic regulation in services affect the volume of trade and the decisions about whether to export to a certain market. This sub-section also considers whether these measures affect developing and developed countries differently and whether these effects differ by sector and firm. Where possible, the impact of these measures on trade in industries where the production process is fragmented is highlighted. Finally, an attempt is made to distinguish between the impact of the measures themselves and the impact of the way in which measures are implemented.

Economic theory and associated empirical research, in general, do not distinguish between mandatory and non-mandatory TBT/SPS measures, and the term standard is often used to denote both. In the absence of a theoretical prediction as to a different impact of a mandatory versus a non-mandatory measure – even when using databases that cover only non-mandatory standards or only mandatory ones – the results are interpreted more generally as the impact of TBT/SPS measures.

Empirical economic literature clearly distinguishes, however, between national or country-specific standards (standards that are different from those in another country) and shared standards (standards that are identical or equivalent between two countries, including international and regional standards). The distinction is made to disentangle the impact on trade of harmonization of TBT/SPS measures. The review of the literature in this section follows this approach.

As far as services are concerned, the economic literature generally looks at overall indexes of the restrictiveness of domestic regulation – and includes measures that go beyond the focus of this report. The following review of the relevant studies mainly highlights an important gap in the existing empirical literature.

(a) Overall effect on trade

When exploring the effects of TBT/SPS measures on trade, one would ideally like empirical evidence to distinguish among different types of measures. This is because TBT/SPS measures affect trade through different channels.

For example, the introduction of product safety regulation will increase production costs but can also serve as an important quality signal, thereby helping to promote the competitiveness of those products that meet stringent standards. Product safety regulations also increase trust in the quality of foreign products, thus reducing transaction costs and fostering trade. Whether these effects will translate into higher imports or export depends on the effect of the measure on the relative costs of domestic and foreign products, and on the willingness of consumers to pay higher prices for safer products.

As a further example, consider the case of compatibility standards. In network industries, where the value of a product increases with the number of consumers and complementary goods, compatibility standards are likely to increase trade. Without such standards, these markets may oversupply varieties and the network sizes may remain too small. Standards in these markets are generally voluntary and can help consumers acquire information about preferences abroad, and help producers to coordinate their activities more efficiently. This general prediction needs to be qualified, however, since compatibility standards can also reflect anti-competitive behaviour.

Except for environmental and food safety regulation, the existing trade literature does not distinguish among different types of measures (for example, whether they address a safety or compatibility concern, or whether they define the characteristics of a product or a testing procedure). Rather, the literature has tended to rely on an index of standardization activities – usually the number of standards or the number of technical measures maintained by a country. The focus has then been on the relationship between this broad measure of TBT/SPS measures and trade flows, or on the cost-raising impact of these measures.

Notwithstanding these limitations, the existing empirical literature finds that, at the aggregate level, TBT/SPS measures may not be associated with lower trade. For example, in a pioneer study on the relationship between standards and aggregate trade

performance, Swann et al. (1996) found that standards promoted trade. They estimated that a 10 per cent increase in the number of country-specific standards (as opposed to "shared" standards)[22] increased UK imports from the rest of the world by 3.3 per cent and exports by 2.3 per cent. With a different specification of the model, but the same dataset, Temple and Urga (1997) found an insignificant effect of standards on trade. Although their findings differed, both studies challenged the predominant view that national standards restrict trade.

Literature that looks at licensing and qualification requirements and procedures and technical standards in services is very limited. It would appear that the only study that attempts to measure the effects of such domestic regulation is Kox and Nordås (2007). In the first part of their study, the authors use a reconstructed Product Market Regulation (PMR) index[23] based on the selected indicators that in their view "come closest to covering the types of regulation mentioned in [General Agreement on Trade in Services] Article VI.4", that is, domestic regulation as defined in this report. While the estimated trade effect of this reconstructed PMR on overall services trade (covering modes 1 and 2 and mode 4, individuals travelling from their own country to supply services in another) is negative, the estimated coefficient on "licences and permits system" (that is mostly closely related to domestic regulation as of GATS Article VI.4) is positive, though small.

In other words, burdensome licensing procedures are found to increase services trade. One possible explanation is that restrictive licensing procedures induce intermodal substitution between export and foreign direct investment (FDI). The finding that the stringency of the "licences and permits system" indicator reduces inward and outward FDI supports this view. In the second part of the study, Kox and Nordås (2007) use banking regulatory indexes developed by the World Bank (Barth et al., 2008). They show that regulation aiming at ensuring appropriate standards (such as accounting standards and financial statement transparency) is positively associated with cross-border trade and FDI in financial services.[24]

(b) Differences across sectors and countries

Studies based on disaggregated trade data show that the effect of TBT/SPS measures depends on the type of sector. One of these studies is by Moenius (2004). Using a gravity model[25] to assess the impact of national standards on trade for a dataset covering 471 sectors at the four-digit Standard International Trade classification (SITC) level and bilateral trade for 12 developed countries, he finds that import-specific standards have a negative impact on imports in the non-manufacturing sectors (namely, food, beverages, crude materials and mineral fuels), but have a positive impact on imports in the manufacturing sector (including oils, chemicals, manufacturing and machinery).

Moenius's interpretation of the results is that standards, by providing exporters with valuable information about market preferences, reduce transaction costs even if they impose adaptation costs. In more differentiated sectors, such as certain manufacturing sectors (for example, high-technology sectors), information costs may be higher. Therefore, information costs' reducing effect outweigh adaptation costs' increasing effect and trade increases.

Moenius's (2004) conclusions are supported by several studies. For example, Blind (2001) finds a positive and significant effect of standards on trade in "instruments for measurement and testing", as does Moenius (2006) for "electrical products". Using information on the measures notified under the SPS and TBT agreements, Disdier et al. (2008b) find an overall negative impact of SPS and TBT measures on trade in agricultural products.

Focusing on notified TBT/SPS environment-related measures (ERM) (see Box D.4), Fontagné et al. (2005) also tend to find a positive effect of ERM on manufacturing trade, but a negative effect on trade in fresh and processed food. More recently, Li and Beghin (2012) perform an analysis of 27 papers that use gravity equations to estimate the effect of TBT/SPS measures on trade. They find that estimates of the trade effects of these measures on agriculture and food industries are less likely to be positive than in other sectors.

In line with the general finding of a negative effect of TBT/SPS measures on trade in agricultural products, the trade literature that uses maximum residual levels (MRLs) of pesticides as an indicator of the stringency of SPS measures consistently finds negative effects of MRLs on imports. Otsuki et al. (2001) find a negative effect of the EU standard on aflatoxin on African exports. In particular, they estimate that moving from the Codex Alimentarius standard, established by the UN Food and Agriculture Organization and the World Health Organization, to the more stringent uniform European Commission standard decreases African exports of cereals, dried fruits, and nuts to Europe by US$ 670 million. Wilson and Otsuki (2004) find a similar effect for MRLs on chlorpyrifos on bananas exports from Latin America, Asia and Africa to OECD countries.

Chen et al. (2008) find a negative effect of regulations on the utilization of pesticides and medicated fish feed on Chinese exports of fresh vegetables, fish and aquatic products between 1992 and 2004. In particular, they find that a 10 per cent stricter measure in the level of pesticides (medicated fish feed) decreases vegetable (fish and aquatic product) exports by 2.8 (2.7) per cent.

