Standards and Regulations: Measuring the Link to Goods Trade

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Summary

In this paper, I estimate the magnitude of the link between technical regulations and exports. I analyze measures notified by World Trade Organization (WTO) members from 2006 to 2015 under the Agreement on Technical Barriers to Trade (TBT). As these measures appear to be a small subset of the true stock of regulations, I assume that the presence of regulations in one country is a proxy for the overall global regulatory environment. In matching these measures with goods trade, this paper finds:[1]

- Technical regulations in WTO notifications were potentially linked to 92 percent of U.S. goods exports in 2015 and 93 percent of global goods exports in 2015.
- In addition, 77 percent of all types of products (by 4-digit commodity classification) were covered by at least one notification.
- The leading WTO members by number of notifications included the European Union (EU), China, the United States, Saudi Arabia, Israel, Uganda, South Korea, Brazil, Kenya, Qatar, Bahrain, Japan, and Canada.
- Several heavily traded sectors were among the most frequently notified: machinery and electronics, vehicles, and mineral fuels. Chemicals, cosmetics, and several food products were also frequently notified.

To check the robustness of these assumptions and results, I also analyze the European Union's TBT measures from 2012 to 2014 as collected by the UN Conference on Trade and Development (UNCTAD). This analysis finds that EU technical regulations in UNCTAD TBT measures were linked to 92 percent of EU global goods imports in 2014 and 92 percent of U.S. goods exports to the EU in 2015.

Introduction

Standards and technical regulations[2] can encourage trade when they provide valuable information about product requirements or consumer preferences. Technical regulations can also inhibit trade when they create unduly restrictive requirements that diverge from international practices. Researchers have extensively explored the trade costs and benefits of standards and technical regulations, with empirical results showing the trade impact varies based on context (see Appendix B for a literature review). Due to the complex web of international regulations, however, it can be difficult to make assertions about the overall relationship between technical regulations and global trade. Given data limitations, researchers have struggled to create a comprehensive measure to show the wide coverage of standards or technical regulations. Most studies seeking to measure the impact of standards or technical regulations on international trade flows have thus focused on a particular sector or trading relationship.

[1] Percentages are rounded to the nearest percent. Chapters 98 and 99 are excluded from analysis and calculation of trade totals; see Section 3 (Findings) for more information.

[2] For definitions of terminology (standards and technical regulations), see Appendix A.

This paper seeks to create measures of the pervasiveness of technical regulations by measuring their link to goods trade. This paper adds to the literature by analyzing World Trade Organization (WTO) members' notifications under the WTO Agreement on Technical Barriers to Trade (TBT Agreement) across a broader set of industries than did previous studies.

The paper begins with a brief discussion in Section 2 of notifications by WTO members to the WTO TBT Committee and related assumptions. Section 3 then discusses findings on the link with goods trade, including the high overall frequency and coverage of measures analyzed as well as economies that stand out. The section also provides sector-by-sector information on commonly and infrequently notified commodities. To check the robustness of the assumptions about WTO notifications and the resulting findings, Section 4 examines the frequency and overage of UNCTAD-collected non-tariff TBT[3] measures. The paper concludes with a brief discussion of areas for future research. The Appendixes contain definitions of key terms, a literature review, a detailed discussion of data sources, additional tables, and several extensions.

WTO Notifications

To examine the pervasiveness of technical regulations, I looked at notifications by WTO members to the Technical Barriers of Trade (TBT) Committee (henceforth "WTO Notifications"). Under the TBT Agreement, WTO members are obligated to notify other members when they are considering adopting a regulation that "may have a significant effect on trade" and for which either the requirements therein are not "in accordance with" relevant international standards[4] or there is no existing international standard. Article 2.9.2 of the TBT Agreement obligates members to notify a measure "at an early appropriate stage, when amendments can still be introduced and comments taken into account"—i.e., before the measure is final. Notifications do not necessarily represent discriminatory trade barriers, but they are designed to cover regulations that differ from international standards in ways that could impact trade.

I examined notifications under Articles 10.6 and 10.7 of the TBT agreements that were made from January 1, 2006 to August 18, 2015[5] and sought to link them with trade data. I only analyzed those for which Harmonized System (HS) commodity classification code information at the 4-digit (HS-4) level or 6-digit (HS-6) level was attached.

WTO notifications seem to be a small subset of actual regulations with potential trade impact. Notifications are only made for new measures, so they would not capture the stock of older regulations. Even for new measures, however, notifications are not an exhaustive list of technical regulations with potential trade impact: notification practices vary among WTO members, with some notifying infrequently. Furthermore, almost half of notifications do not have information on which goods they would potentially impact.

Thus, I assume that a notification for a particular product made by any member is a proxy for the global regulatory environment on this product. Thus, in connecting WTO notifications to goods exports, I link a

[3] For a definition of TBTs, see Appendix A.

[4] Article 2.4 of the TBT Agreement generally obligates WTO members to use international standards "as a basis for their technical regulations."

[5] Notifications initiated after August 18, 2015, were not available as of January 31, 2016.

notification by one country for a particular product with all exports of that product, regardless of destination.[6] This is a strong assumption, which will be tested in Section 4.

Findings

I matched the HS-4 information from the measures in WTO notifications with trade data on 2015 U.S. exports (classified in Schedule B) and 2014 global exports. I calculated two indices, which have been used in the literature[7] to show the pervasiveness of standards and technical regulations and to form the basis of further analysis:

- The **coverage ratio** is the percentage of total trade value—U.S. exports or global exports—linked to at least one WTO member's notification at the HS-4 level.
- The **frequency index** is the percentage of all commodity classifications—total HS-4 product categories with non-zero exports—linked to or subject to at least one measure in one WTO notification. It does not consider the value of trade in the affected products.

The two indices might differ in magnitude if products with higher trade value are more often subject to WTO-notified measures, or if products with lower trade value are less often subject to these measures.

I made two important adjustments to the trade data. First, I excluded chapters 98 and 99. The Harmonized System reserves chapters 98 and 99 for each country's individual use, so there would be no measures available for these chapters.[8] Second, for U.S. exports of aircraft, I made estimates to account for suppressed export data (see Appendix D for details).

Frequency Indexes and Coverage Ratios

Over the past ten years (from January 1, 2006 to August 18, 2015), WTO members notified the TBT Committee of their intention to apply technical regulations in HS-4 codes that comprise 91.7 percent of U.S. exports in 2015 and 92.9 percent of global exports in 2014. Thus, around 92 percent of U.S. exports and 93 percent of global exports were potentially linked to technical regulations.

Table 1 shows the results in detail. For notifications made over the 2006–2015 period, the frequency index—percentage of total HS-4 product categories with non-zero exports for which there was at least one notification—was 76.5 percent for 2015 U.S. exports and 76.9 percent for 2014 global exports.[9]

Table 1: Coverage Ratios and Frequency Indexes for WTO Notifications, 2006-2015

Trade Data Used	Coverage Ratio	Frequency Index
U.S. Exports, 2015	91.7%	76.5%
World Exports, 2014	92.9%	76.9%

[6] For example, during 2006 to 2015 Albania was the only country to notify a regulation applying to fresh and chilled fish (HS 0302). Nevertheless, U.S. and global exports of fresh and chilled fish to all countries are considered covered. For a more detailed discussion of limitations and key assumptions, see Appendix C.

[7] See Appendix B for a literature review.

[8] For example, the United States uses Chapter 99 for tariffs changed by temporary legislation, executive actions, or administrative actions—including miscellaneous tariff bills (MTBs). In the data analyzed, there were no technical regulations linked to any goods in Chapter 98 or 99.

