4. QUANTIFYING NON-TARIFF MEASURES FOR TTIP

KOEN BERDEN AND JOSEPH FRANCOIS

1. Introduction

The Transatlantic Trade and Investment Partnership (TTIP) is not like any other free trade agreement negotiated or signed into existence (Fontagné et al., 2013; Berden et al., 2009). The communicated objectives of TTIP make it clear that its goals include but go beyond traditional market-access elements such as goods and services trade and customs duties, and rules. It is envisaged that TTIP will concentrate in particular on the areas of 'regulatory cooperation' and 'rules'.

Traditional economic (ex-ante) impact analyses used to focus on tariffs, quotas and subsidies (and increasingly also on barriers to services trade) as the main trade policy instruments. With an enlarged scope of trade agreements, like TTIP, which include regulatory cooperation, these analyses were no longer sufficient to estimate the potential impact of TTIP – or any TTIP-like agreement. The main challenge that needed to be addressed in order to be able to quantify the potential economic effects was *how to quantify economically the area of regulatory differences* – in this case between the European Union and the United States.[1]

Several studies have looked at the potential economic effects of TTIP, ranging from Berden et al. (2009) to Fontagné et al. (2013), Francois et al. (2013) and Felbermayr et al. (2013). These studies have been compared by Pelkmans et al. (2014) in their comparative work for the European Parliament. All of these studies focus on the likely macroeconomic and sectoral impacts of TTIP. For that they take as

[1] The comprehensive approach to include regulatory cooperation and rules in trade agreements has first been used in the EU-Canada CETA negotiations and is currently also used by the EU – in parallel with the TTIP negotiations – in the EU-Japan FTA negotiations and the negotiations over the renewal of the EU-Mexico FTA.

input for their methodological approaches different ways to quantify economically regulatory differences, or non-tariff measures (NTMs) as they are also called. NTMs – as opposed to non-tariff barriers (NTBs) – are compatible with the WTO charter. The term NTM is therefore often used as the collective name for regulatory differences or barriers that include technical barriers to trade (TBT) and sanitary and phyto-sanitary (SPS) measures.

In this chapter, we will first identify the methods that have been employed to quantify NTMs (section 2). We then compare some of the most important methods and analyse their differences and look at what they mean for the TTIP negotiations (section 3). We start with a short literature review of past approaches to measuring the costs of non-tariff measures (NTMs). We then look in more detail at four seminal studies to quantify NTMs over the past several years: Dean et al. (2009), Berden et al. (2009), Fontagné et al. (2013) and Egger et al. (2015). These four studies contain cornerstone elements on how to approach NTMs – and these studies thus serve as the basis for most of the quantitative research into the realm of 'regulatory cooperation'.

We find several similarities in the approaches taken. For example, all studies find that trade costs caused by NTMs matter significantly and significantly more than remaining tariff barriers. Also the studies find significant variation of NTMs across sectors and a few sectors where NTMs are particularly high (e.g. processed foods). Differences between the approaches (and thus in results) come from a difference in basic approach (i.e. price- or quantity-based), differences in the data sources used for NTMs (e.g. business survey, UNCTAD TRAINS, past FTA data), econometric specifications (e.g. general equilibrium versus partial equilibrium), and levels of country and sector disaggregation and coverage.

Because all studies conclude that NTMs matter, policy-makers are right to focus on 'regulatory cooperation' in TTIP. Given the significant differences in NTMs across sectors, policy-makers should dive deep into sector-specific elements of NTMs and focus on those sectors where the largest potential gains can be made (i.e. where NTMs are highest, such as in agriculture, automobiles, steel, textiles and insurance services).

An area identified for further research is the fact that unlike trade taxes (i.e. tariffs), regulatory barriers to trade are not generally targeted at trade as the primary policy objective, but rather stem from other strategic policy concerns like consumer safety and/or social and environmental protection. This element should be further investigated.

2. Review of NTM quantification methods

In the past 20 years, we have witnessed two important trends regarding both multilateral and bilateral trade agreements. The first is a relative shift in focus of trade negotiations from tariff reductions to the removal of NTMs. For surveys of earlier work, see Deardorff & Stern (1998) and Ferrantino (2006). The second is an increase in the depth of trade agreements being negotiated (see for example Dür et al., 2014, and Egger et al., 2015). Because of these shifts, the importance of quantifying the impact of NTMs has increased significantly over the past 10 years, and more research into this specific field has been carried out.

There are two basic avenues one can follow in order to estimate in a systematic way the economic and trade effects of NTMs: quantity- and price-based approaches. Quantity-based approaches (or actually value-based approaches as indicated by Ferrantino, 2009) use gravity equations to estimate by how much the presence of an NTM reduces trade flows compared to potential trade. This allows for the estimation of an ad valorem equivalent (AVE) or trade cost equivalent (TCE), essentially a 'fictitious' import tariff, that – if real – would reduce imports by exactly the height of the NTM. Earlier work was done by Baldwin (1975), and Bhagwati & Srinivasan (1975), but also others have since looked at this: Leamer (1988), Trefler (1993), Kee et al. (2008, 2009), Berden et al. (2009), Fontagné et al. (2013), Francois et al. (2013) and Egger et al. (2015). The approaches based on price compare the prices in the importing country with prices of comparable products in free markets, i.e. without distortions. Using detailed price data, a distinction can be made between the impact of NTMs and the impact of local distribution costs in raising the price. Through an instrumental variables approach to incorporate the endogeneity of NTMs, the height of NTMs can be estimated. The 'price gap' or tariff equivalent is then the difference between the price of imports (higher because of the NTM) and the lower world price (in the absence of the NTM). Among those using a price-based approach are Bradford (2003, 2005), Ferrantino (2006), and Dean et al. (2009).

The debate between those proposing price-based approaches (Ferrantino, 2006; Dean et al., 2009) and those favouring quantity-based approaches (Fontagné et al., 2013) is ongoing. According to Ferrantino (2006, p. 20 and Annex 2): "There are several reasons for preferring price gaps to quantity gaps in most cases. First, price gaps measure the difference between two observed values, a distorted (NTM-ridden) price and a non-distorted price. Quantity or value gaps measure the difference between an observed (distorted) value and an estimated ('normal') value of trade, and are thus influenced by the quality of the estimated value, which is subject to the various uncertainties surrounding econometric specifications." Fontagné et al. (2013), on the other hand, argue that although price-based approaches allow for a direct estimation of NTMs – in contrast to the more indirect quantity-based approaches – "largely due to data issues, quantity-based approaches prove more convenient for large-scale analyses such as the one [eds: economic impact assessment of TTIP] conducted here" (Fontagné et al., 2013, p. 8).

Apart from a methodological discussion between price- and quantity-based approaches, we need to be careful here for another reason: unlike trade taxes, regulatory barriers to trade are not generally targeted at trade as the primary policy objective. Rather, we are talking about regulatory approaches to issues such as consumer safety, the stability of financial markets, and environmental protection from – for example – dangerous chemicals. In this case, higher costs (identified by regressions, for example) most certainly reflect the balance between costs of regulation (including trade costs) and benefits linked to the primary policy objective. This point, while acknowledged in passing, is not given full due in quantitative analyses of NTM reductions. Where consumers (aka voters) in the US and EU place different values on such objectives, we need to be careful not to assume that identified barriers are not offset by benefits.

Tariff equivalents/Trade cost equivalents (TCEs)

Despite the methodological debate on the differences between price- and quantity-based approaches, authors from either strand agree that the ultimate goal of the quantification exercise is to yield tariff equivalents (or synonymously, ad valorem equivalents or trade cost equivalents). A TCE is in essence the aggregate height of the differences in regulatory systems expressed in one number: a 'tariff equivalent'. Expressing the total of differences in regulatory systems (estimated through either price- or quantity-based approaches) as one number has several major advantages. First of all, a tariff equivalent makes it conceptually much easier for readers to get a ballpark idea of the degree of regulatory divergence between the EU and US in a specific sector, i.e. for US exports to the EU, the difference in regulations adds up to a 26% TCE in the automotive industry. Second, tariff equivalents make it easy to compare tariff rates and regulatory differences (expressed in tariff equivalents). Third, a tariff equivalent can be compared across sectors, as the measuring unit is the same, i.e. for EU exports to the US, a 73% difference in the food sector is much higher than a 21% difference in the chemicals sector. Fourth, the removal of regulatory differences, i.e. liberalisation scenarios that are used to estimate the consequence of TTIP through regulatory cooperation, can be modelled by lowering tariff equivalents in a sector (or multiple sectors) in a partial or general equilibrium setting. This 'lowering of TCEs' represents any form of regulatory cooperation to address regulatory differences.[2] Please note that this implies that a lowering of a TCE implies a lowering of NTMs, which is lowering of the *differences* between regulatory systems, not lowering the levels of protection or lowering of standards (which goes back to our earlier point on consumer and environmental protection). Fifth, a TCE – being a numerical value – can be inserted into an international trade or macro-economic model to look at the effects of regulatory cooperation on GDP, firm production, consumer prices, wages, jobs, etc., as has been done by Berden et al. (2009), Fontagné et al. (2013), Francois et al. (2013) and Felbermayr et al. (2013).