Several studies show that any negative effects of TBT/SPS measures on trade are concentrated mainly in developing-country exports to developed countries. In contrast, exports from developed countries to other developed countries are not significantly impeded by these measures.[26]

For example, focusing on SPS measures, Anders and Caswell (2009) find substantially different effects between developed and developing countries. They estimate the trade impact of mandatory "hazard analysis and critical control points" (HACCP)[27] requirements for seafood products in the United States between 1990 and 2004. US seafood imports across all exporters were reduced. SPS measures caused a loss in trade value of between US$ 11.4 million to US$ 30.6 million. The impact on developing countries as a group amounted to an export value reduction of 0.9 per cent under HACCP standards, while developed countries as a group gained from the measure.

However, there is wide variation across developing countries. Anders and Caswell (2009) find that larger seafood exporters gained trade shares with the United States, while smaller exporters lost ground. Developing countries were found among both the gaining and the losing group. The trade impact of SPS measures appears to depend in part on the size of the exporter. Similarly, examining the trade effects of notified SPS and TBT measures adopted by the United States, the European Union, Japan, Canada, Australia and Switzerland, Disdier et al. (2008a) find an overall negative effect on total exports from African, Caribbean and Pacific (ACP), Latin American and Asian countries. While ACP country exports appear to have been significantly negatively affected by such measures, the impact on Asian countries is not statistically significant.

Empirical research on domestic services regulation has not examined whether these measures have a different impact on developed and developing countries. This is mainly due to lack of data on services measures for developing countries. As regards differences across sectors, the above-mentioned study by Kox and Nordås (2007) finds that regulation matters more for "other business services" (including legal services, accounting, architecture and engineering) than for "total services" (as measured by total trade through modes 1, 2 and 4). This is consistent with the important role that business services play in production chains and how a marginal increase in trade costs can have a magnified impact on overall trade costs when the production process is fragmented across countries (see Section D.1 and Box D.2).

Box D.4: **Environment-related measures**

One of the basic concerns with environmental regulation is that, in a world where countries differ in the stringency of their environmental regulations and industries differ in their pollution intensities, pollution-intensive firms will locate production in less regulated countries. Therefore, pollution-intensive products will be exported by less regulated countries and imported by countries with more stringent regulation.

In their survey on the effect of environmental regulations on US manufacturing, Jaffe et al. (1995) concluded that there was little empirical evidence that differences in environmental regulations affected international trade and investment flows.

More recent studies have attempted to explain this finding, examining more disaggregated data and treating sample variations more carefully. The general finding is that the impact of environmental regulation on trade changes by country and sector. For example, Ederington et al. (2005) argue that environmental regulations have stronger effects on the pattern of trade between developed and developing economies than among developed countries.

Using data for 21 OECD countries and a gravity model of trade augmented with an indicator of strict environmental regulation, van Beers and van den Bergh (1997) find that strict environmental regulation does not increase imports. However, while they do not find that environmental regulations in pollution-intensive sectors have a significant overall effect on exports, they do find that these measures have a significant and negative effect for those pollution-intensive sectors that are resource based (being less geographically mobile). The finding that stricter environmental standards have a negative impact on exports from pollution-intensive industries is also confirmed in the study by Otsuki et al. (2001).

Focusing on environment-related measures notified under the SPS and TBT agreements, Fontagné et al. (2005) find that for trade in fresh and processed food, these measures tend to restrict trade from developing countries and least-developed countries (LDCs). However, exports from developed countries are not restricted. On the other hand, for the majority of manufactured products, these environmental regulations have either no significant effect or a positive effect, and this result applies to countries at all stages of development.

(c) Volume of trade and export markets diversification

The economic literature examines TBT/SPS measures in goods and equivalent domestic regulation in services as possible fixed costs of entry in a market (Baldwin, 2000 and 2005, and Deardorff and Stern, 2008; Kox and Lejour, 2005) – that is, an initial cost to be paid to access a market. For example, a large initial investment may be required for a firm to comply with a certain foreign standard, but once the new technology is acquired there may be no additional variable costs.[28] Similarly, a qualification or certification requirement for service-providing personnel may involve an initial fixed cost of obtaining the qualification or certification, but no additional variable costs.

As discussed in Section B, assuming the existence of fixed costs to enter a certain market, models of trade with heterogeneous firms show that only the most productive firms in an industry will export. As trade costs are lowered, high-productivity exporting firms expand. The most productive firms enter export markets, while low-productivity firms shrink or exit the market. In these models, the volume of trade between two countries changes both because incumbent exporting firms expand their trade (thus increasing the so-called intensive margin of trade) and because new firms enter the foreign market (thus increasing the extensive margin of trade).[29]

Relatively little is known about how TBT/SPS measures affect individual firms and, in particular, their export decisions. In order to shed light on this issue, the following analysis studies firms' decision to export to a market and the volume of their exports.[30] The advantage of using firm-level data is that it allows us to distinguish between the number of varieties exported by firms, the number of exporting firms, and the value of exports by firms.

To measure the stringency of regulatory measures, the study uses the database on specific trade concerns raised by WTO members in the SPS and TBT committees.[31] While databases typically used[32] to capture the impact of TBT/SPS measures include both measures that restrict trade and those that do not, this database contains information only on those measures perceived to be a potential obstacle to trade. A country would not raise a concern if it did not see that measure as an obstacle to trade.[33]

Drawing on French firms' custom data[34] from 1995 to 2005, the study uses a gravity model of trade to evaluate the effect of SPS and TBT measures raised as specific trade concerns on export performance by firms. The firms' exports are assumed to be determined by demand-side factors (such as income), supply factors (such as sectoral productivity), trade costs (such as distance) and by an additional variable indicating the stringency of SPS and TBT measures.[35]

Although further research is needed to test the robustness of results, preliminary findings show that TBT/SPS measures raised as concerns in WTO committees are associated with a fall in trade. In particular, TBT/SPS measures raised as specific trade concerns appear to reduce the value of exports. The effect on the number of exporting firms is statistically not significant, but the sign of the coefficient is negative (results of the estimations are reported in Appendix Tables D.1 and D.2).

Other studies also find that TBT/SPS measures have a negative effect on export market diversification. In a study (not at firm level) focusing on textile, clothing and footwear exports, Shepherd (2007) shows that a 10 per cent increase in the total number of EU TBT/SPS measures is associated with about a 6 per cent decrease in the product variety of exports (measured as the number of six-digit HS products under a two-digit HS sector) to the EU.

Using data from a World Bank TBTs survey, Chen et al. (2006) also find that TBT/SPS measures impede developing-country exporters' entry into developed markets. In particular, Chen et al. (2006) estimate that these measures reduce the likelihood of firms exporting to more than three markets by 7 per cent. The study, however, is based on a sample of only 619 firms located in 17 developing countries. The measure of a technical barrier to trade is based on firms answering "yes" to the question "Have quality/performance standards impacted your ability to export products?" In other words, this study finds that firms that claim to find TBT/SPS measures an obstacle to trade also tend to export to fewer markets.[36]

There is also some evidence that the effects of TBT/SPS measures on export-market diversification changes depending on the type of firms. Standards and technical regulations (if not harmonized) appear to be particularly harmful to trade for firms that import inputs. In fact, outsourcing firms appear less likely to diversify their export markets than firms that do not outsource. The underlying reason may be that, when inputs are produced, their ultimate destination is unknown and thus they may not meet the technical requirements imposed in the market of the final product (Chen et al., 2006).