[9] The source for U.S. export data was U.S. Department of Commerce and the source for global export data was UN/COMTRADE data; both were retrieved through the Trade Policy Information System (TPIS). In calculating the frequency index for U.S. exports, I considered Schedule B code 8800 to be covered since the majority of its products were covered by WTO notifications. For more information on 8800, see Appendix D.

Note: The marginal effect of Excluding U.S. notifications is small. For example, for world exports the coverage ratio decreases to 92.8 percent and the frequency index decreases to 76.1 percent.
Source: Author's calculations based on WTO notifications from January 1, 2006 to August 18, 2015 by all WTO members; 2015 U.S. export data from U.S. Department of Commerce; and 2014 global exports data from UN Comtrade.

In other words, over three-quarters of HS 4-digit product categories contained products for which at least one WTO member notified intent to apply a technical regulation with potentially significant trade effects.[10] The gap between the coverage ratios and frequency indexes might indicate that products with high export value are more often linked to notifications than are products with lower export value.

Overall, the frequency index and coverage ratio of goods trade affected by technical regulations could be higher, especially since the WTO notifications do not constitute an exhaustive list of all technical regulations for all products. Since there are not data on the full stock of technical regulations, analyzing the different time periods separately (i.e., as flow measurements) shows that the size of our snapshot affects frequency and coverage. For example, when only reviewing notifications made from 2011–2015, the coverage ratio is only 83.6 percent of U.S exports and 83.5 percent of global exports, while the frequency index was only 57.9 percent for U.S. exports and 57.6 percent for global exports. Thus, if we had information on the full stock of all WTO members' technical regulations, the frequency index and coverage ratio might be higher.[11]

Major Economies by Measures Notified

The European Union, China, Saudi Arabia, and United States are the four leading WTO members by number of notifications (table 2). The percent of measures that contained HS information varied vastly by economy: 90 percent or more of the measures notified by Israel, United States, Kenya, Ecuador, and Thailand had HS information, while fewer than 25 percent of measures notified by the European Union and South Korea contained HS information. Thus, eliminating measures with no HS information[12] skews the measures away from some economies. Overall, more than 40 percent of measures were eliminated from analysis due to lack of HS information.

Only 15.4 percent of measures notified by WTO members contained information on the date of entry into force. This may be because many WTO members, including the United States, do not provide a date of entry into force unless notifying a final regulation. Nevertheless, this does not indicate that WTO notifications predominantly contain draft regulations that were never finalized. On the contrary, around 86.8 percent of notified measures with HS information but without a date of entry into force are in force today.[13] Given the limited information available on dates of entry into force, however, this paper does not analyze information on entry into force.

[10] Of the tariff lines with measures notified, the mean number of notifications was 33.3 and the median was 10. For U.S. exports in 2015, tariff lines for which only one measure was notified accounted for 9.6 percent of all non-zero tariff lines and 6.1 percent of all U.S exports.
[11] For example, adding notifications from 1995 to 2005 increases the numbers. When examining all notifications from January 1, 1995 through August 18, 2015, the coverage ratio for U.S. exports increases to from 91.7 to 95.0 percent and the frequency index increases to from 76.5 to 81.5 percent.
[12] See Appendix C for details on data processing.
[13] This is based on a random sample of notifications. The margin of error at the 95 percent confidence level is ±5.2 percent. See Appendix F for more details.

Table 2: WTO Notifications by Member, 2006–2015

Economy	Measures Notified, 2006-2015	Percent with HS info	Percent with date of entry into force
European Union*	1,198	24%	20%
China#	949	77%	9%
Saudi Arabia	857	57%	2%
United States	856	93%	36%
Israel	694	94%	7%
Uganda	502	90%	0%
South Korea	498	12%	12%
Brazil	445	57%	14%
Kenya	423	91%	8%
Qatar	390	68%	1%
Bahrain	390	71%	1%
Japan	335	41%	13%
Canada	310	67%	47%
Ecuador	310	90%	52%
Thailand	275	92%	10%
Other economies	4,408	46%	15%
Total	12,840	59%	15%
Excluding United States	11,984	56%	13%

* Numbers for the European Union includes notifications made by the EU itself as well as notifications made by EU member states. Romania notified 10 measures in 2006 before accession to the EU; these are not included in the EU's numbers.
# Numbers for China exclude Hong Kong and Macao, which made a combined 25 notifications.
Source: Author's calculations based on WTO notifications from January 1, 2006 to August 18, 2015.

Analysis by Sector

Since the primary focus of the paper is on the link between technical regulations and U.S. exports, the sectoral analysis is performed for all notifications by WTO members besides the United States.

Chapters Most Frequently Notified

Several HS 2-digit commodity classifications—known as chapters—stand out due to the number of entries for their commodities. The most notified chapters by number of measures (shown in Table 3) are Chapters 84 and 85, which are two of the most heavily traded sectors and cover many different types of machinery and electronic goods. Several other heavily-traded sectors—mineral fuels and vehicles—are also among the most frequently notified. Cosmetics, chemicals, and food also feature in the top chapters. The number of notifications per chapter can also be scaled by the number of HS-4 categories (see Table A.5 in Appendix E), but this does not produce markedly different results.

Table 3: Top 10 Most Commonly Notified Chapters

Chapter	Description	Number of Entries	Number of HS-4 lines in HS-2	% of World Exports, 2014
84	Nuclear Reactors, Boilers, Machinery and Mechanical Appliances; Parts	3,135	49	12.1%
85	Electrical Machinery and Equipment; Sound Recorders and Reproducers; Television Image and Sound Recorders and Reproducers; Parts and Accessories	2,786	86	12.7%
20	Preparations of Vegetables, Fruit, Nuts or Other Parts of Plants	2,472	9	0.4%
90	Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical or Surgical Instruments and Apparatus; Parts and Accessories	2,118	33	3.1%
40	Rubber and Articles Thereof	1,978	17	1.1%
22	Beverages, Spirits, and Vinegar	1,954	9	0.6%
73	Articles of Iron or Steel	1,106	26	1.8%
87	Vehicles Other than Railway or Tramway Rolling-stock, and Parts and Accessories Thereof	1,006	16	8.0%
33	Essential Oils and Resinoids; Perfumery, Cosmetic or Toilet Preparations	974	7	0.7%
21	Miscellaneous Edible Preparations	941	6	0.4%
39	Plastics and Articles Thereof	837	26	3.4%
04	Dairy Produce; Birds' Eggs; Natural Honey; Edible Products of Animal Origin, Not Elsewhere Specified or Included	762	10	0.6%
38	Miscellaneous Chemical Products	749	26	1.1%
27	Mineral Fuels, Mineral Oils and Products of Their Distillation; Bituminous Substances; Mineral Waxes	549	16	14.0%

Note: Based on entries created from notifications by all WTO members except the United States. Only entries with an HS-4 or an HS-6 code were used. One notification may produce multiple entries under the same HS classification.
Source: Author's calculations based on notifications from January 1, 2006 to August 18, 2015; 2014 global export data from UN Comtrade.

High Frequency Indexes

In twenty-seven chapters, all HS-4 categories had notifications during the 2006 to 2015 period. These chapters—shown in Table 4—cover coffee, meat, cereals, fertilizers, sugars, beverages, tobacco, and several different types of textiles.