In order to do justice to both strands of work to quantify NTMs in the remainder of this section, we will cover four different studies: the price-based NTM estimation work of Dean et al. (2009) and the quantity-based NTM estimation work of Berden et al. (2009), Fontagné et al. (2013) and Egger et al. (2014). It needs to be noted that Dean et al. (2009) do not focus on measuring the potential economic impact of TTIP in particular, while the other three studies aim to do that – and as such some model specifications are different (e.g. sector selection).

While we have stressed regulatory cooperation and reduction of differences in the discussion so far, it is not so clear that empirical evidence to date actually reflects this. In particular, trade costs may follow from differences in approach to the same objective, or from differences in the objectives themselves. We discuss this point further when we turn to the concept of actionability. At this point, however, we wish to stress the risk that we, as economists, may focus too much here on cost and not enough on the benefit side of regulations that happen to have trade and investment effects.

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[2] In this chapter we look at the econometric techniques of quantifying the economic costs and benefits of NTMs, not at the different ways in which regulatory alignment can be achieved. Whether it is better to aim for harmonisation of standards, harmonisation of regulations, mutual recognition of standards, mutual recognition of regulations or mutual equivalence is outside the scope of this chapter, and is covered in chapter 3 of this book.

2.1 The Dean et al. (2009) NTM quantification methodology (price-based)

Dean et al. (2009) employ a price-based approach. This means they use city-level retail price data to estimate the impact of core NTMs on prices and assess their significance. In doing so they base themselves on Bradford (2003, 2005) for price data for many products in many countries, and on Kee et al. (2008, 2009) for NTM incidence data. They go through four distinct steps in their price-based approach.

The four-step approach:

I. NTM incidence and retail price data
II. Price gap
III. Variable coefficients
IV. From variable coefficients to sector-specific TCEs

I. NTM incidence and retail price data

Dean et al. (2009) needed to collect two types of data for their analysis. First, in order to get a better understanding of the extent and types of NTMs across countries and products, they draw upon two complementary datasets: the UNCTAD TRAINS database and the USITC database (Donelly & Manifold, 2005). These data bases document EU (from the EU Market Access Database) and US (USTR National Trade Estimate Report on Foreign Trade Barriers – which includes information from the WTO Trade Policy Reviews) private-sector complaints about NTMs. The UNCTAD TRAINS database (including WITS) collects data from publicly available sources and reports in detail at the tariff line level. The authors used the potentially complementary information from the two databases, while at the same time there was overlap in the reported NTMs. This is why Dean et al. compare the two datasets and conclude that NTMs appear to be widespread, and the two databases partially overlap but also provide specific independent information. This is why they used the two databases combined.

In addition to the NTM incidence, Dean et al. (2009) required extensive amounts of price data in order to carry out a 'price gap' analysis. They used city-level retail price data for 47 products from around 115 cities from the EIU CityData for 2001. This allowed the authors to examine inter- and intra-country price differences, some of which can be attributed to NTMs. They found that price differences are both product- and country-specific – again an indication for the widespread nature of NTMs.

II. Price gap

Dean et al. (2009) also employed the data from Step I in a differentiated product model. This model takes into account different varieties, in particular a distinction between imported and domestic varieties. This approach matters because a big challenge for the price-based approach is product differentiation: "The model captures the fact that the retail price in a particular location will likely be an average of the retail prices of all the imported and domestic varieties sold locally, and that these products are likely to be differentiated by source" (Dean et al., 2009, p. 4).

Then, using the EIU CityData for 2001, they observe price differences – in deviation from purchasing power parity (PPP). This they define as the Price Gap or 'PG' – the dependent variable.

III. Variable coefficients

In order to capture the NTM effect (NTM rent of country i, Q_i), the retail price gap between the home country and foreign country (PG_{ii^*}) is regressed on local distribution margins (μ), transport costs (D), and specific tariffs (T). The authors also correct for endogeneity of NTMs by adding two interaction terms – one with country income and one with tariffs. This is depicted in equation (1) as:

$$PG_{ii^*} = \beta(\mu_i - \mu_{i^*}) - \gamma(D_i - D_{i^*}) - \delta(T_i - T_{i^*}) + \sigma_0(Q_i - Q_{i^*}) + \sigma_1\left(Q_i\tilde{Y}_i - Q_{i^*}\tilde{Y}_{i^*}\right) + \sigma_2\left(Q_i\tilde{T}_i - Q_{i^*}\tilde{T}_{i^*}\right) + \varepsilon_{ii^*} \quad (1)$$

where σ_0 is the average price premium due to NTMs. This is the coefficient that is the core of the chapter: a regression analysis coefficient to single out the additional price effect of NTMs by country and sector. If this coefficient is statistically significant and positive, we can conclude that the NTM effect is one that increases the price gap. The coefficient information is presented in column (A) of Table 4.1 below. Dean et al. (2009) do this for 65 countries. In Table 4.1, we only report findings for the EU and US – as this chapter focuses on the quantification of NTMs in the area of TTIP, hence on the EU and US.

IV. From variable coefficients to country-specific, sector-specific TCEs

Step III above (Variable Coefficients) yields country-specific, sector-specific regression coefficients for the NTM effect. The variable coefficient of the NTM effect can be changed into trade cost estimates (tariff equivalents) as follows:

$$TCE = 100\ x\ (e^{\varepsilon} - 1) \qquad (2)$$

where ε is the NTM effect regression coefficient. The TCE (in percent) is the estimated increase in prices in a country, per sector, as a consequence of NTMs. This information is presented in column (B) of Table 4.1 below.

Table 4.1 Country estimates NTM coefficients and NTM TCEs

Country and Sector	**NTM effect regression coefficients (A)**	**NTM TCEs (%) (B)**
EU (average 18 EU member states)		
- Fruits/vegetables		48.2
- Bovine meat		68.2
- Processed food		35.6
- Apparel		46.3
United States		
- Fruits/vegetables	0.47	60.6
- Bovine meat	0.59	80.0
- Processed food	0.30	34.6
- Apparel	0.20	22.6

Data source: Dean et al. (2009).

Final results

The Dean et al. (2009) study leads to some interesting findings. First, they find for 65 countries and four sectors TCEs through direct NTM price-based estimation (above we report only for the EU and US because these NTMs are relevant for the TTIP negotiations). Second, they find that NTMs complement tariffs – in some sectors the presence of a tariff reduces the price effect of the NTM. Third, in some sectors there is a correlation between the restrictiveness of NTMs with country income (some positive, some negative).[3] Fourth, the level of NTMs displays some significant sector- and country-variation. Finally, they find that NTMs matter significantly in explaining trade restrictiveness in the sectors examined.

2.2 The Berden et al. (2009) NTM quantification methodology (quantity-based)

In order to quantify NTMs, the Berden et al. (2009) study develops five distinct steps in line with the quantity-based approaches to quantifying NTMs. This basic quantification work has been used to quantify the potential effects of TTIP (combined with CGE analysis) by Berden et al. (2009), Francois et al. (2013), and Capaldo (2014). The five steps take the reader from grass-roots views on regulatory divergences by firms that do business across the Atlantic to an estimate of trade cost equivalents (TCE) involved for EU-US and US-EU trade at sectoral level.