In addition, TBT/SPS measures appear to negatively affect market entry even more for small firms. Focusing on the electronics sector, Reyes (2011) examines the response of US manufacturing firms to the harmonization of EU product standards with international norms. He finds that harmonization increases the entry of firms, and that the effect is stronger for US firms that already export to developed countries but not to the European Union. As expected, these firms are on average smaller than firms already exporting to the European Union. Focusing on Senegal, Maertens and Swinnen (2009) show that vegetable

exports have risen sharply despite increasing sanitary requirements, resulting in important income gains and poverty reduction. However, tightening food regulation also induced a shift in the profile of exporters from small farmers to large-scale integrated estate production.

Overall, firm-level studies show a negative effect of TBT/SPS measures on trade, both through a lower volume of trade per firm and reduced market entry. This result may be partly explained by the type of variable used in some of these studies for TBT/SPS measures, which tend to capture only restrictive measures. In addition, some evidence points to TBT/SPS measures being particularly trade restrictive for small firms and outsourcing firms. However, more research is needed to understand how these results vary across sectors and firms.

There is no firm-level study looking specifically at the effects of domestic regulation (narrowly defined as of GATS Article VI.4) on export-market entry for services. Using aggregate data, Kox and Nordås (2007) find that the determinants of market entry and the volume of trade are largely the same. In particular, domestic regulations aimed at ensuring higher quality standards in financial services (accounting standards and financial statement transparency) appear to be associated with both higher export values and increased entry. However, existing evidence on services is too limited to draw general conclusions.

(d) Does conformity assessment matter for goods trade?

Conformity assessment refers to testing, inspection and certification, as well as to a supplier's declaration of conformity.[37] Conformity assessment procedures are necessary for achieving important policy objectives, such as the protection of consumers' health and safety. They can, however, also be unnecessary obstacles to trade when they are duplicative, inefficient or applied in a discriminatory manner.

Testing, inspection and certifying compliance with a certain TBT/SPS measure entails costs. These costs are necessary because they assure compliance with the required standard. Yet, they can also be an unnecessary obstacle to trade, when foreign providers are competent to provide the required level of assurance in a cost-effective manner, but this competence is not recognized by the importing country. Ideally, attestation of conformity would be carried out just once in a cost-effective manner and then recognized everywhere. Yet, even the existence of a well-functioning technical infrastructure in many countries does not automatically lead to single conformity assessment, thus unnecessarily increasing transaction costs (see Section B.1).[38]

There are several dimensions of conformity assessment costs. It is not just that the fees for testing, inspection or certification may be unnecessarily high. Unnecessary costs also arise because exporters need to comply with testing and certification requirements in each of the countries to which they are exporting. Even if importing countries rely on internationally harmonized product standards – or accept another country's standards as equivalent – they may still have a separate conformity assessment requirement. This can substantially increase the costs of exporting, not least because exporters face the risk that goods are rejected by the importing country after shipment.

When conformity assessment requirements differ significantly across countries, and the procedures are opaque, companies may face additional costs associated with obtaining the necessary information, and redesigning products to meet different countries' conformity assessment standards and requirements.

In addition, lengthy conformity assessment procedures also imply additional costs associated with sales revenues forgone while the product is under review. For some time-sensitive products, such as textiles and clothing and high-technology products with a short life cycle, time delays can have a severe impact on profitability and market penetration.

Conformity assessment costs have not been systematically quantified. This is because some aspects, such as the opportunity cost of lost sales, are difficult to measure. However, the extent to which conformity assessment costs are perceived as obstacles to trade clearly emerges from several surveys and case studies (see Box D.5).

Little is known about the impact of conformity assessment procedures on trade. Focusing on a sample of developing countries, a study by Chen et al. (2006) claims that conformity assessment issues significantly impede trade. On the basis of firm-level survey data, they find that firms answering "yes" to the questions "Have testing procedures impacted your ability to export products?" and "Do you have difficulty obtaining information about applicable regulations in the countries listed?" also have a significantly lower propensity to export. They also find that testing procedures are particularly burdensome for agricultural firms.

In all likelihood, the impact of conformity assessment procedures on trade varies across sectors. The OECD (1999) survey stresses that even the nature of conformity assessment costs varies by product according to their technical characteristics. Terminal telecommunications equipment and automotive components, for example, require an initial approval of the product before it can be exported. In the case of dairy products, each individual consignment must be tested both prior to export and/or at the port of entry. Thus conformity assessment procedures are a fixed

Box D.5: Reporting of conformity assessment procedures as barriers to trade: selected examples

The fact that conformity assessment costs are perceived as important obstacles to trade clearly emerges from several surveys. In the business survey on non-tariff measures conducted by the International Trade Centre (see Section C.2), product certification, product testing and inspection requirements applied in importing countries represent more than half of all firms' complaints about TBT/SPS measures in the 11 developing countries analysed.

Costs of certification also appear as a prominent obstacle to trade in a survey on the effects of SPS-related private standards conducted by the WTO Secretariat (see G/SPS/GEN/932/Rev.1). Seventeen out of the 22 respondents included a reference to high certification costs. The survey also notes that developing-country exporters consider compliance with private standards to be a prerequisite for exporting to a large number of developed-country markets.

Compliance costs for private standards are high, and they are significantly affected by the cost of certification. While the cost of certification varies depending on the sector, the examples provided indicate that the average annual certification fee may reach between US$ 2,000 and US$ 8,000 for a private standard. In addition, countries report significant costs associated with the time-consuming process of meeting private-standard requirements, especially for microbiological and chemical analyses, not to mention the difficulty of finding accredited laboratories with adequate detection techniques. These costs rise significantly when tests have to be conducted abroad. Overall, these costs are deemed a significant impediment to trade for small-scale producers that, as a consequence, are excluded from production chains.

Testing and certification costs also appear to be a significant obstacle to trade for exports from developed countries. The 2011 National Trade Estimate Report on Foreign Trade Barriers (NTE Report) – an annual survey carried out by the United States Trade Representative to identify foreign barriers to US exports – offers several examples. For instance, it claims that "Thailand imposes food safety inspection fees in the form of import permit fees on all shipments of uncooked meat. Currently, imports face fees of 5 baht per kilogram (approximately $160 per ton) for red meat (beef, buffalo meat, goat meat, lamb, and pork) and for offal, and 10 baht per kilogram ($320 per ton) for poultry meat. Fees for domestic meat inspections are much lower and are levied in the form of a slaughtering or slaughterhouse fee. The fees are $5 per ton for domestic beef; $21 per ton for poultry; $16 per ton for pork; and zero for offal".

Lengthy certification procedures can also be the main obstacles to trade. For example, the 2011 NTE Report relates US industry concerns about lengthy approval procedures for new pharmaceutical products in Hong Kong, China, which inhibits their ability to market products on a timely basis. Similarly, the NTE Report raises a concern over Paraguay's "non-automatic import licenses on personal hygiene products, cosmetics, perfumes and toiletries, textiles and clothing, insecticides, agrochemicals, and poultry. Obtaining a license requires review by the Ministry of Industry and Commerce and sometimes by the Ministry of Health. The process is slow, taking up to 30 days for goods that require a health certification. Once issued, the certificates are valid for 30 days."

cost of exporting telecommunications equipment and automotive component markets – borne in advance. On the other hand, they are a variable cost for dairy exports.