Table 4: Chapters with 100% Frequency Index at HS-4 Level

Chapter	Description	% of Global Exports, 2014
94	Furniture; bedding etc; lamps nesoi etc; prefab bd	1.42%
61	Apparel articles and accessories, knit or crochet	1.27%
62	Apparel articles and accessories, not knit etc.	1.25%
64	Footwear, gaiters etc. and parts thereof	0.82%
44	Wood and articles of wood; wood charcoal	0.80%
2	Meat and edible meat offal	0.78%
10	Cereals	0.71%
33	Essential oils etc; perfumery, cosmetic etc preps	0.67%
22	Beverages, spirits and vinegar	0.66%
4	Dairy prods; birds eggs; honey; ed animal pr nesoi	0.57%
19	Prep cereal, flour, starch or milk; bakers wares	0.40%
63	Textile art nesoi; needlecraft sets; worn text art	0.38%
7	Edible vegetables & certain roots & tubers	0.38%
20	Prep vegetables, fruit, nuts or other plant parts	0.36%
34	Soap etc; waxes, polish etc; candles; dental preps	0.35%
31	Fertilizers	0.35%
68	Art of stone, plaster, cement, asbestos, mica etc.	0.30%
16	Edible preparations of meat, fish, crustaceans etc	0.29%
9	Coffee, tea, mate & spices	0.28%
54	Manmade filaments, including yarns & woven fabrics	0.27%
17	Sugars and sugar confectionary	0.26%
24	Tobacco and manufactured tobacco substitutes	0.24%
55	Manmade staple fibers, incl yarns & woven fabrics	0.23%
60	Knitted or crocheted fabrics	0.19%
11	Milling products; malt; starch; inulin; wht gluten	0.11%
13	Lac; gums, resins & other vegetable sap & extract	0.05%
36	Explosives; pyrotechnics; matches; pyro alloys etc	0.04%
All	Total	13.41%

Source: Author's calculations based on notifications by all WTO members except the United States from January 1, 2006 to August 18, 2015, and 2014 global export data from UN Comtrade.

Chapters 84 and 85 (machinery and mechanical appliances; electrical machinery and equipment; etc.) and chapter 87 (vehicles and parts), which together account for 33.1 percent of global exports, had a combined frequency index of 94.7 percent (see Table A.4 in Appendix E).

Other chapters with high frequency indexes and coverage ratios cover iron and steel; ceramic products; organic chemicals; optical, photographic, or measuring/checking instruments and medical or surgical instruments; edible fruit & nuts; fish, crustaceans, and aquatic invertebrates; and pharmaceutical products. For a full list of frequency indexes and coverage ratios, see Table A.4 in Appendix E.

Low Frequency Indexes

For 23.1 percent of HS-4 commodity categories for which there were global exports in 2014, no WTO members notified any measures under the TBT agreement over the 2006 to 2015 period. These commodity categories represented 7.1 percent of global exports in 2014. In examining frequency indexes and coverage ratios at the HS 2-digit level, there were few clear patterns across or within sectors. (See Table A.4 in the Appendix for a full list of chapters with frequency indexes and coverage ratios.) Table 5 shows chapters that had frequency indexes below 40 percent, which include wood pulp, pearls and precious stones, works of art, musical instruments, live trees and plants, and cork, tin, nickel, and lead and articles thereof. These commodities could be ones for which technical regulations have limited relevance, or for which technical regulations would not provide a competitive advantage for domestic producers. Alternately, they could be products for which international standards are used across the world.

Table 5: Chapters with Less than 40% Frequency Index at HS-4 Level

Chapter	Description	Frequency Index	Coverage Ratio	% of World Ex 2014
75	Nickel and articles thereof	38%	18%	0.18
53	Veg text fib nesoi; veg fib & paper yns & wov fab	36%	51%	0.02
42	Leather art; saddlery etc; handbags etc; gut art	33%	94%	0.45
66	Umbrellas, walking-sticks, riding-crops etc, parts	33%	5%	0.02
78	Lead and articles thereof	33%	0%	0.04
81	Base metals nesoi; cermets; articles thereof	31%	56%	0.10
91	Clocks and watches and parts thereof	29%	2%	0.33
71	Nat etc pearls, prec etc stones, pr met etc; coin	28%	68%	3.68
5	Products of animal origin, nesoi	27%	68%	0.06
67	Prep feathers, down etc; artif flowers; h hair art	25%	54%	0.05
45	Cork and articles of cork	25%	47%	0.01
6	Live trees, plants, bulbs etc.; cut flowers etc.	25%	43%	0.13
14	Vegetable plaiting materials & products nesoi	25%	18%	0.01
80	Tin and articles thereof	20%	14%	0.04
47	Pulp of wood etc; waste etc of paper & paperboard	14%	20%	0.27
92	Musical instruments; parts and accessories thereof	13%	2%	0.04
97	Works of art, collectors' pieces and antiques	0%	0%	0.12
37	Photographic or cinematographic goods	0%	0%	0.09
46	Mfr of straw, esparto etc.; basketware & wickerwrk	0%	0%	0.01

Source: Author's calculations based on notifications by all WTO members except the United States initiated from January 1, 2006 to August 18, 2015, and 2014 global export data from UN Comtrade

UNCTAD TBT Non-Tariff Measures

To check the robustness of the assumptions underlying the analysis of WTO notifications, I examined TBT-related non-tariff measures for the European Union (EU) collected by the UN Conference on Trade and Development (UNCTAD)—henceforth "UNCTAD TBT NTMs" or "EU TBT NTMs." UNCTAD collects data for selected economies on certain non-tariff measures (NTMs) that could potentially affect trade

and has complied information on TBT NTMs[14] from 2014 in 25 economies. Information from previous years is limited, but in some cases the measures date back years or decades.

I chose to focus on EU TBT NTMs, which were available from 2012 to 2014, because the EU is the largest U.S. trading partner and the partner to which the U.S. exported the second-most varieties of goods in 2015.[15] All of the EU TBT NTMs from this time period had commodity classification data included at the 8-digit EU Combined Nomenclature (CN-8) level. Since the EU CN-8 tariff lines differ from global and U.S. tariff lines at the 8-digit level, I also categorized the NTMs under the parent 6-digit (HS-6) commodity classification to match with U.S. export data. I then matched HS-6 and CN-8 information from EU TBT NTMs with 2014 EU imports at the HS-6 and CN-8 level.[16]

Table 6: Frequency Index and Coverage Ratio for EU TBT NTMs

U.S. Exports, HS-6	92.4%	92.5%
EU Imports, HS-6	94.4%	92.9%
EU Imports, CN-8	91.8%	91.8%

Note: EU import data covered all EU-28 imports in 2014 at the 8-digit Combined Nomenclature (CN) commodity classification level.
Source: Author's calculations based on UNCTAD NTM data; 2015 U.S. export data from U.S. Department of Commerce; 2014 HS-6 EU import data from UN Comtrade; and 2014 CN-8 EU import data from Eurostat.

Table 6 shows the results for analyses of EU TBT NTMs. I found that EU TBT NTMs from 2012 to 2014 were linked to 92.4 percent of U.S. exports to the EU in 2015, with a frequency index 92.5 percent of U.S. product categories with nonzero exports.[17] For EU imports from the world at the HS-6 level, 94.4 percent of 2014 imports were covered by TBT NTMs, accounting for 92.9 percent of product categories.[18] When looking at EU imports at the 8-digit (CN-8) commodity classification level, 91.8 percent of EU imports were covered by TBT NTMs, accounting for 91.8 percent of tariff lines with non-zero imports.

Unlike in the results for WTO notifications, there are smaller gaps between the frequency indexes and the coverage ratios for EU TBT NTMs. This could indicate better data coverage, perhaps because UNCTAD NTMs are compiled by outside experts while WTO notifications are voluntary.[19] Alternatively, it

[14] UNCTAD (2013) defines NTMs as "all measures altering the conditions of international trade, including … [those] that restrict trade and those that facilitate it." UNCTAD (2012) defines TBT NTMs as "measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the SPS Agreement."

[15] In 2015, the United States exported the most varieties of goods at the HS-6 product category level to Canada, with the EU receiving the second most. The EU received 92 percent of all of the types of goods exported by the United States, based on number of tariff lines for which there were exports in 2015. (Source: 2015 U.S. export data from U.S. Department of Commerce.)