The five-step approach

The five steps to go from survey results on transatlantic regulatory barriers to TCE are the following:

I. Business survey to get bilateral NTM survey numbers
II. From NTM survey numbers to NTM index
III. From NTM index to gravity regression variable coefficient
IV. From variable coefficient to transatlantic, EU and NAFTA[4] TCEs
V. From transatlantic, EU and NAFTA TCEs to sector specific TCEs

I. Business survey to get bilateral NTM survey numbers

Is it more difficult to trade between France and the US for a French exporter than to trade between France and Spain? Or between Poland and Italy, Poland and India and Poland and the US? Or for a US exporter to export to Mexico or to Germany? In light of the definition of an NTM, the costs for a French producer to produce and sell inside

[3] It seems logical to us that, where regulatory barriers reflect income sensitive demand for higher consumer protection (as in food products and consumer goods), we would see such a positive correlation.

[4] NAFTA = North American Free Trade Agreement.

France are not zero, because regulatory differences, e.g. to protect food safety or the safety of a car we drive in, lead to various costs.

The business survey then collected two types of data. First, firms were asked to indicate on a scale from 0 to 100 how restrictive each of their export markets was (compared to their home market as a benchmark).[5] The 5,500 data points from both large firms and SMEs that were the result of this survey allowed Berden et al. to generate exporter-importer specific survey numbers of NTMs with a country-pair specific NTM variable between 0 and 100. These survey numbers were – for statistical reasons – then aggregated into specific exporter destination NTM values, averaging the indicated NTM for each country. This information is presented in column (A) of Table 4.2. Second, firms were asked to list the main (sector-specific) barriers that they ran into when exporting. The lists of barriers were prioritised based on the firm survey responses, discussions with (sector) experts and literature information. The lists of barriers were also used to look at whether barriers involved economic rents and/or costs and the degree to which each of the barriers would be 'actionable' or not. The concept of actionability contains the sub-concepts of 'technical actionability' and 'political actionability'. For example, the electricity systems in the EU and US differ (220 volts a.c. vs. 110 volts) – which would require such an investment that this difference is deemed 'technically non-actionable'. In some sectors, e.g. aerospace, national security concerns imply that some regulatory differences are 'politically non-actionable'.

The additional survey information on costs-rents and on actionability are significant, because this information allows us to be more accurate in our estimations: they reduce the scope for TTIP impact to only those regulatory differences that can logically be addressed, i.e. are 'actionable'. And they give a better insight into the redistribution effects of TTIP from producers to consumers or vice versa (redistribution of economic rents) and the cost effects of TTIP (costs). Both the degrees of actionability and costs-rents differ per sector and for EU exports to the US and US exports to the EU (bi-directional).

5 Whereby a value of '0' presents a completely open and 'free trade' environment and a value of '100' a completely closed environment. A scale from 0 to 100 was chosen to allow for enough variation in the survey responses.

II. *From NTM survey numbers to NTM index*

The NTM survey numbers (Step I) are transformed into an NTM index in log scale conforming to OECD best practice:

$$\text{Trade/investment level of restrictiveness} = \ln(1 + 0.01 * \text{NTM survey value}) \tag{3}$$

This is done so that the coefficients on the index can be interpreted as elasticities with respect to changes in the level of restriction across the index. Shifting the origin is done to handle zero values in the original data. This information is presented in column (B) of Table 4.2.

III. *From NTM index to gravity regression dummy-variable coefficients*

The way to measure the impact of trade agreements, in this case TTIP, on trade and investment is through employing the gravity equation (Tinbergen, 1962; Linneman, 1966; Aitken, 1973). The gravity equation derives its name from Newton's law of gravitation. In international trade this has come to mean that the trade flow of goods (services) from one country to the other is related to the economic sizes of the two countries and the physical distance between them. In addition various control variables are added, e.g. dummies for sharing a common border or speaking a common language, as are policy-based trade costs, e.g. tariffs, or NTMs.

The gravity equation has a remarkable explanatory power and as such has become the work horse in looking at the impact of trade agreements (Sapir, 1981; Bergstrand & Egger, 2007; Berden et al., 2009). In Berden et al., three different dummies have been defined to capture the potential effect of the TTIP agreement. These three dummies – when interacted with the NTM index constructed in Step II – capture effects that, when added up, yield the total effect of NTM reductions because of TTIP. First an EU dummy is defined that has a value '1' if both countries in the bilateral trade pair are members of the EU and '0' if otherwise. This dummy captures the intra-EU preferential treatment given to other EU members compared to external partners.

This means that a reduction in non-EU NTMs, e.g. EU-US through TTIP, will make the US more and other EU members relatively less attractive and thus divert trade and investment away from European partners to – for example, in the case of TTIP – the US. Second, a NAFTA dummy is constructed that has a value '1' if both countries in the bilateral trade pair are members of NAFTA and '0' if otherwise. As with the EU, this dummy captures the intra-NAFTA preferential treatment given to other NAFTA members compared to external partners. This means that a reduction in non-NAFTA NTMs, e.g. EU-US through TTIP, will make the EU more and other NAFTA members relatively less attractive and thus divert trade and investment away from NAFTA partners to – for example, in the case of TTIP – the EU. Finally, the authors define a transatlantic dummy, i.e. a dummy that has a value '1' if there is a transatlantic pair and '0' if this is not the case. The transatlantic dummy measures the increase in transatlantic trade and investment in case of a once percent decrease in the NTM index. For service sectors, the business survey did not yield sufficient numbers of responses and therefore the OECD FDI restrictiveness indicators have been used instead.

IV. From variable coefficient to transatlantic, EU and NAFTA trade cost equivalents (TCE)

Step III yields – overall and sector level – regression coefficients for the EU dummies, NAFTA dummies and transatlantic dummies for trading block membership. These are variables with a bi-directional dimension (exporter and importer). The coefficients on the EU, NAFTA and transatlantic dummy variables can be changed into trade cost estimates as follows:

$$TCE = 100\ x\ (e^{\varepsilon} - 1) \qquad (4)$$

where ε is the gravity regression coefficient. The TCE (in %) is the estimated increase in trade costs as a consequence of NTMs (regulatory differences) in the EU, NAFTA and transatlantic market place. This information is presented in columns (C), (D) and (E) of Table 4.2.

V. From transatlantic, EU and NAFTA TCEs to sector specific TCEs

Having calculated in Step IV the TCE values (%) for the intra-EU preference margins (EU dummy), intra-NAFTA preference margins (NAFTA dummy) and transatlantic offset margins (transatlantic dummy), it is possible to derive the total NTM effects for the EU and US of TTIP. For the EU the total NTM effect is the intra-EU preference margin minus the transatlantic offset margin. For the US, the total NTM effect of TTIP is the intra-NAFTA preference margin minus the same transatlantic offset margin. That is, it is assumed that the preferential intra-EU and intra-NAFTA treatment is extended across the Atlantic. This information is presented in columns (F) and (G) of Table 4.2.

Table 4.2 From NTM values to trade cost equivalents for trade flows (Steps I to V)

Sector	NTM values (Step I) (A)		NTM index (Step II) (B)		Intra-EU preference margin (Steps III-IV) (C)	Intra-NAFTA preference margin (Steps III-IV) (D)	Transatlantic offset margin (Steps III-IV) (E)	Net NTM effect EU to US (Step V) (F)	Net NTM effect US to EU (Step V) (G)
	EU to US	**US to EU**	**EU to US**	**US to EU**				**EU to US**	**US to EU**
Aerospace & space	56.0	55.1	0.44	0.44	18.8	19.1	0.0	19.1	18.8
Automotive	34.8	31.6	0.30	0.27	16.3	17.6	-9.2	26.8	25.5
Chemicals	45.8	53.2	0.38	0.43	23.9	21.0	0.0	21.0	23.9
Communication services	44.6	27.0	0.37	0.24				1.7	11.7
Electronics	30.8	20.0	0.27	0.18			-6.5	6.5	6.5
Cosmetics	48.3	52.2	0.39	0.42	34.6	32.4	0.0	32.4	34.6
Financial services	29.7	21.3	0.26	0.19				31.7	11.3
Insurance services	29.5	39.3	0.26	0.33				19.1	10.8
Food & beverages	45.5	33.6	0.38	0.29	56.8	73.3	0.0	73.3	56.8
OICE	37.9	32.3	0.32	0.28	8.9	12.7	-10.2	22.9	19.1
Pharmaceuticals	23.8	44.7	0.21	0.37	24.0	18.2	8.7	9.5	15.3
Transport services	39.9	17.6	0.34	0.16					
Biotechnology	46.1	50.2	0.38	0.41					