A study by Schlueter et al. (2009) looks at trade effects of different types of SPS measures imposed on meat products. After grouping 21 types of measures in six classes, they find that whereas disease-prevention measures, tolerance limits for residues and contaminants, and conformity assessment and information requirements increase trade, production-process requirements and requirements for handling of meat after slaughtering restrict trade.

The paper by Fassarella et al. (2011) looks at the impact of SPS and TBT measures on exports of poultry meat by Brazilian exporters to the main world importers in the period 1996 to 2009. They find that the impact of aggregated TBT and SPS measures on Brazilian poultry meat exports are insignificant. However, when measures are disaggregated, conformity assessment has a negative and significant impact on the volume of Brazilian poultry meat exports, while packaging and labelling requirements, and/or disease-prevention measures (regionalization or quarantine treatment) have a positive and significant impact on the volume of Brazilian poultry meat exports.

This report attempts to assess the importance of conformity assessment requirements relative to product-characteristics regulations on overall food and agricultural trade.[39] Relying on the database on specific trade concerns regarding SPS measures described in Section C, the analysis distinguishes between concerns related to conformity assessment (such as certificate requirements, testing, inspection, and approval procedures) as set out in Annex C of the SPS Agreement, and concerns related to other issues

(such as requirements on disease treatment, maximum residual levels, or the geographical application of the measure). The impact of these two types of concerns on the probability that firms will export and on the volume of trade is analysed using both a simple dummy for the existence of an SPS measure and a frequency measure.[40]

The analysis suggests that, in general, SPS measures imposed by an importing country and raised as specific trade concerns have a negative impact on the probability that firms will export to the market concerned (results are reported in Appendix Table D.3). However, conditional on the probability that firms export (that is, for firms already in the export market), the value of exports increases.[41] In particular, the results suggest that it is conformity assessment-related factors that have the most negative impact on the probability of entering a market, while measures related to the characteristics of the product explain most of the positive impact on the value of trade. Although more research is needed, one possible explanation is that SPS measures, by enhancing consumers' trust in imported products, increase trade for those exporters that manage to overcome the fixed cost of entering a market.

In sum, the empirical evidence suggests that conformity assessment costs (mostly relating to trade in food and agricultural products) are an important obstacle to trade.

3. Harmonization and mutual recognition

The discussion in the previous sub-sections suggests that the use of TBT/SPS measures and domestic regulation in services by the importing country can have ambiguous effects on trade. In the event that they have adverse trade effects, it is imperative to consider how these harmful trade impacts may be alleviated.

Harmonization and mutual recognition of TBT/SPS measures are commonly believed to be steps towards more open trade. However, economic theory provides an ambiguous answer to the question of whether harmonization increases or decreases trade, as well as whether harmonization has more impact than mutual recognition on boosting trade (see Box D.6). This section, therefore, reviews the empirical evidence on these issues.

(a) Is harmonization trade creating?

The empirical literature measures the extent of harmonization of standards in different ways. Some studies consider a standard as harmonized if it conforms with an international standard published by the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU) or similar bodies. Other studies treat standards as harmonized if they are common to a group of countries.

Notwithstanding these differences, a general finding in the literature is that harmonization increases trade. For example, using the number of bilaterally-shared standards reported in the standards-related data from the Perinorm database, and taking country-specific standards into account, Moenius (2004) finds that shared standards have a positive and significant effect on bilateral trade.

Using a gravity model of trade for the period 1995-2002, Clougherty and Grajek (2008) find that conformity with ISO 9000 in developing countries appears to enhance exports to developed countries (a similar effect was estimated in Grajek (2004)). The authors do not, however, find that conformity with ISO standards in developed countries has a significant effect on either exports or imports. Focusing on trade within the European Union, Vancauteren and Weiserbs (2005) find that harmonization has a significant effect on a country's exports.[42] In particular, they find that countries that have a larger than average share of trade in sectors covered by the EU harmonization directive export more. More recently, using an index of variations in regulation on veterinary drugs and pesticides across countries, Gervais et al. (2011) estimate that differences in standards have a negative effect on trade in pig meat and beef.

Harmonization is also found to have a positive effect on the diversification of export markets (the so-called extensive margin of trade) – that is, on the number of exported varieties and export destinations. Albeit limited by the lack of firm-level data, Shepherd (2007) is the first study to explore the impact of harmonization at the extensive margin of trade. Focusing on the exports of textiles, clothing, and footwear, he finds that harmonization is associated with higher export variety, mainly for low-income countries' exports to the European Union.

Focusing on the electronics sector, Reyes (2011) examines the response of US manufacturing firms to the harmonization of EU product standards with international norms. The author uses the share of non-harmonized standards in an industry[43] as a measure of trade costs due to a variety of standards.

Reyes' study finds that increasing harmonization increases US exports to the European Union. In particular, this increase is due to more US firms entering the EU market. Exports from US firms already present in the EU market before the harmonization decrease. Overall, exports increase. Product standard harmonization seems to be more important than tariffs for the propensity to export. Furthermore, new exporting firms are smaller than those already exporting to the

Box D.6: **Harmonization versus mutual recognition**

This box explores the possible role of harmonization and mutual recognition of TBT/SPS measures and compares their advantages and disadvantages. For the purposes of this box, TBT/SPS measures and domestic regulation in services are treated together as "standards" because the conclusions from the theoretical literature apply generally to goods and services regulation.

Suppose that two trade partners are confronted with the same market failure but address it with the use of different standards. This means that existing exporters will have to bear the costs of adapting their products to the requirements of the destination country or produce goods that meet both standards. The different standards of regulation have a negative effect on market entry – the extensive margin of trade – as it acts as a fixed market entry cost (Kox and Lejour, 2005).

Now, consider a case in which a firm operating under increasing returns to scale[44] serves the domestic market and can potentially export to three foreign markets, upon paying a fixed (sunk) market entry cost. If this cost is market-specific, the firm can only realize market-specific economies of scale in each of the export markets. Since the two countries have the same market failure, an effective solution for both countries would be to choose a common standard or recognize each other's standard.

Harmonization implies a common definition of both the policy objective and the technical requirements to achieve it, while mutual recognition refers to the reciprocal acceptance of the measures applied in both countries. Both approaches are considered trade-enhancing as they produce economies of scale and permit a more efficient allocation of resources (Chen and Mattoo, 2008). Taking the example of the firm described in the previous paragraph, if the fixed cost of entry is the same for all export markets, as is the case under mutual recognition and harmonization, the firm can realize global economies of scale, and realize cost savings. However, each solution affects trade in a different way and, in general, it is not possible to define whether harmonization or mutual recognition is more trade-enhancing.

In general, harmonization is expected to boost trade more than mutual recognition for the following reasons. As countries adopt the same standards, products are more homogenous and better substitutes for both producers and consumers than in a mutual recognition framework, thus reducing home-bias – that is, the general preference for domestically-produced goods (World Trade Organization (WTO), 2005b). Common standards lower the information costs faced by consumers and increase their confidence about the quality of imported products (Dissanayaka et al., 2001). This also applies for business-to-business relationships, where harmonization enhances communication effectiveness (Grajek, 2004). They also allow compatibility between imported and domestically-produced products (Baller, 2007).