[16] The source for EU import data was Eurostat. I made estimates to account for suppressed U.S. aircraft export data, as discussed in Appendix D.

[17] There were 52 tariff lines with zero U.S. exports in 2015 that were linked to TBT NTMs.

[18] There were no tariff lines with zero imports linked to TBT NTMs.

[19] The CEPII NTM-MAP database provides frequency and coverage of each economy's imports for which UNCTAD has collected NTM data. Coverage ratios vary widely, indicating some of the limitations of the UNCTAD data set. For a detailed discussion, see appendix C.

could indicate that UNCTAD experts have linked NTMs under a certain commodity heading (e.g., 8418) to all of the subheadings contained therein (e.g., 8418.10, 8418.21, etc.).

Overall, the analysis of EU TBT NTMs supports the assumptions and findings for the analysis of WTO notifications. Based on the high coverage and frequency, it seems reasonable to assume that WTO notifications underrepresent the true number of technical regulations in place in WTO member economies, and that a notification for a particular product made by any WTO member could serve as a good proxy for the overall global regulatory environment on that product.

Conclusion

Technical regulations—especially those that that are based on national or regional standards instead of on international standards—can create additional costs for exporters as they seek to adapt their products and processes to differing regulatory requirements around the globe. The high coverage ratios (around 92–93 percent) and frequency indexes (from 77–92 percent) for WTO notifications and EU TBT NTMs show the widespread nature of technical regulations and their important link with goods trade. Further research, however, is necessary to determine whether the strong link represents a quantifiable impact on the volume of trade.

Additional research could involve an econometric model that would use data on WTO Notifications or UNCTAD TBT NTMs to estimate the effect of frequency and coverage levels on import volume, domestic prices, or consumer welfare in importing economies. Research could also examine WTO Notifications across time for countries that routinely notify measures to see whether impact varied depending on the notification trends. Further research could also look at a narrower set of NTMs—individual WTO notifications or UNCTAD TBT NTMs, or NTMs within a certain sector—to estimate whether these led to a change in trade flows.

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Appendix A: Defining Standards, Technical Regulations, and TBTs

The term "**technical regulations**" is used throughout this paper to describe mandatory conformity assessment and other technical requirements that affect goods. This includes requirements for:

- products (e.g., maximum allowable levels for mercury in fish),
- labeling (e.g., required nutritional labels for food products),
- processes (e.g., compulsory standards for managing hazards when using certain chemicals), and
- testing (e.g., required testing for lead paint in children's toys).

It does not include standards or other voluntary certifications—such as certified sustainable wine production or Fair-Trade certification—in the same categories.
Compliance with technical regulations is required by law to get a product in the market, while compliance with **standards** is not required. With standards, however, consumer preferences, large buyers' requirements, or government information may lead to lower sales of products that do not meet the standards.

The lines between technical regulations and standards are not always clear. For example, standards in one country may be mandatory technical regulations in another country, and governments can make standards into technical regulations by incorporating them into law. Indeed, Article 2.4 of the TBT Agreement generally obligates WTO members to use international standards "as a basis for their technical regulations."

According to the World Trade Organization (WTO), technical barriers to trade **(TBTs)** "generally result from the preparation, adoption, and application of different…regulations and conformity assessment procedures" in a way that creates obstacles to trade.[20] Notifications by WTO members to the TBT Committee do not necessarily represent TBTs: Article 2.2 of the WTO TBT Agreement allows "legitimate objectives" for regulation—for example, protecting human health, plant life, or the environment—as long as the regulations do not create "unnecessary obstacles to international trade."

Even backed by legitimate objectives, however, technical regulations can lead to increased costs for exporters through reduced economies of scale and the need for additional testing and product redesign. Moreover, technical regulations can sometimes be used deliberately to shield domestic industries from international competition—and thus would be considered TBTs.[21]
UNCTAD defines NTMs as "all measures altering the conditions of international trade, including … [those] that restrict trade and those that facilitate it": trade barriers are a subset of NTMs that are intended to "favor domestic over foreign suppliers."[22] TBT NTMs are "measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the SPS Agreement."[23]

Appendix B: Related Literature

Many researchers have sought to show the trade impact of standards and technical regulations. Korinek et al. (2008) and Swann (2010) provide extensive overviews of literature on quantifying this impact. In

[20] WTO, "Technical Information on Technical Barriers to Trade."
[21] UNCTAD (2003), "World Trade Organization: 3.10 Technical Barriers to Trade," 3.
[22] UNCTAD (2013), *Non-Tariff Measures to Trade*, 2.
[23] UNCTAD (2012), "International Classification of Non-Tariff Measures," 15.

general, most studies focus on the impact of national or regional standards and technical regulations (i.e., those that differ from international standards), which varies depending on the countries and the industries examined.[24]

In addition, there are many studies seeking to estimate the impact at the firm level of complying with national standards, such as Maskus, Otsuki, and Wilson (2005). Another approach has been to look at the effect on trade of standards harmonization and mutual recognition agreements, as did Chen and Mattoo (2008), Baller (2007), and Reyes (2011).
Researchers face challenges, however, in matching information on individual standards and technical regulations with corresponding trade data: there is no official concordance between the categories in the International Classification for Standards (ICS) and the commodity classifications in the Harmonized Commodity Description and Coding System (HS).[25]

Studies Using Standards Data from Perinorm

Several studies have used Perinorm, a commercial database containing standards in over 20 countries and some technical regulations information, to build data sets that link standards data to trade data. Perinorm includes information on whether countries' national standards and technical regulations are identical (or equivalent) to certain international standards—or to trading partners' standards. Perinorm does not, however, feature information on which commodities are covered by a given standard. Previous studies therefore had to create concordances between Perinorm standards and trade commodity classifications. With concordances in place, researchers generally measured the number of standards in force in a given year for particular commodities, along with how many of those were harmonized with relevant international standards. Researchers also often created frequency indexes, which showed the percentage of all relevant tariff lines that were linked to a national or international standard, and coverage ratios, which showed the percentage of trade that was linked to a national or international standard. Using these and other variables, researchers have created models to estimate the impact of the evolving stock of standards on the industries and countries they examined.

For example, Swann et al. (1996) matched standards in Germany and the United Kingdom with Standard Industrial Classification (SIC) codes in the manufacturing sector to find that, from 1985 through 1991, international standards adopted by the UK increased exports while national UK standards raised both imports and exports. Moenius (2004) created a concordance between standards in 14 countries from 1980 to 1995 with 471 Standard International Trade Classification (SITC) commodity categories at the 4-digit level. He found that international standards promoted bilateral trade, while national standards reduced trade in simple products (e.g., agriculture) but increased trade in complex goods (e.g., manufactured goods). This finding fits with the idea that standards can provide valuable information on compatibility requirements and consumer preferences for complex goods that would be difficult to find elsewhere. Moenius (2006) took a similar approach to standards and technical regulations for electrical products, finding that both national and international standards and regulations increased trade.

[24] National standards and regional standards diverge from international standards.
[25] The HS is a numerical product classification system that is used by most economies for collecting trade statistics and national tariffs. Created and maintained by the World Customs Organization, the HS consists of chapters numbered 01 through 97—the two-digit level—with chapters 98 and 99 reserved for domestic use by each country and chapter 77 reserved for international use. Within chapters, the HS provides detailed classifications up to the 6-digit level (e.g., 8407.50) for over 5,000 commodity groups. (World Customs Organization, "What is the Harmonized System (HS)?" http://www.wcoomd.org/, accessed December 29, 2015)

Czubala et al. (2009), Shepherd (2007), and Shepherd and Wilson (2013) based their analyses on the World Bank's EU Standards Database (EUSDB). The EUSDB consists of European Union (EU) standards from 1993 to 2005 in the agricultural, textiles, and clothing sectors. The standards were matched to relevant HS 4-digit codes through examination of each standard's verbal description. In addition, each standard was assigned a dummy variable on whether it was harmonized with a relevant International Standards Organization (ISO) standard.