Sector	**NTM values (Step I) (A)**		**NTM index (Step II) (B)**		**Intra-EU preference margin (Steps III-IV) (C)**	**Intra-NAFTA preference margin (Steps III-IV) (D)**	**Transatlantic offset margin (Steps III-IV) (E)**	**Net NTM effect EU to US (Step V) (F)**	**Net NTM effect US to EU (Step V) (G)**
ICT	20.0	19.3	0.18	0.18				3.9	14.9
Construction services	45.0	37.3	0.37	0.32				2.5	4.6
Machinery	50.9	36.5	0.41	0.31					
Medical equipment	49.3	44.5	0.40	0.37					
Other business services	42.2	20.0	0.35	0.18				3.9	14.9
Personal, recreational services	35.8	35.4	0.31	0.30				2.5	4.4
Steel	35.5	24.0	0.30	0.22	11.9	17.0	0.0	17.0	11.9
Textiles	35.6	48.9	0.30	0.40	11.0	8.5	-8.2	16.7	19.2
Wood & paper products	30.0	47.1	0.26	0.39	11.3	7.7	0.0	7.7	11.3
Travel services	35.6	17.6	0.30	0.16					
Total average	**38.1**	**35.2**	**0.33**	**0.30**	**21.8**	**22.8**	**-2.3**	**17.7**	**17.5**

Data source: Berden et al. (2009).

Final results

The Berden et al. (2009) study reaches some interesting conclusions and yields specific insights. First of all, the study has been able to generate bi-directional, i.e. EU-US and US-EU, TCEs at sector level for 18 different sectors. Since agriculture was not in the scope of the study, no results have been reported for agriculture. Second, the study shows that there is significant NTM-level variation across sectors and depending on the direction of the trade flow. Third, combining the NTM approach with OECD FDI restrictiveness indexes, the study also finds NTM levels for service sectors. Fourth, because an NTM index is used, the study was able to employ a friction-variable approach[1] to determine the effect of NTMs *per se*, staying away from the problem that residual approaches suffer from: measurement errors or omitted variables lead directly to errors in the estimated NTM levels. They find that NTMs matter more than tariffs in creating barriers to trade and that the level of restrictiveness varies significantly.

2.3 The Fontagné et al. (2013) NTM quantification methodology

Fontagné et al. (2013) come up with estimates of NTMs for goods and services. For goods, they base themselves on Kee et al. (2009), while for services they draw from Fontagné et al. (2011). This section summarises the approaches by Kee et al. (2009) and Fontagné et al. (2011).

I. Quantifying NTMs for goods – Kee et al. (2009)

Kee et al. (2009) go through three steps: they define three types of restrictiveness indicators, they describe the approach to estimate ad valorem equivalents (AVEs) of NTMs at tariff line level, which is equivalent to the trade restrictiveness indexes (TCEs).

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[1] A friction-variable approach is one where the specific variable – in this case the 'NTM index' – is used as an independent variable on the right-hand side – and as such has a coefficient to be measured. The friction variable approach is set against the 'residual' approach, whereby it is assumed that the regression (with all its control variables) captures everything, except for the NTM effect which is the residual. This means that any effect not captured by the regression equation ends up in the residual – and as such in the level of NTMs. The residual approach is clearly considered inferior to the friction-variable approach because of the risk of mis-estimation (especially over-estimation), which is why the latter approach has been chosen in Berden et al. (2009).

Tariff and NTM data

The main sources that Kee et al. (2009) use for tariff data come from the WTO's Integrated Database and UNCTADs TRAINS. In addition, the MAcMap database is used for specific tariffs as well as for data on unilateral, bilateral and regional preferences. The main source for core NTM data (see below) is the UNCTAD's TRAINS database. NTMs are price control measures, quantity restrictions, monopolistic measures and technical regulations. In addition, the authors use the WTO's Trade Policy Reviews and the EU's Standard's Database (Shepherd, 2004). The agricultural domestic support is obtained from the WTO members' notifications (see Hoekman et al., 2004, for a discussion on this variable).

TRI, OTRI and MA-OTRI restrictiveness indicators

Kee et al. (2009) start by arguing that in order to measure TCEs properly, in line with Anderson & Neary (1992), two aggregation problems need to be addressed: the aggregation of different forms and types of trade policies and the aggregation across different goods that have different degrees of economic importance. Anderson & Neary (1994, 1996) find that *"one single indicator cannot provide a measure of trade distortions a country imposes on itself while simultaneously capturing trade distortions imposed on its trading partners"* (Kee et al., 2009, p. 173). In line with Anderson & Neary, Kee et al. define the Trade Restrictiveness Index (TRI) – domestic welfare effect of domestic trade policies; the Overall Trade Restrictiveness Index (OTRI) – effect of domestic trade policies on domestic imports; and the Market Access-Overall Trade Restrictiveness Index (MA-OTRI) – effect of domestic trade policies on domestic exports.

AVE equivalents of NTMs at tariff line level and trade restrictiveness

Kee et al.'s theoretical foundation comes from Leamer (1990) with an 'n-good n-factor' general equilibrium model. The import value of a good is regressed on exogenous world prices, tariff line dummies, country characteristics, economic size, a dummy for islands and a measure for distance to world markets as well as three variables that are the focus of the analysis: a dummy indicating the presence of a core NTM, a variable measuring the degree of agricultural domestic support, and ad valorem tariffs for that good. Various corrections are applied to this basic regression to correct for – for example – tariff endogeneity and lack of time variation. In its essence, Kee et al. (2009)

estimate the impact of core NTMs and agricultural domestic support on imports at tariff line level.

In order to make the estimated core NTM variable comparable to ad valorem tariffs, the quantity impact needs to be transformed into price-equivalents:

$$AVE = \frac{\partial \ ln \ p^d}{\partial \ NTM} \tag{5}$$

The AVEs are calculated in each country at the tariff line level. The AVE is positive when the NTM is binding and 'zero' when the NTM is not binding. In Table 4.3 below, the main empirical results of Kee et al. (2009) for NTM TCEs are reported for the EU and US.

II. Quantifying NTMs for services – Fontagné et al. (2011)

In addition to the estimates for NTMs in goods by Kee et al. (2009), Fontagné et al. (2013) base themselves on Fontagné et al. (2011) regarding services NTM estimates. They use a quantity-based approach using gravity, while addressing specific services-related problems along the way. For example, in services – as opposed to goods – non-discriminatory market access is not influenced by the presence of tariffs but rather by NTMs, e.g. regulatory divergences. Also, measuring cross-border trade in services implies an analysis of only one of the four modes, mode 1.

Services trade data

Fontagné et al. (2011) use the GTAP database as the main source for services trade data, providing them with bilateral trade in services for 14 services sectors (in 2004): construction, communication, trade, finance, other services (education, health, defence, public services), business, transport (air, water, other), insurance, recreational services, dwelling, water, and energy – reducing this to seven sectors through some aggregations. The authors use IMF data on GDP and Producer Price Indexes and population data from the World Development Indicators of the World Bank. For trade in services the authors use the OECD data because of better country coverage and annual frequency. This implies that they miss some countries but still 89% of all global services trade is covered.

Tariff equivalents of NTMs for services

It is regulatory differences, i.e. NTMs, that constitute barriers to trade in services. Because we cannot observe directly the individual regulations (in a quantity-based approach to quantifying NTMs), through gravity, Fontagné et al. (2011) compare actual trade with the theoretical situation of free trade in services without any trade costs associated. This yields a ratio that represents the deviation of actual imports of services of a country compared to its potential free trade imports. Because the free trade imports can also not be directly seen, Fontagné et al. (2011) define a benchmark country as the 'free trader' and calculate everything else compared to this benchmark. This allows Fontagné et al. (2011) to estimate the tariff equivalent – under the assumption of a constant elasticity of substitution (something that is most likely not the case as is suggested by Francois et al., 2009). The TCEs that Fontagné et al. (2013) find are reported below in Table 4.3.