However, it is possible that harmonization can have a negative impact on trade that can be avoided through mutual recognition. Harmonization reduces the number of varieties in the market (for example, harmonization to a certain higher-quality standard removes from the market lower-quality products that some consumers may have been willing to buy). When demand for foreign products is driven by love for variety, a lower degree of differentiation among products will diminish trade. Moreover, harmonization may generate compliance costs that vary for different countries if certain countries lack the expertise to take full part in the setting of international standards or if they lack bargaining power. In this case, the gains from harmonization will not be equally distributed among participating countries.

In contrast, mutual recognition allows an equal distribution of gains from removing TBT among countries. When this approach is in place, firms can sell in foreign markets without bearing the cost of harmonization. Therefore, when love for variety is important for trade or when costs of adaptation to a new (harmonized) technology are high, mutual recognition should be expected to boost trade more than harmonization.

Harmonization and mutual recognition also take place within regional agreements, with different consequences for trade with countries that are not part of the agreement (World Trade Organization (WTO), 2005b; Chen and Mattoo, 2008; Mattoo and Sauvé, 2003). On the one hand, harmonization decreases the costs of learning about the regulation of each member of the agreement and avoids the associated costs of compliance, thus benefiting producers that are not in the agreement. On the other hand, it can increase compliance costs for firms outside the agreement, especially for firms in less developed countries, which often lack the infrastructure and expertise required to comply with new regulations (Otsuki et al., 2001). With mutual recognition, external producers can choose to produce according to the standards adopted in the country that better suit their production advantages, implying lower costs.

European Union before harmonization. These results suggest that working towards a harmonization of product rules across markets could assist small- and medium-sized firms in entering new export markets.

Economists have argued that differences in regulation across countries (policy heterogeneity) reduce services trade in the same way that it does for goods. As discussed in Box D.2, Kox and Lejour (2005) show that in a standard monopolistic competition model of trade, different standards of regulation across countries reduce bilateral trade.[45] In support of this theoretical prediction, empirical evidence shows that mutual recognition or regulatory harmonization have a positive effect on trade.[46]

De Bruijn et al. (2008) consider the prospective effects of the EU Services Directive, proposed in 2004 by the European Commission to reduce the impediments to trade, on bilateral trade in commercial services. By combining the changes in regulatory diversity with the empirical results of the gravity analysis, they estimate that total trade of commercial services within the European Union increases by an average of 28 per cent as a result of the Services Directive, as approved in 2006. This rises to 44 per cent for the original proposal by the European Commission, which included the country of origin principle.[47] As they argue, such large differences implicitly show the economic benefits of mutual recognition of regulatory standards.

In addition, Kalemli-Ozcan et al. (2010) consider the retrospective effects that regulatory harmonization based on the EU's Financial Services Action Plan (FSAP) had on cross-border banking activities. Such activities increased significantly among European countries that quickly adopted the financial services directives of the FSAP. Their results suggest that legislative harmonization in financial markets had a positive effect on cross-border banking integration that is additional to the generally positive effects of euro area membership.[48]

(b) Regional integration

A growing number of regional/preferential trade agreements include provisions on TBT/SPS measures. The analysis of the content of preferential trade agreements (PTAs) in last year's report (WTO, 2011) show that approximately 60 per cent of the agreements include such provisions.

In particular, mutual recognition of conformity assessment and harmonization of technical regulation are among the most common approaches of integration in the TBT area. While the objective of fostering mutual recognition of conformity assessment tends to be a feature that occurs with equal frequency across several types of PTAs, significant differences exist in terms of their tendency to include harmonization of technical regulations between EU-type and North American-type agreements. For example, while the agreements signed by the European Union typically include harmonization provisions, PTAs involving North American countries tend to include mutual recognition of technical regulations.

Furthermore, last year's report highlights two features of PTAs. First, PTAs that harmonize standards are likely to present "hub-and-spoke" characteristics, with the larger partner representing the hub to whose standards the spokes conform. Therefore, the report cautions that this tendency may hinder further trade opening among major regional groupings. Secondly, "deep" PTAs (that is, more ambitious PTAs in terms of the depth of integration of TBT provisions) are more likely between countries at higher and similar levels of development. Therefore, the report warns about the risks of moving towards a two-tiered world that would further marginalize developing countries.

This year's report takes the analysis a step further and looks at the evidence of how harmonization and mutual recognition provisions in PTAs affect trade. Harmonization and mutual recognition, when they occur at the regional level, affect countries outside the region differently. While harmonized standards allow entry into the whole regional market once the harmonized standard is adopted, mutual recognition may not provide access to third countries. For example, agreements involving mutual recognition of conformity assessment procedures are likely to have trade-diverting effects for countries outside the agreement if they are subject to strict rules of origin (i.e. laws, regulations and administrative procedures which determine a product's country of origin).

Suppose, for example, that following an agreement between country A and country B, only goods made in country A (satisfying specific rules of origin) can circulate freely in country B after being tested and certified in A. This privilege does not extend to products originating in third countries. Therefore, a firm located in country C will have to pay twice as much as a firm located in A (or B) for conformity assessment in order to access markets A and B. In the case of services, suppose that countries A and B have signed an agreement providing for mutual recognition of qualification requirements. A services provider from country C willing to serve both A and B markets will have to pay twice as much to obtain the necessary qualification requirements. Mutual recognition of conformity assessment procedures (in the former example) or of qualification requirements (in the latter example) between A and B when accompanied by rule of origin therefore increases the costs for firms located in third countries relative to firms located in A and B, thus diverting trade.

Very few empirical studies have looked at how SPS/TBT-related policies in PTAs have affected trade

both within and outside the region covered by the agreement. Existing studies indicate that regional agreements on harmonization tend to divert trade and that trade diversion affects exports negatively, especially from developing countries. For example, Cadot et al. (2010) show that the existence of PTAs between developed and developing countries (North-South agreements) hurts trade between developing countries (South-South trade) and impedes developing countries' attempts to diversify into new markets.

Chen and Mattoo (2008) estimate a gravity model of bilateral trade of 28 OECD countries and 14 non-OECD countries at the three-digit SITC product level. Their analysis indicates if two countries have signed a mutual recognition agreement (MRA) for a certain sector and the number of harmonization directives between the two countries for a product. The analysis also indicates whether MRAs include rules of origin.

Chen and Mattoo find that harmonization agreements can increase trade between participating countries but will not necessarily increase trade with other countries. In particular, they find that harmonization increases exports from developed countries outside the region, but it reduces exports from developing countries outside the region. MRAs tend to increase trade within the region. MRAs also increase trade with countries outside the region if they are not associated with rules of origin. However, when the MRAs contain rules of origin, trade with countries outside the region is negatively affected, especially exports from developing countries.

Finally, focusing on two sectors, telecommunications equipment and medical devices, Baller (2007) examines the impact of MRAs and harmonization agreements on bilateral trade among 26 OECD countries and 22 non-OECD countries.[49] Her results indicate that while MRAs increase both the probability of entering a new market (the extensive margin of trade) and the volume of trade (the intensive margin), harmonization of standards or technical regulation has ambiguous effects. Like Chen and Mattoo (2008), her findings suggest that regional harmonization increases trade with developed countries but hinders trade with developing countries.