Using the EUSDB, Czubala et al. (2009) estimated that the EU's regional standards reduced African exports of clothing and textiles to the EU more than did the EU's use of international standards. Shepherd (2007) examined trade variety in textiles, clothing, and footwear and concluded that increasing numbers of overall standards decreased partners' export variety, while an increasing proportion of international standards in these sectors slightly increased export variety. Shepherd and Wilson (2013) found that the EU's use of regional food and agricultural standards hurt trade partners' exports of these products—particularly from developing countries—while the EU's use of international standards generally had either no effect or a small positive effect on exports. These findings generally fit with the idea that standards diverging from international practice can inhibit trade, while international standards can encourage trade.

Portugal-Perez et al. (2009) used an ICS-to-SITC concordance table developed by Blind (2004) to automatically match EU standards for electronic and electric products from 1990 to 2007 with SITC codes. They found that the EU's use of international standards increased EU imports, while the EU's use of regional standards had no effect or a small negative effect on EU imports.
Manual concordance based on reading individual standards (or summaries thereof) is highly labor-intensive and requires some level of product expertise. On the other hand, using 'automatic' concordance tables across many sectors typically leads to a loss of product-level detail. In addition, Perinorm does not contain standards and technical regulations from China, India, Mexico, Taiwan, and several other major importers. Thus, it is not practical to build a detailed, comprehensive dataset across many sectors or many countries.

WTO Notifications and UNCTAD NTMs

Some researchers have used measures notified by WTO members under the WTO Agreements on Technical Barriers to Trade (TBT) and the Application of Sanitary and Phytosanitary Measures (SPS). Disdier, Fontagné, and Mimouni (2007) reviewed notifications under the SPS and TBT agreements at the HS 4-digit level in certain agricultural products by creating frequency indexes and coverage ratios for imports potentially affected by an importing country's notified measures. They found that the presence of notified measures in OECD countries did not harm exports from other OECD countries, while they did harm developing countries' exports to OECD countries. They also noted that EU Member States' measures were "more trade-impeding" than other OECD members' measures.

Bao and Qiu (2012) analyzed notifications to the TBT Committee made by 105 economies from 1995–2008 across all sectors. Instead of using frequency indexes and coverage ratios, they used the number of notifications made by each economy in each year as a variable in a two-stage gravity model. They found that an increasing number of notifications by one economy reduced trading partners' probability of exporting to the economy but increased export volume. They also found that developing economies' notifications have a significant effect on other developing economies' exports, but not on developed economies' exports; conversely, developed economies' notifications affect fellow developed economies' exports more than developing economies exports.

Recent data collection efforts by UNCTAD on non-tariff measures (NTMs) have led some researchers to examine these NTMs—not only TBT but also many other types of measures. Malouche, Reyes, and Fouad (2013) compared selected frequency indexes and coverage ratios within regions. To create a dataset for further research, Gourdon (2014) used NTM data from 2010 to 2012 to calculate frequency indexes and coverage ratios for imports by a number of economy, and also calculated prevalence scores (average number of NTMs applied to each product by each economy). The Centre d'Études Prospectives et d'Informations Internationales (CEPII) collects these in a database, the CEPII NTM-MAP, which provides frequency indexes, coverage ratios, and prevalence scores for economies' imports.

Cadot and Gourdon (2015) used CEPII NTM-MAP data to estimate ad-valorem equivalents (AVEs) for TBTs and other NTMs by type of products, finding an average AVE of 5 percent and AVEs between 7 and 10 percent for vehicles, animals, vegetables, fats and oils, beverages and tobacco, and optical/medical instruments. They also found regional trade agreements reduce AVEs through "deep-integration" clauses, such as mutual recognition or harmonization.

Appendix C: Data Sources

WTO Notifications

WTO member notifications to the TBT Committee include information on the products that the regulations would cover, often as a list of Harmonized System (HS) codes or International Classification for Standards (ICS) codes. For HS codes, notifications may be at the 2-digit level up to the 6-digit level. Members provide these formal notifications to the WTO Secretariat, which compiles them and circulates them to WTO members. Where members provide product information as an ICS code, the WTO Secretariat converts it to HS using a table with HS-to-ICS concordances. Such product information—similar to the 'automatic' concordances applied in Portugal-Perez et al. (2009)—is labeled as WTO-interpreted information.[26]

Advantages and Limitations of Analyzing Notifications

Notifications provide a link between technical regulations and goods trade that makes them useful for thinking about trade barriers. The majority of notifications are connected to particular commodities, which allows us to see patterns across all commodities and across a time period without labor-intensive manual concordance.[27] Nevertheless, using notifications as a data source creates limitations on the assertions we can make about trade and trade barriers:

1. Measures notified under the TBT agreement do not necessarily constitute trade barriers for WTO purposes. Per Article 2.2 of the TBT Agreement, they should instead reflect "legitimate objectives" for regulation and should be designed to avoid "unnecessary obstacles to trade."
2. Notifications contain incomplete information on whether the notified measure was ever brought into force. Making a notification thus indicates that a WTO member has a desire to regulate, not that it will have a final regulation. Since the WTO does not require updates on whether notified measures have come into force, the list of notifications will contain some measures that never became law.[28] Although only 15.4 percent of notifications contained the date on which the measures had come into force or would come into force (see Table A.1), around 86.8 percent of notifications with HS information but no date of entry into force have been placed in force.[29] Furthermore, even measures that are notified but not brought into force could still affect trade if exporters find the notification a credible threat and response by seeking alternative markets or otherwise changing export patterns.
3. The HS information connected to WTO notifications (see Table A.1) may not accurately reflect the products covered. The WTO Secretariat does not verify whether members have included the correct HS codes or ICS codes in notifications. Thus, errors or misrepresentations in the notifications could impact the accuracy of this paper's analysis. In addition, the HS-to-ICS concordance tables may not accurately capture the products covered by the notifications where members did not provide HS information.[30]

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[26] For more information on HS-to-ICS concordance and the tables used, see WTO, "I-TIP Goods: Integrated Analysis and Retrieval of Notified Non-Tariff Measures" (accessed December 9, 2015).

[27] From 2006 to 2015, 58.8 percent of notifications contained HS information, whether member-provided or WTO-interpreted.

[28] According to the WTO, the TBT Agreement does not "seek to maintain a reliable stock on measures in force (although members have been increasingly notifying the entry into force on a voluntary basis)." (Source: WTO, "I-TIP Goods: Integrated Analysis and Retrieval of Notified Non-Tariff Measures," accessed December 9, 2015.

[29] This is based on a random sample. At the 95 percent confidence level, the margin of error is 5.2 percent. See Appendix F for more details.

[30] WTO members provided HS information for 29.7 percent of total notifications initiated from January 1, 2006, to August 18, 2015.