Table 4.3 Country estimates NTM coefficients and NTM TCEs

Country and Sector	NTM TCEs EU (%) (A)	NTM TCEs US (%) (B)
Agriculture	48.2	51.3
Manufacturing	42.8	32.3
Services*	32.0	47.3
- Communication	38.6	36.9
- Construction	53.2	95.4
- Financial services	51.2	51.3
- Insurance services	44.9	43.7
- Business services	32.6	42.3
- Other services	39.1	8.8
- Trade	48.0	61.5
- Transport	29.1	17.5
- Water	65.3	98.4

* For services, we report the unweighted average of EU member states from Fontagné et al. (2011) as the EU results.

Data sources: Kee et al. (2009) and Fontagné et al. (2011).

Final results

The Fontagné et al. (2013) study reaches some interesting conclusions. First of all, they combine the import elasticity and TCE for goods estimates of Kee et al. (2009) with the services NTM estimates of Fontagné et al. (2011) to get NTM estimates across agriculture, industry and services. Second, the results from Kee et al. (2009) results are based on an elaborate dataset and they use different trade restrictiveness indicators. They find NTMs at tariff line level using an approach that comes close – but is not exactly equal – to a price-based approach.

2.4 The Egger et al. (2015) NTM quantification methodology

Egger et al. (2015 forthcoming) focus on the quantification of NTMs while taking into account the depth of free trade agreements (Dür et al., 2014). They then use the estimated TCEs of NTMs in a CGE model to look at the potential effects of TTIP. The focus of this section is on the first part of their work: estimating the TCEs of NTMs. Like the other authors, Egger et al. (2015) recognise that the challenge in quantifying the effects of deep agreements is that most of the elements under negotiation cannot be directly measured quantitatively, something that is possible with tariffs.[2] Egger et al. (2015) go through two steps to get to TCEs: first, they estimate levels of NTMs through a gravity model using historical evidence from (depth of) FTAs and then they take those estimates to turn them into ad valorem TCEs.

Three-step approach

I. FTA data
II. Estimations of NTMs
III. Calculating TCEs

I. FTA data

In order to get estimates of NTMs, Egger et al. (2015) look at evidence from past FTAs. The EU has engaged for decades in reducing NTMs in its internal market project; many (bilateral) FTAs have been signed over the past decade and the depth of these FTAs has increased over time. Through the DESTA – ***Des****ign of* ***T****rade* ***A****greements* – database, a solid

[2] Tariffs allow us to more easily measure the difference between domestic prices and the world price, deriving the price wedge that then can be analysed straightforwardly with existing models and methods.

measure for the depth of trade agreements has become available. The DESTA data is used as a variable in the gravity analysis of Step II.

II. Estimations of NTMs

Egger et al. (2015) specify a gravity equation, modelling bilateral trade flows as a function of country-specific fixed effects, bilateral control variables, e.g. geography, culture, history, a measure of political distance (polity),[3] tariff margins by country-pair (within or outside FTAs). Egger & Larch (2011) have shown that the NTM effect of FTAs corresponds to the combined effect of FTAs conditional on tariffs and the depth of FTAs. This is important, because it means that the NTM effect of FTAs can be estimated as 'beyond tariff reductions'. The gravity regressions are run for each sector separately for two reasons: first, to allow for trade elasticities to vary across sectors as evidenced by Broda & Weinstein (2006) and Egger et al. (2012); second, to allow NTMs to vary across sectors as was shown by Cadot & Malouche (2012) and Berden et al. (2009).

In order to estimate the importance of NTMs, the authors include two variables: a dummy indicator for intra-EU relationships and an integer-value DESTA variable (ranging from 0 to 7) that indicates the depth of non-EU FTAs based on Dür et al. (2014). Egger et al. (2015) estimate a separate parameter for EU membership because it allows them to single out the EU internal market effects compared to other FTAs – since EU membership and the EU internal market clearly go beyond liberalisation policies in other FTAs. The results of this gravity estimation are presented below in Table 4.4 for goods (Columns (A) and (B)) and in Table 4.5 for services.

For NTMs in services – as already alluded to in the previous section by Fontagné et al. (2013) – various other issues matter (see also Francois & Hoekman, 2010, for a general discussion). Egger et al. (2015) do not estimate these NTMs themselves but rather work with estimates of trade restrictions in services from the World Bank (Borchert et al., 2014), AVEs for trade barriers in services based on the World Bank data (Jafari & Tarr, 2015), and assessments of GATS bindings and how these

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[3] Egger et al. (2015) also include a measure of political distance based on measures from the political science literature. They use the Quality of Governance expert survey dataset (Teorell et al., 2011), in particular the pairwise similarity of polity, reflecting evidence that homophily is important in explaining direct (economic and) political linkages (De Benedictis & Tajoli, 2011).

compare to PTA services commitments from the WTO (Roy, 2011 database, updated 2013).

III. Calculating TCEs

The estimates obtained under Step II for the coefficients for FTA depth (DESTA) and the EU membership dummy are taken by Egger et al. (2014) to derive potential changes in ad valorem trade costs along the same lines as Berden et al. (2009):

$$TCE = 100\ x\ (e^{\varepsilon} - 1) \tag{6}$$

The results of the TCE equivalents for goods are presented below in Table 4.4 and for services in Table 4.5. Both in Columns (C) and (D) NTM TCE values are reported. Column (C) shows the results when the gravity regression is run with the EU dummy as a benchmark, i.e. the NTM effect compared to the EU because it is the deepest FTA we know of today. Column (D) shows the NTM TCE estimates when the gravity regression is run with the DESTA variable (for depth of FTAs), comparing the existing NTMs to an average depth of an FTA as the benchmark.

Table 4.4 Gravity results and TCE equivalents (%) for goods (EU membership and FTA depth)

Sector	**Gravity coefficients EU IM (A)**	**Gravity coefficients FTA depth (B)**	**NTM TCE (%) EU dummy (C)**	**NTM TCE (%) FTA depth (D)**
Goods	*0.575*	*0.087*	*12.9*	*13.7*
Primary food	1.610	0.150	25.2	15.8
Energy	-0.001	0.169	-0.01	16.1
Processed food	1.499	0.158	48.4	33.8
Beverages & tobacco	1.498	0.215	41.8	42.0
Petrochemicals	0.270	0.173	7.9	24.2
Chemicals & pharma	0.889	0.110	20.6	29.1
Metals	1.268	0.086	38.5	16.7
Motor vehicles	1.299	0.184	19.5	19.3
Electrical machinery	0.631	0.009	19.4	1.8
Other machinery	0.133	0.071	1.6	6.2
Other goods	0.468	0.043	5.7	3.6

Data source: Egger et al. (2015).

Table 4.5 Gravity results and TCE equivalents (%) for services (EU membership and FTA depth)

Services	**AVEs of current policies (%)**	
	EU	**US**
Services	12.8	12.9
Construction*		
Air transport	25.0	11.0
Maritime transport	1.7	13.0
Other transport	29.7	0.0
Distribution	1.4	0.0
Communications	1.1	3.5
Banking	1.5	17.0
Insurance	6.6	17.0
Professional and business	35.4	42.0
Personal, recreational		
Public services		

* Construction is taken from Berden et al. (2009).

Data source: Egger et al. (2015).

Final results

Egger et al. (2015) employ a new approach to estimating the height of NTMs through a quantity-based approach framework. For goods, they do not employ detailed NTM data – either from existing databases or a business survey – but they look at (the depths of) past FTAs, with the EU Internal Market project singled out in particular and use the evidence from the past to look at NTM potential. For services, they build on the work done by Borchert et al. (2014) on trade restrictions in services and Jafari & Tarr (2015) on ad valorem tariff equivalents for trade barriers in services. They find that NTMs pose significant trade restrictions, but more in goods than in services. This could be explained in part by the fact that for services, only modes 1 and 2 and to an indirect extent mode 3 are captured, and that services have a much larger non-tradable share. They also find that compared to the EU benchmark this effect is (on average) larger than compared to the FTA depth. This is the case because the EU dummy captures the deepest FTA there is, while the FTA depth is an average of the depth of the FTAs (which is less deep than the EU post-WWII project).

3. Analysing and summarising the results

"Give me a one-handed economist", US President Harry Truman told the press, frustrated by his economic advisors who kept on saying "on the one hand … on the other hand …". Reading this chapter thus far, you may have similar feelings. Indeed, there are many differences between the studies carried out, but let's start out this section with some important similarities across the studies, followed by the differences.