There is no empirical analysis that looks specifically at the discriminatory effects of MRAs concerning domestic regulation in services. The few empirical studies on trade diversion in the services sector[50] use dummy variables indicating the existence of a preferential trade agreement between two given countries. Such variables do not allow us to distinguish between market access and national treatment commitments (i.e. the principle of giving others the same treatment as one's own nationals), on the one hand, and mutual recognition of standards and requirements, on the other hand.

As argued by Fink and Jansen (2009), the scope for discrimination is likely to be limited by two factors. One is that MRAs tend to apply mostly to restrictions relevant for mode 4 movements, a mode of trade that even at the regional level has not benefited from significant levels of trade opening. The other factor is that MRAs tend to apply to only a small number of professional services sectors, notably accounting, architects and engineering, and only a few MRAs feature automatic recognition of qualifications (OECD, 2003).

To sum up, evidence suggests that regional integration of TBT/SPS measures has trade-diverting effects, especially to the detriment of developing countries. This finding is consistent with the evidence that deep preferential trade agreements in the area of TBT/SPS measures are more likely among countries with a higher and more similar level of income. This finding also highlights the risk that regional integration on TBT/SPS measures may lead to a multi-tiered world where certain developing countries are marginalized.

4. Conclusions

The trade literature estimates the degree of restrictiveness of non-tariff measures and services measures by estimating an "ad-valorem tariff equivalent (AVE)", i.e. the level of an ad-valorem tariff that would have an equally trade-restricting effect as the measures at issue. The use of AVEs to measure the trade impact of NTMs, however, presents conceptual and methodological limitations. For example, the equivalence of tariffs and quotas breaks down in the presence of market uncertainty, or when NTMs take the form of fixed market entry costs, such as those associated with meeting certain technical requirements.

AVEs do not adequately capture the trade-restrictive impact of certain non-tariff measures when the production process is fragmented across countries because they fail to take into account the cumulative effect of measures along the production chain. Additionally, in the case of services measures, the estimated AVEs neither account for the possible substitution between different modes of supply nor for the complementarity between trade in services and trade in goods.

Notwithstanding these limitations, existing empirical evidence suggests that non-tariff measures and services measures can significantly restrict trade. In particular, NTMs can be as trade-restrictive as tariffs, and even more so in the case of certain high- and middle-income countries. In the case of services measures, while restrictions to trade are generally higher in developing countries than in developed countries, they do not appear to be systematically associated with a country's level of development.

A comparative analysis of the role that various types of non-tariff measures play in the overall level of NTM

restrictiveness does not exist. However, it is clear that the impact on trade is not necessarily restrictive for all measures. TBT/SPS measures do not unambiguously increase or decrease trade. In general, TBT/SPS measures have positive effects for more technologically advanced sectors, but negative effects on trade in fresh and processed goods. As economic theory suggests, the introduction of a new TBT/SPS measure yields a trade-off between higher costs of adaptation to new requirements for producers and lower information costs for consumers, who can be confident about the quality of the product in question. The prevalence of a positive effect of TBT/SPS measures on manufacturing goods may suggest that information costs are more important or adaptation costs lower in these sectors than in non-manufacturing sectors.

When TBT/SPS measures have a negative effect, the impact tends to be greatest for developing-country exports. There is also evidence that TBT/SPS measures have a more negative impact on trade in food and agriculture – mainly because of the costs associated with conformity assessment procedures. In addition, TBT/SPS measures appear to reduce the likelihood of export market diversification. Small firms – and firms that outsource their intermediate inputs – appear to be most affected by TBT/SPS measures.

Harmonization and mutual recognition of standards are ways in which any negative effects of TBT/SPS measures can be mitigated. Harmonization is shown to enhance the presence of small and medium-sized firms in export markets. However, if harmonization or mutual recognition occurs within regional trade agreements, there may be significant trade-diverting effects on countries outside the agreement. This appears to be especially the case for developing countries. Furthermore, as stressed in last year's World Trade Report, there is a risk of a "lock-in" effect, whereby the regional harmonization of standards may reduce incentives for further trade opening. There is also a risk of a multi-tiered regulatory world emerging, in which developing countries are marginalized.

The economics literature on domestic regulation related to qualification and licensing requirements and procedures and technical standards is extremely limited. Most studies look at a much wider set of services measures and are, therefore, not informative for this report. In relation to the financial services sector, the existing literature finds that regulation aimed at ensuring appropriate standards (such as accounting standards and financial statement transparency) is positively associated with cross-border trade and foreign direct investment in financial services. As with TBT/SPS measures, there is also some evidence that a reduction in policy diversity, carried out through mutual recognition or convergence of international standards, has increased services trade.

Regardless of their objective, TBT/SPS measures and domestic regulation in services may or may not reduce trade. Negative trade effects, when they exist, generate negative spillovers across countries. This provides a rationale for international cooperation. Harmonization and mutual recognition help to reduce the undesired negative trade effects of legitimate public policy. However, both approaches highlight the need for capacity building to address regulatory challenges in developing countries.

The costs related to compliance and conformity assessment impinge particularly on developing countries. This is because they lack the technical infrastructure necessary to effectively develop and design technical regulation, standards and conformity assessment procedures. Also, they lack the laboratories and accredited certification bodies to test and certify compliance with a certain standard. These issues are the focus of Section E.

Endnotes

1 This section only focuses on domestic regulation measures relating to qualification and licensing requirements and procedures, and technical standards. This narrow set of measures is the equivalent in services of TBT/SPS measures in goods.

2 The agricultural sector may also be subject to core NTMs.

3 It is worth noting that these AVEs were constrained to be trade impeding through an exponential transformation in the estimated equation. This takes away from the fact that NTMs may actually enhance trade at times.

4 See Box D.1 for a description of the TTRI and OTRI.

5 This assumes perfect information. If, for example, quality differences between products are signalled by technical regulations, such NTMs could lower prices and increase trade.

6 See Box D.1 for a description of the market access versions of the TTRI and OTRI.

7 As explained in Box D.1, this is a measure of the restrictiveness faced by exporters.

8 This follows a World Bank classification of these countries according to data in 2001.

9 Using the "price gap" method to estimate the impact of NTMs on trade, Bradford (2003) finds the AVEs of NTMs to be of the same order of magnitude for a sample of developed countries, thereby reinforcing the results of Kee et al. (2009). However, the former's estimates are distinctly higher because the study uses the "price gap" method – AVEs are measured as the difference between import and retail prices, after correcting for transport and distribution costs, and hence include more policy restrictions in their definition of NTMs (Kee et al., 2009). At the same time, it is possible that for certain NTMs, quantity-based econometric methods give biased estimates. In the case of TBT and SPS measures, for instance, if compliance costs are passed on to unit values, regressing the value of imports on a measure of NTMs will underestimate their trade impact. Similarly, if there is market power in the importing country, the domestic price will rise by more with a quantitative restriction (QR) than a tariff reducing imports by the same amount. Hence, the AVE of a QR, derived from a quantity-based estimation, would be underestimated.

10 Regressing the natural logarithm of the AVE of NTMs in 2001 on the level of GDP per capita in 2001, we found a p-value of 0.133.

11 The estimated trade effect represents the percentage premium on products restricted by an NTM in a country relative to the price of those products in countries without NTMs.