Table A.1: WTO Notifications by Year, 2006–2015

Year	Number of Notifications	Percentage with date of entry into force	Percentage with HS information
2006	872	4.7%	60.3%
2007	1,029	6.8%	56.4%
2008	1,250	8.9%	85.6%
2009	1,487	20.1%	65.6%
2010	1,413	22.1%	65.3%
2011	1,216	15.0%	63.9%
2012	1,552	10.8%	57.0%
2013	1,600	10.2%	57.0%
2014	1,526	20.1%	34.1%
2015	895	29.3%	42.0%
Total	**#REF!**	**14.9%**	**58.8%**

** Notifications examined for 2015 cover less than 8 months of notifications.*
Note: Includes all notifications initiated from January 1, 2006, to August 18, 2015.
Source: Author's calculations based on data retrieved from WTO Integrated Trade Intelligence Portal (I-TIP) on December 11, 2015

Key Assumptions

For several reasons, I assume that WTO notifications are a small subset of the true stock of technical regulations applied by WTO members:

1. Notifications do not constitute an exhaustive list of all technical regulations with a potentially significant trade impact in all WTO member countries. For example, countries make notifications by choice; there is no penalty for non-compliance. If members are facing capacity constraints within government—or are considering measures that might not comply with the TBT Agreement—they do not have strong incentives to notify.[31]

2. WTO members have different thresholds for what should be notified. For example, India reported that it had around 19,313 standards at the end of 2014, of which 70 percent did not have corresponding international standards; [32] from 2006 through 2014, however, India only notified 35 measures to the TBT Committee.[33] In addition, in the interest of transparency, some members make notifications even when they intend to incorporate relevant international standards into national law.[34] Thus, notifications do not isolate national or regional standards in the way Perinorm data can.[35]
3. The TBT Agreement only obligates members to notify new measures, not measures that existed prior to the Members' accession to the TBT Agreement. Thus, the database of notifications represents the flow of measures, not the stock of all measures in force.

[31] Countries may have incentives not to notify measures that would not comply with the TBT Agreement, as it would increase trade partners' knowledge of such measures and could lead to WTO disputes. See Malouche, Reyes, and Fouad (2013).
[32] WTO Secretariat (2015), *Trade Policy Review: India, 2015*, 59.
[33] Author's calculations based on WTO notifications from January 1, 2006 to August 18, 2015.
[34] See footnote 7 in USTR (2014), *2014 Report on Technical Barriers to Trade*, 14–15.
[35] In addition, notified measures may apply to products for which international standards have not yet been developed (e.g., newly-developed consumer products, such as electronic cigarettes or virtual-reality headsets).

4. Within the WTO notifications examined, 41.2 percent of notifications did not have HS information and thus could not be linked with goods exports.

Given these factors, I considered the WTO notifications to be a proxy for the larger regulatory environment. Thus, I assume that that a notification by one economy for one product category indicates that this product is linked to U.S. exports and global exports, regardless of destination of those exports. This is a strong assumption, which I test in Section 4 by using another source of data on technical regulations.

Data Processing

The WTO Integrated Trade Intelligence Portal (I-TIP) contains information compiled by the WTO about certain trade policy measures, including both tariff measures and non-tariff measures (NTMs). I used I-TIP to retrieve information about all of the 12,840 WTO member notifications to the TBT Committee that were initiated during January 1, 2006 to August 18, 2015.[36] I only examined newly notified measures that had not been withdrawn, and did not cover those with revised, corrected, or added information.

I did not examine earlier notifications in detail because WTO members notified less frequently: they notified an average of 625 notifications per year from 1995 through 2005, compared to 1,327 per year from 2006 to 2014. In addition, only 32 percent of notifications before 2006 contained HS information, leaving even fewer regulations to link with goods trade.
I eliminated notifications for which no HS code information was attached so that there would not be a need for manual concordance between measures and commodity classifications. The remaining 7,544 notifications either contained HS codes provided by the notifying members or contained WTO-interpreted HS codes.

Many measures contained more than one HS code, so I created a separate entry for each code specified. Of these 44,158 entries, I eliminated 9,180 entries (20.8 percent of the total) that provided only HS-2 product information so as to focus on more precise commodity classification; HS-2 codes do not provide information about which specific product categories are being targeted for regulation. I sorted the remaining 34,978 entries into groups at the HS 4-digit level. For entries containing HS 6-digit information, I categorized them under their parent HS 4-digit classification.

To calculate the frequency indexes and coverage ratios for WTO notifications, I matched the 4-digit HS information from the notifications—using the assumptions made in this previous section—with trade data on U.S. exports and global exports.[37] For U.S. trade data, I used 2015 total exports from 4-digit commodity classifications in the *Schedule B: Statistical Classification of Domestic and Foreign Commodities Exported from the United States*.[38] For global trade data, I used UN Comtrade data on 2014 exports by HS-4 category.

[36] Data were retrieved on December 11, 2015.
[37] Although measures contained in U.S. notifications would not directly affect U.S. exports, I included U.S. notifications when calculating frequency indexes and coverage ratios linked to U.S. exports. This is consistent with assumption that notifications serve as a proxy for the global regulatory environment. The marginal effect of including U.S. notifications is minimal; see note to Table 1 in Section 2.
[38] For 2015 U.S. exports, there were 20 HS-4 lines that were linked to WTO notifications but for which there were no U.S. exports. Based on trade partners' reported imports, these 20 lines include several for which U.S. export

UNCTAD TBT Non-Tariff Measures

The UN Conference on Trade and Development (UNCTAD) began collecting data on non-tariff measures (NTMs) in 1994 and reaffirmed its efforts in 2006 with the creation of the Group of Eminent Persons on Non-Tariff Barriers and enlisting the help of a Multi-Agency Support Team. Starting in 2009, UNCTAD worked with local consultants around the world as well as national ministries to collect NTM data on "official measures currently imposed" by selected countries that could potentially affect trade.[39]

UNCTAD has developed an original classification scheme for NTMs, for which experts classify each NTM according to which type of measure it is (e.g., SPS measures are classified as "A" and TBT measures as "B") and then by which type of requirement it is (e.g., a product registration requirement related to SPS would be A81). UNCTAD experts also map NTMs to the HS codes affected at the HS-6 level, or the national tariff line code (at the 8-digit level) if more specific.[40] The classification system allows researchers to compare NTMs across countries.

UNCTAD defines TBT NTMs as "measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards, excluding measures covered by the SPS Agreement."[41] UNCTAD features information on TBT NTMs from 2014 in only 25 economies: the European Union; 17 countries in the Americas (including Argentina, Brazil, and Mexico); and 7 countries in Africa. Fewer countries are covered in 2012 and 2013, and coverage from 2009 to 2011 is highly limited. For some economies UNCTAD has included older measures dating back over 30 years.

Advantages and Disadvantages

UNCTAD TBT NTMs create several of the same limitations that WTO notifications create. Like WTO notifications, UNCTAD TBT NTMs are not necessarily trade barriers,[42] nor do they cover standards. They also include countries' regulations that incorporate international standards, so they do not isolate national or regional standards. Similarly, they too may not represent the full stock of measures, as UNCTAD has only classified older measures for certain countries.

Unlike WTO notifications, however, UNCTAD TBT NTMs only include measures that are being applied, so the NTMs do not cover proposed measures that are never brought into force. In addition, UNCTAD does not rely on self-reporting, so UNCTAD's TBT NTMs are likely to be more expansive in catching measures than are WTO notifications. That said, as UNCTAD only relies on official documents, data would be less comprehensive for economies whose governments do not routinely publish regulations in official gazettes or on official websites.

Data Processing

The World Bank World Integrated Trade Solution (WITS) database contains UNCTAD's NTM data. I focused on European Union (EU) NTMs on TBTs, for which there is coverage from 2012 to 2014. There were 284 measures from this time period, each of which had commodity classification data at the 8-digit

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data appear to be suppressed to avoid revealing individual company information, such as photocopiers; magnetic tape recorders and other sound recording apparatus; and records, tapes, and other recorded media.

[39] UNCTAD (2014). "Guidelines to Collect Data on Official Non-Tariff Measures," 3.

[40] UNCTAD (2014) provides detailed guidelines for classification by product.

[41] UNCTAD (2012), "International Classification of Non-Tariff Measures," 15.

[42] Gourdon (2014) points out that they are "largely regulatory policies in response to a variety of concerns raised by society…[and] are not necessarily restrictive" but that many "likely have distortionary impact on trade."