3.1 A systematic comparison of empirical studies

Similarities in approaches

The first important similarity is the fact that all the studies – although to slightly differing degrees – find that TCEs of NTMs are significant and of a higher order of magnitude than tariff barriers today. The second important similarity is that those studies that could look at a more disaggregate level find that the variation of TCEs across sectors is significant: trade barriers and regulatory divergences differ significantly across sectors. The third important similarity is that they all agree that summarising NTMs in terms of TCEs or tariff equivalents is the best way to incorporate the multi-dimensional and complex issue of regulatory cooperation into a manageable variable to work with further, at least at the moment. In other words, the approach is certainly not ideal, but is the best we have given the state of the art in terms of data availability and applicable methodologies. This caveat is an important one. We can expect improvements as better data and methods become available.

Differences in approaches

As highlighted in the chapter so far, there are many different ways to approach the issue of quantifying regulatory cooperation/NTMs. In order to structure these differences, we categorise them into the following components, which we then use to compare the studies in Table 4.6 below: basic approach to quantifying NTMs: quantity- or price-based; data sources to start measuring NTMs; econometric specifications; level of disaggregation and coverage of service sector NTMs.

Basic approach to quantifying NTMs: quantity- or price-based approaches – row (A) in Table 4.6

In line with the two main strands in the literature one of the differences between the recent studies is that one uses the price-based approach (Dean et al., 2009), which means they use detailed price data to estimate the impact of core NTMs on prices and assess their significance. From there they can estimate TCEs of the NTMs. The other authors use the quantity-based approaches (Berden et al., 2009; Fontagné et al., 2013; Egger et al., 2015). They use gravity equations to estimate by how much the presence of an NTM reduces trade flows compared to potential trade. This then allows for the estimation of a tariff equivalent or TCE.

Data sources to start measuring NTMs – row (B) in Table 4.6

The most pronounced difference between the covered approaches is the set of input data used (in combination with the econometrics). Dean et al. (2009) focus on detailed price data to create the dependent variable – the price gap. They have price data for 47 products which they can aggregate into four agricultural sub-sectors. The authors also employ the UNCTAD TRAINS and USITC databases for NTM incidence – to measure the share of NTMs in explaining this gap. They use both datasets combined because – though they overlap in part – they also contain distinct information and are partially complementary. Berden et al. (2009) conducted a large business survey with 5,500 responses to create a bilateral import-export NTM index that – together with data from GTAP (2007) – was inserted into a gravity equation to estimate the statistical and economic significance of NTMs for the dependent variable, trade and investments in goods. For services – as the business survey responses were too few, they used the OECD FDI restrictiveness indicators. The survey also yielded information on specific barriers, how important they were according to firms and an assessment of whether the individual barriers would affect costs or economic rent (or a combination of both). Fontagné et al. (2013) base themselves on Fontagné et al. (2011) for services NTM estimates – using the GTAP database (2004) – and on Kee et al. (2009) for goods NTM estimates – who use the UNCTAD TRAINS database for NTM information supplemented by MAcMaps and WTO Trade Policy Reviews as well as WTO notifications. Finally, Egger et al. (2015) use a combination of GTAP (2011) data and data from past FTAs – by means of an EU dummy and the DESTA variable to measure the depth of FTAs. DESTA have a value between 0 and 7 whereby 7 is the deepest form of a trade agreement. Recently, trade agreements have increased in depth.

Econometric specifications – row (C) in Table 4.6

The detailed econometric specifications differ between the studies. Most distinct is the approach by Dean et al. (2009) since they carry out a regression analysis with retail price gaps as the dependent variable and tariffs and NTMs – adjusted for differences in local distribution mark-ups, transport costs and specific tariffs. The other three studies all use the gravity equation and the same dependent variable – but the gravity equations are not specified in the same way. In Berden et al. (2009) the gravity equation contains the NTM index on the right-hand side, allowing the authors to measure the contribution of NTMs to the trade gap (and thus indirectly the price gap). Egger et al. (2015) employ the gravity equation with an EU dummy and the DESTA variable for depth of FTAs on the right-hand side as two independent variables. They also add a variable called 'polity' to correct for political distance. Finally, Fontagné et al. (2013) – using Kee et al. (2009) for goods NTM estimation – use the gravity equation but run it per sector, employing a partial equilibrium and not a general equilibrium approach. For services, they rely on Fontagné et al. (2011), whereby a gravity equation is used.

Level of sector disaggregation – row (D) in Table 4.6

The level of disaggregation differs across the studies. Dean et al. (2009) focus on four agricultural sub-sectors – at a high degree of disaggregation, but for only a small part of the economy. It is clear that the large amount of data needed for the price-based approach limits the scope in terms of the number of sectors that can be studied. Fontagné et al. (2013) explore a limited number of goods sectors, but a comparable number of service sectors to Berden et al. (2009) and Egger et al. (2015). In terms of goods sector disaggregation Berden et al. (2009) and Egger et al. (2015) use the GTAP database (2007 and 2011) to reach the highest level of disaggregation covering the entire economy.

Coverage of service sectors – row (E) in Table 4.6

Dean et al. (2009), using detailed price data, focus on four agricultural sectors but do not look at service sectors. Berden et al. (2009), using the business survey, cover nine service sectors that are also in GTAP (2007). Fontagné et al. (2013) cover the same nine service sectors but use the GTAP (2004) database. Finally, Egger et al. (2015) use the broadest service sector coverage available in GTAP (2011), looking at NTMs in 11 sectors.

Table 4.6 Structured comparison of different approaches to quantifying NTMs

Components	**Dean et al. (2009)**	**Berden et al. (2009)**	**Fontagné et al. (2013)**	**Egger et al. (2015)**
Basis approach to quantifying NTMs (A)	Price-based approach	Quantity-based approach	Quantity-based approach	Quantity-based approach
Data sources to start measuring NTMs (B)	UNCTAD TRAINS and USITC for NTM incidence + retail price data for 47 products EIU City data 2001	Business survey (5,500 responses), OECD FDI restrictiveness indicators, GTAP 2007 pre-release	UNCTAD TRAINS, MAcMaps, WTO TPR, WTO member notifications, GTAP 2004	EU dummy and FTA depth dummy (past FTA results); GTAP 2011
Econometric specifications (C)	Regression analysis with retail price gap as dependent variable and tariffs and NTMs (and other control variables) as independent variables	Friction variable gravity analysis with goods & services trade (and investment) as dependent variable and NTMs (and control variables) as independent variables	For goods NTMs estimation use the gravity equation but run it per sector – employing a partial equilibrium and not a general equilibrium approach. For services NTMs a gravity equation is used	Gravity analysis with goods & services trade as dependent variable and EU/FTA depth variables (and control variables) as independent variables
Level of disaggregation (D)	Fruits & vegetables, bovine meat, processed food, apparel	Aerospace & space, automotive, chemicals, communication, electronics, cosmetics, financial, insurance,	Agriculture, manufacturing, services – communication, construction, financial,	Overall goods, primary food, energy, processed food, beverages & tobacco, petrochemicals, chemicals & pharma,

Components	Dean et al. (2009)	Berden et al. (2009)	Fontagné et al. (2013)	Egger et al. (2015)
		food & beverages, OICE, pharmaceuticals, transport, biotechnology, ICT, construction, machinery, medical equipment, other business services, personal & recreational, steel, textiles, wood & paper, travel	insurance, business, other services, trade, transport, water	metals, motor vehicles, electrical machinery, other machinery, other goods, overall services, air transport, maritime transport, other transport, distribution, communications, banking, insurance, professional and business services, personal, recreational, public services
Coverage of services sectors (E)	No	Yes, 9 sectors	Yes, 9 sectors	Yes, 11 sectors
Country coverage (F)	60 countries	EU, US and other countries combined into ROW	Goods: 78 countries Services: 65 countries	12 regions

Country coverage – row (F) in Table 4.6

The three GTAP-based studies (Fontagné et al., 2013; Berden et al., 2009; and Egger et al., 2015) cover the entire world economically, but aggregate countries into relevant groups. Berden et al. (2009), focusing on TTIP, aggregate all GTAP countries into the EU, US and Rest of World (ROW). Egger et al. (2015) – also focusing on TTIP – define the EU, US, EFTA, Turkey, Other Europe, Mediterranean, Japan, China, TPP countries, Other Asia, Other middle-income, and low-income countries. Fontagné et al. (2013) specify 78 countries for goods trade and 65 for services trade. Finally, Dean et al. (2009) cover 60 countries.