12 This is different from the implication of "binding" in a legal sense. It refers to the fact that conditional on presence of tariffs and other NTMs, the trade effect of a particular NTM may not be statistically significantly different from zero.

13 Even the landed duty-paid price may contain wholesale and retail margins because importers, wholesalers, and retailers may share the NTM rents among themselves, especially since large retailers are integrated into the earlier stages of the distribution process (Bannister, 1994; Krishna and Tan, 1992).

14 See Section C for a description of the methodology.

15 The four services categories are travel, transport, government and commercial services.

16 Transport, travel, communications services, construction, insurance, financial services, royalties and licence fees, computer and information services, other business services, government services and personal, cultural and recreational services.

17 For developed countries, as much as three-quarters of services trade is in intermediate inputs (Miroudot et al., 2009).

18 Manufacturers may choose to export directly or through intermediaries who move goods through wholesale and retail distribution networks. Ahn et al. (2011) show that the share of export through intermediaries is positively correlated with the difficulty of accessing destination markets. This is because when barriers to trade are large, relatively small and less productive exporters use intermediaries to export.

19 According to Bernard et al. (2011), however, there are large variations in the importance of intermediaries across countries (and products).

20 Multinational retailers also tend to source their private labels from developing countries (Nordås, 2008) and there are cases where they have provided the scale and stability of demand necessary for developing country farmers to invest in modern production technology (Dolan and Humphrey, 2010).

21 The trade effects of regulatory heterogeneity (with a focus on TBT/SPS measures and domestic regulation in services) are further analysed in Section D.3.

22 Perinorm contains information on all standards developed in the 21 countries covered, including information on the relationship among standards originated in different countries. This information defines whether two standards are identical, equivalent or non-equivalent, on the basis of ISO/IEC Guide 21.

23 There is a large literature that studies the effect of regulation in services on trade using Product Market Regulation (PMR) indicators. See for instance Nicoletti and Mirza (2004), Lennon et al. (2009) and Schwellnus (2007). In general this literature estimates a negative effect of regulation on services trade. However, PMR covers a range of measures that goes beyond domestic regulation as of GATS Article VI.4. Therefore, they are not taken into account in this review. The same issue pertains also to other studies such as Nicoletti et al. (2003) that use the index of non-manufacturing regulations (NMR) and Kimura and Lee (2006) that use an "Economic Freedom of the World" (EFW) indicator.

24 The Annex on Financial Services in the GATS explicitly allows countries to take prudential measures to protect investors and depositors and to ensure the integrity and stability of the financial system. The analysis of Kox and Nordås (2007) shows that most such measures have a positive effect on services trade. This effect is larger for regulation in the exporting country than for regulation in the importing country.

25 Gravity models are econometric models of trade which acquire their name from their similarity to Newton's theory of gravitation. The gravity model of trade predicts that the volume of trade between any two countries will be positively related to the size of their economies (usually GDP) and inversely related to the distance (and other measures of trade costs) between them.

26 See, for example, OECD (1999); Otsuki et al. (2001); Wilson and Otsuki (2004); Gebrehiwet et al. (2007); and Disdier et al. (2008a).

27 HACCP is a food safety and quality management system that involves monitoring, verifying and validating compliance with regulatory requirements in all stages of production at all times.

28 Fixed costs are independent of the amount produced or exported, while variable costs increase with the level of production or exports.

29 For a review of the theoretical literature on heterogeneous firms, see Helpman (2011) and Redding (2010).

30 Details of this analysis can be found in Fontagné et al. (2012).

31 For a description of this database, see Section C.

32 Measures notified at WTO or Perinorm.

33 See Section C.1 for a discussion on available datasets.

34 French Custom data contain firm-level data on annual shipments by all exporting French firms in the period 1995-2005 to all partner countries around the world. We thank CEPII for providing access to these data.

35 The estimated equation is:
$$y_{d,s,t} = \beta_1 STC_{d,s,t} + D_d + D_s + D_t + D_{t,s} + D_{t,d} + \varepsilon_{d,s,t},$$
where subscripts s, d and t indicate sector, destination country and year. y is in turn: (i) the average number of varieties exported by firms, (ii) the average value exported by firms, (iii) the number of new firms, (iv) the total number of exporters. The explanatory variable STC is: (i) a dummy variable equal to one if a specific trade concern was raised by France against an SPS or a TBT measure to be adopted in an export market, (ii) the frequency ratio of the number of HS4 sectors affected by the measure within each HS2 sector and the number of HS4 sectors in that HS2. Explanatory variables are lagged one year to capture the possibility that the measure related to a specific trade concern can affect trade with a delay. In fact, STCs may relate to draft measures not yet in force. Fixed effects included in the regression address the omitted variable problem by controlling for all destination-time specific variables (such as income and all demand side variables in destination countries) and sector-time specific aspects (such as sectoral productivity shocks).

36 It is unclear to what extent a problem of self-selection may bias these results.

37 In a wider sense, it also includes the area of metrology, which is an important prerequisite for conformity assessment and accreditation (the evaluation of the competence of any institution involved in conformity assessment).

38 For this reason, governments encourage cooperation between conformity assessment bodies and sometimes are actively involved in mutual recognition agreements (MRAs).

39 Details of this study can be found in Crivelli and Gröschl (2012). The study uses a Heckman model to estimate the results. They estimate a probit binary choice model of the form
$$\Pr(import_{ijtHS4} > 0) = \boldsymbol{\phi}(\alpha_0 + \alpha_1 SPS_{ij(t-1)HS4} + \alpha_2 \mathbf{X_{ijt}} + D_i + D_j + D_t + D_{HS4} + \varepsilon_{ijtHS4}),$$
where φ (•) is a standard normal distribution function, and an outcome equation of the form
$$\ln(import_{ijtHS4} | import_{ijtHS4} > 0) = \alpha_0 + \alpha_1 SPS_{ij(t-1)HS4} + \alpha_2 \mathbf{X_{ijt}} + \alpha_\lambda \lambda(\boldsymbol{\alpha}) + D_i + D_j + D_t + D_{HS4} + \varepsilon_{ijtHS4},$$
where D denotes dummy variables and X is a vector of standards gravity control variables and multilateral resistance terms and $\lambda(\alpha)$ is the inverse mills ratio.

40 This is the count of the number of SPS measures in place on HS4 product lines within an HS2 sector divided by the number of products within an HS2 sector.

41 This last result is in contrast with the finding of Fontagné et al. (2012) discussed above that exports of French firms are negatively affected by TBT/SPS measures on which specific trade concerns have been raised. This may be due to the fact that Crivelli and Gröschl (2012)'s sample includes developing countries. For these countries, the positive demand effects of SPS/TBT measures are likely to be more relevant than for French exporters.

42 Similar results are found in De Frahan and Vancauteren (2006) for food products.

43 Defined as the number of CENELEC standards that are not identical to an existing IEC standard over the total number of standards in each SIC4 industry.

44 A production technology is characterized by increasing returns to scale when average costs fall as the level of production increases.

45 Policy heterogeneity is considered as a fixed sunk cost. Due to its fixed cost nature, policy heterogeneity has two effects on the level of bilateral services trade. First, it reduces the number of exporting firms. Secondly, it increases the average size of the exporting firms. In the theoretical framework of Kox and Lejour (2005), the first effect dominates. Therefore, the level of bilateral exports is negatively related to the degree of bilateral policy heterogeneity.