EU Combined Nomenclature (CN-8) tariff line level. As many of the NTMs covered multiple commodity classifications, there were a total of 54,395 entries.[43]
Since the EU and the U.S. commodity classifications match at the 6-digit level but vary at the 8-digit level, I also categorized the NTMs under the parent 6-digit commodity classification. To calculate the frequency index and coverage ratio for the UNCTAD TBT NTMs, I matched the HS-6 information from the NTMs with 2015 U.S. total exports from 6-digit Schedule B commodity classifications. I also matched the NTMs with EU imports at the HS-6 level and the CN-8 level to calculate separate frequency indexes and coverage ratios.

CEPII NTM-MAP

Although I could have drawn frequency and coverage numbers for EU TBT NTMs from an existing database, I calculated them separately to be consistent with the methodology I used for WTO notifications. That database, CEPII NTM-MAP (see Appendix B for background), includes information on frequency and coverage information in all economies for which UNCTAD has collected TBT NTM data.

Table A.2 offers frequency and coverage information for selected economies. The coverage ratios vary widely from economy to economy, from Hong Kong and India (99.9 percent coverage) to Honduras (1.6 percent) and Senegal (1.3 percent). This variation shows some of the limitations of the UNCTAD NTM data: since UNCTAD only relies on "official national documents" for information on NTMs,[44] data would likely be less complete for economies with less transparent government practices. Economies that publish a lower proportion of their regulations might also publish a lower proportion of their NTMs. An interesting extension could involve researching the relationship between government transparency and coverage and frequency numbers.

Table A.2: CEPII NTM-MAP Coverage Ratio and Frequency Index for Selected Economies

Economy	Coverage Ratio	Frequency Index
Hong Kong	99.9%	99.9%
India	99.9%	99.6%
European Union	95.2%	93.0%
Turkey	89.8%	76.9%
Argentina	81.7%	81.6%
China	78.4%	60.3%
Brazil	72.7%	72.4%
Mexico	67.4%	56.4%
Ecuador	54.5%	50.5%
Rwanda	53.3%	30.1%
Ghana	44.6%	37.7%
Venezuela	36.4%	19.1%
Peru	36.6%	24.1%

[43] The mean number of commodity classifications covered per measure was 191.5; the median number covered was 20.
[44] UNCTAD (2014). "Guidelines to Collect Data on Official Non-Tariff Measures," 4.

Russia	32.1%	22.6%
Pakistan	23.7%	26.8%
Mali	18.8%	8.7%
Guatemala	5.7%	4.1%
Honduras	1.6%	3.0%
Senegal	1.3%	1.9%

Note: Year of UNCTAD NTMs used is 2014, except for Hong Kong (2010), India (2012), Turkey (2010), China (2012), Rwanda (2011), Russia (2009), and Senegal (2012).
Source: CEPII (2015), "Non-Tariff MAP Database."

Appendix D: Accounting for Exports from the U.S. Aircraft Sector

Since 2009, the U.S. Census Bureau has suppressed export data for a number of 10-digit Schedule B commodities in the aircraft sector by combining them into the Schedule B code 8800.00.0000 (referred to hereafter as 8800.[45] In 2015, U.S. exports classified under this code were $103 billion, which represented 7.9 percent of U.S. total exports to the world, and 12.0 percent of U.S. total exports to the EU.[46] The commodity classification 8800 does not exist in the Harmonized System, so no countries would be able to make notifications to the WTO TBT Committee for measures that could match these exports.

To estimate the percentage of these exports that might be linked to mandatory standards, I considered the 4-digit and 6-digit categories that contain the Schedule B codes that comprise 8800.[47] During the 2006 to 2015 period, WTO members made notifications for all 4-digit classifications except 8805. In UNCTAD TBT NTMs, EU NTMs occurred in all of the 6-digit classifications.
Since it is impossible to determine the percent of U.S. exports of 8800 covered by each suppressed commodity category, I considered instead the European Union's exports of the relevant HS-4 (see Table A.3) and HS-6 commodities. The EU's 28 members exported $321 billion of the HS-4 products to non-EU countries in 2014 and $31 billion of the HS-6 products. Using these as a proxy for U.S. exports, I estimate that 99.9 percent of U.S. exports of 8800 would be covered during 2006 to 2015. For UNCTAD NTMs, I estimate that 100 percent of U.S. exports would be covered by EU TBT NTMs.

Table A.3: 2014 European Union Exports from HS-4 covered by Schedule B classification 8800

HS-4 and Description	Exports to the world (millions of $)
4011--New pneumatic tires, of rubber	31,850.4
4012--Retread or used pneu tires, solid tires etc, rubbr	1,239.2
6812--Fabricated asbestos fibers, items of mixtures etc	10.5

[45] For more details, see U.S. Census Bureau, "Aircraft Industry Trade Data Changes," June 10, 2009, http://www.census.gov/foreign-trade/statistics/notices/aircraft/index.html.
[46] This calculation of total exports excludes exports classified under chapter 98 and 99.
[47] For a full list of Schedule B codes at the 10-digit level, see U.S. Census Bureau, "Aircraft Industry Trade Data Changes: Affected Classification Codes," http://www.census.gov/foreign-trade/statistics/notices/aircraft/codes.html.

7007--Safety glass, of tempered or laminated glass	5,867.1
8407--Spark-ignition recip or rotary int comb piston eng	20,589.5
8411--turbojets, turbopropellers & oth gas turbines, pts	55,033.3
8412--Engines and motors nesoi, and parts thereof	9,815.7
8525--Trans appar for radiotele etc; tv camera & rec	9,317.4
8526--Radar apparatus, radio navig aid & remote cont app	6,994.6
8527--Reception apparatus for radiotelephony etc	,808.6
8543--Electrical mach etc, with ind functions nesoi, pts	9,781.0
8801--Balloons & dirigibles; gliders etc	20.0
8802--Aircraft, powered; spacecraft & launch vehicles	91,875.2
8803--Parts of balloons etc, aircraft, spacecraft etc	43,152.2
8805--Aircraft launch gear; deck-arrest; gr fl train; pt	286.5
9014--Direction finding compasses & navig inst etc, pts	3,311.8
9029--Revolution & production count, taximeters etc, pts	3,569.6
9401--Seats (except barber, dental, etc), and parts	28,365.3
Total	**321,079.3**

Source: UN COMTRADE

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Appendix E: Additional Tables

This table shows the frequency index and coverage ratio for all HS-2 categories (chapters) —except for 98 and 99. It also shows the number HS-4 tariff lines within each chapter for which there were no notifications. These calculations exclude WTO notifications made by the United States.