Strengths and weaknesses of the different approaches

Each of the covered approaches has its merits and challenges. And in light of the complex discussion of how to quantify NTMs it is important to at least summarise some of the main strengths and weaknesses of each of the approaches in order to aid policy-makers in deciding what model they deem best-suited to the policy questions at hand. In Table 4.7 below, we present a short summary of the main strengths and weaknesses per approach.

Table 4.7 Summary of main strengths and weaknesses of NTM quantification approaches

Study	Strengths	Weaknesses
Dean et al. (2009)	• The direct estimation of the contribution of NTMs on the price gap • The direct link at product level (if price data available) to NTMs that could explain the price gap • The treatment of NTMs as endogenous and in combination with tariffs and income (through interaction terms) • The careful assessment of both the UNCTAD TRAINS database and USITC database and	• The large amounts of price data needed for all products affected by large-scale FTA effects is not available – so not suitable to large-scale FTA policy questions • NTM incidence is needed to distinguish NTMs from other factors that influence the price gap – how to measure the presence of NTMs? • Some of the TCEs attributed to NTMs could represent price premia because of

Study	Strengths	Weaknesses
	combining the (partially complementary) information available in each of these datasets	product differentiation, not because of the existence of NTMs
Berden et al. (2009)	• The use of a business survey that leads to the construction of an NTM index (values 0-100) that allows for a friction variable gravity regression approach • The combination of business survey and OECD FDI restrictiveness indexes to yield bi-directional and sector-specific NTM estimates • The characterisation of NTMs into cost and/or economic rent inducing – very important for estimating welfare impacts of NTMs • Information on actual barriers faced while exporting to the EU/US by small and large firms	• Indirect estimation of the price gap: first the quantity gap, then with price elasticities the price gap – adding risk of the quality of the estimation • The explained trade gap cannot be directly linked to NTMs at product level • The risk of a biased business survey (checked econometrically and no bias found) • The concept of 'actionability' in order to divide NTMs into those that can potentially be addressed and those that cannot/are not likely to be addressed limits the potential of regulatory cooperation, but is empirical only
Fontagné et al. (2013)	• The estimation work of Kee et al. is grounded in theory (Anderson & Neary) • The method of Kee et al. allows for estimation of bootstrap standard errors for the TCEs that take into account sampling and	• Indirect estimation of the price gap: first the quantity gap, then with price elasticities the price gap – adding risk of the quality of the estimation • In addition to the above, any mis-estimation of transport

Study	Strengths	Weaknesses
	estimation errors (indicating whether the quality of the estimation is a risk) • Kee et al. use very detailed NTM incidence data at tariff line level using detailed import elasticities – coming closer to product-level barriers	costs also affects the NTM impact (Dean et al.); • The explained trade gap cannot be directly linked to NTMs at product level (even though Kee et al. are close) • The partial equilibrium approach chosen by Kee et al. may lead to a bias (overestimation) of NTMs – direct impact, no income effects and no substitution effects possible • Kee et al. depend on ability of Heckscher-Ohlin model specification to explain trade flows
Egger et al. (2015)	• The approach to estimate potential NTMs based on a very large amount of information from past FTAs • The use of DESTA as a variable in the gravity equation to insert a measure of the depth of FTAs • The careful treatment of political variables ('polity') and sensitivity analysis to take the Berden et al. concept of actionability to a new (tested) level	• Indirect estimation of the price gap: first the quantity gap, then with price elasticities the price gap – adding risk of the quality of the estimation • The explained trade gap cannot be directly linked to NTMs at product level

Source: Compiled by the authors.

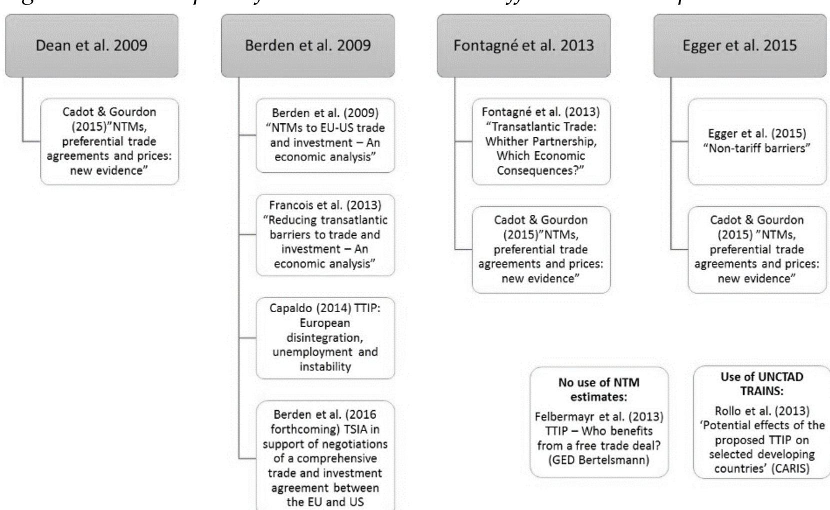
3.2 Juxtaposing the four approaches

Comparison of study results, policy recommendations and relevance for TTIP negotiations

The four studies covered in detail in this chapter have been used to various degrees to look at the potential effects of TTIP. It is important to note that in order to measure the potential effects of TTIP, quantifying the level of NTMs is only one – and the first – methodological step. In order to come up with economic estimates of a potential TTIP agreement, four methodological steps need to be taken:

1) Quantification of NTMs as explained in this chapter
2) Combining the quantified NTM estimates with tariff line information
3) Developing liberalisation scenarios that could be the result of the TTIP negotiations
4) Employing a macro/trade model (partial or general equilibrium) to look at the macro-economic effects

Figure 4.1 NTM quantification work used in different TTIP impact studies



Source: Authors' own configuration.

Link between NTM quantification and TTIP impact studies

Many studies have in recent years worked through these four steps in order to quantify the potential effects of TTIP. And these studies have shown different results of a potential TTIP agreement because of different choices made in any of these four steps: different estimations of NTMs (the topic of this chapter), different tariff line data depending on what year the study was carried out, different liberalisation scenarios, i.e. anticipated levels of ambition, and different macro/international trade models to look at the final welfare effects. In Figure 4.1, we show what NTM estimation work has been used in some of the main studies carried out to estimate the potential impact of TTIP.

Comparison of NTM estimation results and link to policy-making

In Table 4.8 we present the summary of estimated NTM results per study and per sector (or aggregate thereof). This is in essence a meta-results table for the most important NTM estimates carried out so far, focusing on the EU and US from the TTIP perspective. From this table some interesting conclusions can be drawn.

First of all, it becomes clear from all studies that NTMs matter significantly in terms of their effect on international trade. The studies confirm that NTMs matter more than tariffs (2.2% for the US and 3.3% for the EU on average, according to Fontagné et al., 2013). This result matters for policy-makers because it suggests they should focus their attention relatively more on regulatory cooperation than on tariffs when negotiating new free trade agreements, as that is the area where potential barriers are highest. In fact, Egger et al. (2015) show that this is indeed what policy-makers are doing in recent trade agreements – stemming from the fact that the depth of FTAs negotiated and under negotiation has increased significantly in recent years.

Second, when we look across sectors, there appears to be a significant degree of variation between NTMs at sector level and depending on the direction of EU-US trade. For example, in processed foods, the NTMs found are much higher than in electrical machinery (electronics), and in general manufacturing goods NTMs are found to be higher than services NTMs (with the exception of Fontagné et al., 2013). This result implies that policy-makers should drill down into NTMs at sector level. They could focus first on those sectors where the differences are significant (and thus the scope for reduction is larger) based on as broad a range of studies as possible.

Third, in some sectors the studies show strikingly similar results. For example, when comparing the results of both the price-based and quantity-based approaches for processed foods, we find that the results are quite comparable across all studies. Furthermore, in some sectors like agriculture, automotive, steel, textiles, and insurance services – though level estimates vary – all studies find significant levels of NTMs.