46 As argued by Fink and Jansen (2009), mutual recognition in the context of services can cover a wide range of practices including recognition of prudential regulations under financial services (to facilitate mode 3), recognition of educational qualifications with a view to enrolment in higher education or further training (to facilitate mode 2), as well as recognition of professional qualifications (to facilitate mode 4).

47 The "country of origin principle" (CoOP) was a key element in the original proposal by the European Commission. According to this principle, operators providing cross-border services into another member state without establishing there permanently would be required to respect only the rules and regulations of their country of establishment, without being subject to other member states' rules each time they crossed a border. The CoOP in fact would have applied mutual recognition of regulatory standards between EU member states (with some limitations). However, the amended Services Directive adopted by the European Parliament and the Council at the end of 2006 excluded the CoOP, which had come under fire because of fears of social dumping. As far as domestic regulation is concerned, the Services Directive provides for the simplification of qualification and licensing requirements and procedures.

48 Other studies such as Kox and Lejour (2005) and Kox and Nordås (2007) also attempt to estimate how any negative effect of burdensome regulation on services trade can be reduced through harmonization or mutual recognition. However, they use indicators of regulatory heterogeneity based on the PMR data, measuring heterogeneity in a much wider set of measures than just domestic regulation covered in this report.

49 Baller (2007)'s database contains information on eight MRAs relevant to medical devices and 14 MRAs relevant to telecommunications equipment. It also contains information on 22 EU harmonization agreements and 19 ASEAN harmonization agreements.

50 Park and Park (2011) apply a gravity regression analysis to four major services sectors – financial, business, communications and transportation services. They find that the PTAs create services trade among members and do not divert services trade from non-members. Van der Marel and Shepherd (2011) find evidence that from a number of sectors – transport, communications, business services, finance, and trade services – PTAs are not only trade creating between member countries, but also with respect to non-members. Francois and Hoekman (2010) is the only study that isolates possible trade diversion effects in services, in particular within the European Union. In this case, evidence of trade diversion is found only for business and informatics and telecoms services, where they estimate a 13.3 per cent increase in trade volumes within the EU relative to third countries.

Appendix D.1

Appendix Table D.1: **Effects of SPS measures on export performances by firm**

Dependent variables	Ln n. of varieties exported by firms	Ln n. of varieties exported by firms	Ln exports value by firms	Ln exports value by firms	Number of exporting firms	Number of entry firms
	OLS	OLS	OLS	OLS	Poisson	Poisson
	(1)	(2)	(3)	(4)	(5)	(6)
$SPS_{d, s, t-1}$	-0.130***		-0.725***		0.065	
	(0.021)		(0.106)		(0.314)	
$SPS\ Freq_{d, s, t-1}$		-0.167***		-0.910***		-0.166
		(0.036)		(0.197)		(0.671)
Observations	86850	86850	86850	86850	86850	86850
R-squared	0.343	0.343	0.425	0.425	-	-

Note: The variable SPS denotes a dummy for the existence of a measure (against which a concern was raised) in the sector. The variable SPSFreq is a count of the concerns raised normalized by the number of products (HS4) within an HS2 sector. Results are obtained using one-year lag explanatory variables (aggregate estimation at HS2 level, the sample includes only firms exporting for at least five years during the period 1995-2005). All regressions include time, sector, destination country, time-sector and time-destination country fixed effects. Robust standard errors in parentheses. *** indicates a significance level of 1 per cent.

Source: Authors' calculations using the database from Fontagné et al. (2012).

Appendix Table D.2: **Effects of TBT measures on export performances by firm**

Dependent variables	Ln n. of varieties exported by firms	Ln n. of varieties exported by firms	Ln exports value by firms	Ln exports value by firms	Number of exporting firms	Number of entry firms
	OLS	OLS	OLS	OLS	Poisson	Poisson
	(1)	(2)	(3)	(4)	(5)	(6)
$TBT_{d, s, t-1}$	-0.065***		-0.661***		-0.193	
	(0.018)		(0.098)		(0.319)	
$TBT\ Freq_{d, s, t-1}$		-0.062***		-0.876***		-0.217
		(0.023)		(0.133)		(0.503)
Observations	86850	86850	86850	86850	86850	86850
R-squared	0.342	0.342	0.425	0.425	-	-

Note: The variable TBT denotes a dummy for the existence of a measure (against which a concern was raised) in the sector. The variable TBTFreq is a count of the concerns raised normalized by the number of products (HS4) within an HS2 sector. Results are obtained using one-year lag explanatory variables (aggregate estimation at HS2 level, the sample includes only firms exporting for at least five years during the period 1995-2005). All regressions include time, sector, destination country, time-sector and time-destination country fixed effects. Robust standard errors in parentheses. *** indicates a significance level of 1 per cent.

Source: Authors' calculations using the database from Fontagné et al. (2012).

Appendix Table D.3: **Impact of SPS measures on agricultural and food trade, 1996-2010**

SPS Variable:	$SPSFreq_{ij(t-1)HS2}$				$SPS_{ij(t-1)HS4}$			
Dependent Variable:	$Pr(import_{ijtHS4})$	$ln(import_{ijtHS4})$	$Pr(import_{ijtHS4})$	$ln(import_{ijtHS4})$	$Pr(import_{ijtHS4})$	$ln(import_{ijtHS4})$	$Pr(import_{ijtHS4})$	$ln(import_{ijtHS4})$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SPS\ measure_{ij(t-1)HS4}$	-0.160***	0.641***			-0.144***	0.661***		
	(0.06)	(0.15)			(0.05)	(0.14)		
$SPS\ Conformity_{ij(t-1)HS4}$			-0.309***	-0.473*			-0.270***	-0.406*
			(0.08)	(0.28)			(0.07)	(0.23)
$SPS\ Characteristic_{ij(t-1)HS4}$			0.019	0.988***			0.012	0.962***
			(0.07)	(0.24)			(0.06)	(0.19)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Estimated correlation (rho)	0.461		0.508		0.460		0.460	
	(0.01)		(0.01)		(0.01)		(0.01)	
Estimated selection (lambda)	1.372		1.091		1.370		1.371	
	(0.04)		(0.04)		(0.04)		(0.04)	
Log pseudolikelihood	-7773030		-7772832		-7772958		-9756160	
Wald Chi2	49855.54		49752.98		49914.95		49838.46	
Observations	5, 452, 530		5, 452, 530		5, 452, 530		5, 452, 530	

Note: Estimation method is the Heckman Selection Model (maximum likelihood). SPSFreq is a count of the concerns raised normalized by the number of products (HS4) within an HS2 sector (results using these variables are reported in columns (1) to (4)). SPS denotes a dummy for the existence of a measure (against which a concern was raised) in the sector (results reported using this variable are reported in columns (5) to (8)). Controls include the log of the product of GDPs, the log of the product of populations, the log of distance, adjacency, common language and colonial heritage. Common religion is the selection variable in the first stage estimation. Importer, exporter, HS4 product, year fixed effects, and multilateral resistance (MR) terms à la Baier and Bergstrand (2009) are included in all regressions. Standard errors in parentheses. ***, * indicate a significance level of 1 and 10 per cent, respectively.

Source: Crivelli and Gröschl (2012).