Finally, when comparing estimated service sector NTM levels – though the height of NTMs differs – all studies that looked at services NTMs find that financial services, insurance services and maritime transport services are much more restrictive in the US than in the EU. Policy-makers can take note of the reported sectors and trends found across the studies as cross-validated, and treat them as 'more likely to be accurate' (as compared to those sectors or results where divergences in findings are high – see next point).

Fourth, the studies show some important differences in results. Dean et al. (2009) and Fontagné et al. (2013) find on average much higher levels of barriers from NTMs than Berden et al. (2009) and Egger et al. (2015). It is not easy to compare the studies because they use different levels of sector aggregations, e.g. Fontagné et al. (2013), only use report aggregate manufacturing results, not sector-specific ones. However, when we attempt to analyse where the differences in results come from, we find that the answer lies in part in what sectors are estimated and in what data and methodological approaches are used.

- First, when turning to what sectors have been estimated, we note that Berden et al. (2009) do not include estimations on the agricultural sector. Dean et al. (2009) and Fontagné et al. (2013) find high agricultural barriers – which explains in part why on average for all sectors the Berden et al. (2009) study finds lower NTMs, i.e. agricultural barriers are not included. So if policy-makers want to focus on the NTM levels in agriculture, they should turn to one of the other three studies.
- Second, we find that Dean et al. (2009) and Fontagné et al. (2013) – based on Kee et al. (2013) for manufacturing sectors – both use the UNCTAD TRAINS database, which collects NTMs and gives them a value '1' if present and '0' if absent. Berden et al. (2009) rely on the business survey results while Egger et al. (2015) use past FTAs as the benchmark (EU and FTA depth) – which do not have a binary nature. We believe that an important driver of the results is the binary nature of the NTMs in the UNCTAD TRAINS database versus the scaled variables of the Berden et al. business survey and FTA depth variable in Egger et al. Because the presence of any NTM is given a value '1' it is possible to overestimate NTMs using UNCTAD TRAINS. There are large data limitations to measure the incidence, impact, nature and importance of NTMs. All approaches are approximations that could help policy-makers focus on 'the biggest bang for the buck' – especially if the studies cross-validate each other's results.

- Third, it is important to note that Kee et al. (2009) themselves indicated that – as already outlined by Anderson (1998) – employing a partial equilibrium assumption on the estimation approach *"may lead to overestimating the degree of trade restrictiveness as the potential for substitution across markets is frozen in our setup…"* (Kee et al., 2009, p. 196). Since Fontagné et al. (2013) take the results for NTM estimations in goods from Kee, this estimation bias may also be present in their work. For policy-makers it is therefore important to realise that the Fontagné et al. (2013) results could be biased upwards.
- Fourth, Dean et al. (2009) use the price-based approach where they directly estimate the price gap and estimate the share of the price gap that can be attributed to NTMs, corrected for various factors. They however acknowledge that any measurement error in any of the control variables, e.g. transport costs, could lead to mismeasurement of the NTM variable (Q) as the residual variable that is measured. This implies that if any control variable is under-valued or if there is any effect that is not captured by the control variables, the potential NTM effect increases, thus possibly overestimating the impact of NTMs. For policy-makers it is therefore important to realise that the Fontagné et al. (2013) results could be biased upwards.
- Fifth, especially in services, the differences in NTM estimates between Berden et al. and Egger et al. on the one hand and Fontagné et al. on the other are large. This cannot be attributed to the GTAP database, because both Berden and Fontagné use the same GTAP 2007 version. Instead, we believe the different results stem from the fact that Kee et al. (2009) use a partial equilibrium approach to estimating NTMs, taken subsequently by Fontagné, combined with the use of the UNCTAD TRAINS dummy variable. For policy-makers, this means that NTMs are high, but maybe not as high as presented by Fontagné.

Finally, the price-based approaches require very large amounts of data at product level to work. If policy-makers are looking to estimate NTMs for specific products, and if price data are available in sufficient quantities, then the price-based approach is a very useful one to use. However, for estimating the impact of – for example – TTIP requires measuring the impact on tens of thousands of products in many sectors. For such an exercise price data are not available. Hence, using price-based approaches for all encompassing trade agreement impacts is not recommended.

Table 4.8 Summary of NTM quantification results per study

Sector	**NTM TCE estimates by Dean et al. (2009)**		**NTM TCE estimates by Berden et al. (2009)**		**NTM TCE estimates by Fontagné et al. (2013)**		**NTM TCE estimates by Egger et al. (2015) – EU dummy (goods)/current policy (services)**		**NTM TCE estimates by Egger et al. (2015) – FTA depth (goods)/current policy (services)**	
	(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**
	EU	**US**	**EU to US**	**US to EU**	**EU**	**US**	**EU**	**US**	**EU**	**US**
All goods							*12.9*	*12.9*	*13.7*	*13.7*
Agriculture					*48.2*	*51.3*	25.2	25.2	*15.8*	*15.8*
- Bovine meat	68.2	80.0								
- Fruits & vegetables	48.2	60.6								
Manufacturing					*42.8*	*32.3*				
- Aerospace & space			19.1	18.8						
- Automotive			26.8	25.5			19.5	19.5	19.3	19.3
- Beverages & tobacco							41.8	41.8	42.0	42.0
- Biotechnology										
- Chemicals			21.0	23.9			20.6	20.6	29.1	29.1
- Cosmetics			32.4	34.6						
- Electronics (electrical machinery)			6.5	6.5			19.4	19.4	1.8	1.8

Sector	NTM TCE estimates by Dean et al. (2009)		NTM TCE estimates by Berden et al. (2009)		NTM TCE estimates by Fontagné et al. (2013)		NTM TCE estimates by Egger et al. (2015) – EU dummy (goods)/current policy (services)		NTM TCE estimates by Egger et al. (2015) – FTA depth (goods)/current policy (services)	
	(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**
	EU	**US**	**EU to US**	**US to EU**	**EU**	**US**	**EU**	**US**	**EU**	**US**
- Energy							-0.01	-0.01	16.1	16.1
- Machinery							1.6	1.6	6.2	6.2
- Medical equipment										
- Office, Info & comm equip.			22.9	19.1						
- Other goods							5.7	5.7	3.6	3.6
- Petrochemicals							7.9	7.9	24.2	24.2
- Pharmaceuticals			9.5	15.3			20.6	20.6	29.1	29.1
- Processed food	35.6	34.6	73.3	56.8			48.4	48.4	33.8	33.8
- Steel (metals)			17.0	11.9			38.5	38.5	16.7	16.7
- Textiles	46.3	22.6	16.7	19.2						
- Wood & paper products			7.7	11.3						
Services			*8.5*	*8.9*	*32.0*	*47.3*	*12.8*	*12.9*	*12.8*	*12.9*
- Air transport services							25.0	11.0	25.0	11.0
- Communication services			1.7	11.7	38.6	36.9	1.1	3.5	1.1	3.5

Sector	NTM TCE estimates by Dean et al. (2009)		NTM TCE estimates by Berden et al. (2009)		NTM TCE estimates by Fontagné et al. (2013)		NTM TCE estimates by Egger et al. (2015) – EU dummy (goods)/current policy (services)		NTM TCE estimates by Egger et al. (2015) – FTA depth (goods)/current policy (services)	
	(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**
	EU	**US**	**EU to US**	**US to EU**	**EU**	**US**	**EU**	**US**	**EU**	**US**
- Construction services			2.5	4.6	53.2	95.4	4.6	2.5	4.6	2.5
- Distribution							1.4	0.0	1.4	0.0
- Financial services (banking)			31.7	11.3	51.2	51.3	1.5	17.0	1.5	17.0
- ICT			3.9	14.9						
- Insurance services			19.1	10.8	44.9	43.7	6.6	17.0	6.6	17.0
- Maritime transport services					65.3	98.4	1.7	13.0	1.7	13.0
- Other business services			3.9	14.9	32.6	42.3	35.4	42.0	35.4	42.0
- Other transport services							29.7	0.0	29.7	0.0
- Pers., recreational services			2.5	4.4						
- Trade					48.0	61.5				
- Transport services					29.1	17.5				
- Travel services										
Total average	**49.6**	**49.5**	**17.7**	**17.5**	**41.0**	**42.2**	**17.0**	**18.7**	**16.4**	**18.1**

Data sources: Dean et al. (2009), Berden et al. (2009), Kee et al. (2009), Fontagné et al. (2011) and Egger et al. (2015).

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