Table A.4: Frequency Index and Coverage Ratio by Chapter, 2014 World Exports

HS	Description	Frequency Index	Coverage Ratio	% Of Global Exports, 2014	HS-4 Tariff Lines Not Notified
33	Essential oils etc; perfumery, cosmetic etc preps	100%	100%	0.7%	0
63	Textile art nesoi; needlecraft sets; worn text art	100%	100%	0.4%	0
55	Manmade staple fibers, incl yarns & woven fabrics	100%	100%	0.2%	0
2	Meat and edible meat offal	100%	100%	0.8%	0
24	Tobacco and manufactured tobacco substitutes	100%	100%	0.2%	0
4	Dairy prods; birds eggs; honey; ed animal pr nesoi	100%	100%	0.6%	0
44	Wood and articles of wood; wood charcoal	100%	100%	0.8%	0
7	Edible vegetables & certain roots & tubers	100%	100%	0.4%	0
61	Apparel articles and accessories, knit or crochet	100%	100%	1.3%	0
9	Coffee, tea, mate & spices	100%	100%	0.3%	0
68	Art of stone, plaster, cement, asbestos, mica etc.	100%	100%	0.3%	0
10	Cereals	100%	100%	0.7%	0
31	Fertilizers	100%	100%	0.3%	0
11	Milling products; malt; starch; inulin; wht gluten	100%	100%	0.1%	0
34	Soap etc; waxes, polish etc; candles; dental preps	100%	100%	0.3%	0
13	Lac; gums, resins & other vegetable sap & extract	100%	100%	0.0%	0
54	Manmade filaments, including yarns & woven fabrics	100%	100%	0.3%	0
16	Edible preparations of meat, fish, crustaceans etc	100%	100%	0.3%	0
60	Knitted or crocheted fabrics	100%	100%	0.2%	0
17	Sugars and sugar confectionary	100%	100%	0.3%	0
62	Apparel articles and accessories, not knit etc.	100%	100%	1.3%	0
19	Prep cereal, flour, starch or milk; bakers wares	100%	100%	0.4%	0
64	Footwear, gaiters etc. and parts thereof	100%	100%	0.8%	0
20	Prep vegetables, fruit, nuts or other plant parts	100%	100%	0.4%	0
94	Furniture; bedding etc; lamps nesoi etc; prefab bd	100%	100%	1.4%	0
22	Beverages, spirits and vinegar	100%	100%	0.7%	0
36	Explosives; pyrotechnics; matches; pyro alloys etc	100%	100%	0.0%	0
73	Articles of iron or steel	96%	100%	1.8%	1
85	Electric machinery etc; sound equip; tv equip; pts	95%	99%	18.7%	4
90	Optic, photo etc, medic or surgical instrments etc	94%	84%	3.2%	2
84	Nuclear reactors, boilers, machinery etc.; parts	94%	99%	6.4%	3
87	Vehicles, except railway or tramway, and parts etc	94%	100%	8.1%	1
72	Iron and steel	93%	93%	2.4%	2

69	Ceramic products	93%	95%	0.3%	1
8	Edible fruit & nuts; citrus fruit or melon peel	93%	100%	0.6%	1
29	Organic chemicals	91%	96%	2.3%	4
41	Raw hides and skins (no furskins) and leather	91%	99%	0.2%	1
3	Fish, crustaceans & aquatic invertebrates	88%	99%	0.6%	1
95	Toys, games & sport equipment; parts & accessories	88%	97%	0.5%	1
82	Tools, cutlery etc. of base metal & parts thereof	87%	86%	0.4%	2
93	Arms and ammunition; parts and accessories thereof	86%	100%	0.1%	1
28	Inorg chem; prec & rare-earth met & radioact compd	86%	97%	0.6%	7
52	Cotton, including yarn and woven fabric thereof	83%	99%	0.4%	2
21	Miscellaneous edible preparations	83%	97%	0.4%	1
18	Cocoa and cocoa preparations	83%	93%	0.3%	1
30	Pharmaceutical products	83%	99%	3.0%	1
59	Impregnated etc text fabrics; tex art for industry	82%	49%	0.1%	2
76	Aluminum and articles thereof	81%	65%	1.0%	3
27	Mineral fuel, oil etc.; bitumin subst; mineral wax	81%	99%	14.1%	3
57	Carpets and other textile floor coverings	80%	89%	0.1%	1
51	Wool & animal hair, including yarn & woven fabric	77%	84%	0.1%	3
15	Animal or vegetable fats, oils etc. & waxes	76%	99%	0.6%	5
70	Glass and glassware	75%	95%	0.4%	5
32	Tanning & dye ext etc; dye, paint, putty etc; inks	73%	98%	0.5%	4
83	Miscellaneous articles of base metal	73%	97%	0.4%	3
12	Oil seeds etc.; misc grain, seed, fruit, plant etc	71%	98%	0.6%	4
40	Rubber and articles thereof	71%	86%	1.1%	5
48	Paper & paperboard & articles (inc papr pulp artl)	70%	71%	1.0%	7
1	Live animals	67%	90%	0.1%	2
56	Wadding, felt etc; sp yarn; twine, ropes etc.	67%	95%	0.1%	3
89	Ships, boats and floating structures	63%	95%	0.8%	3
39	Plastics and articles thereof	62%	68%	3.3%	10
38	Miscellaneous chemical products	58%	80%	1.1%	11
35	Albuminoidal subst; modified starch; glue; enzymes	57%	75%	0.2%	3
50	Silk, including yarns and woven fabric thereof	57%	91%	0.0%	3
79	Zinc and articles thereof	57%	15%	0.1%	3
23	Food industry residues & waste; prep animal feed	56%	44%	0.5%	4
86	Railway or tramway stock etc; traffic signal equip	56%	76%	0.3%	4
96	Miscellaneous manufactured articles	53%	55%	0.3%	9
25	Salt; sulfur; earth & stone; lime & cement plaster	52%	71%	0.3%	14
43	Furskins and artificial fur; manufactures thereof	50%	41%	0.1%	2
26	Ores, slag and ash	48%	91%	1.3%	11
74	Copper and articles thereof	47%	73%	0.9%	10
58	Spec wov fabrics; tufted fab; lace; tapestries etc	45%	65%	0.1%	6

49	Printed books, newspapers etc; manuscripts etc	45%	84%	0.3%	6
65	Headgear and parts thereof	43%	91%	0.1%	4
88	Aircraft, spacecraft, and parts thereof	40%	99%	1.2%	3
75	Nickel and articles thereof	38%	18%	0.2%	5
53	Veg text fib nesoi; veg fib & paper yns & wov fab	36%	51%	0.0%	7
42	Leather art; saddlery etc; handbags etc; gut art	33%	94%	0.4%	4
66	Umbrellas, walking-sticks, riding-crops etc, parts	33%	5%	0.0%	2
78	Lead and articles thereof	33%	0%	0.0%	4
81	Base metals nesoi; cermets; articles thereof	31%	56%	0.1%	9
91	Clocks and watches and parts thereof	29%	2%	0.3%	10
71	Nat etc pearls, prec etc stones, pr met etc; coin	28%	68%	3.7%	13
5	Products of animal origin, nesoi	27%	68%	0.1%	8
67	Prep feathers, down etc; artif flowers; h hair art	25%	54%	0.1%	3
45	Cork and articles of cork	25%	47%	0.0%	3
6	Live trees, plants, bulbs etc.; cut flowers etc.	25%	43%	0.1%	3
14	Vegetable plaiting materials & products nesoi	25%	18%	0.0%	3
80	Tin and articles thereof	20%	14%	0.0%	4
47	Pulp of wood etc; waste etc of paper & paperboard	14%	20%	0.3%	6
92	Musical instruments; parts and accessories thereof	13%	2%	0.0%	7
97	Works of art, collectors' pieces and antiques	0%	0%	0.1%	6
37	Photographic or cinematographic goods	0%	0%	0.1%	7
46	Mfr of straw, esparto etc.; basketware & wickerwrk	0%	0%	0.0%	2
Total		**76.10%**	**92.80%**	**100%**	**299**

Note: Based from entries created from measures notified by members from January 1, 2006, to August 18, 2015, by all WTO members except the United States. Only entries with an HS-4 or an HS-6 code were used.
Source: Author's calculations based on WTO notifications by all WTO members except the United States from January 1, 2006 to August 18, 2015, and 2014 global export data from UN Comtrade.

Appendix F: Information on Entry into Force

To study further whether measures notified to the WTO TBT Committee were likely to be in force, I examined the population of notifications from all WTO members (besides the United States) made between January 1, 2006, and August 18, 2015, for which the I-TIP entry contained HS information but contained no information on the date of entry into force. I only looked at notifications with HS information because these were the notifications analyzed for this paper. From these 5,920 notifications, I took a simple random sample (without replacement) of 159 notifications.

For each measure in the sample, I verified whether the measure was in force by seeking a reference to a final regulation in an official government gazette or the catalogue of a standards organization. Where these sources were unavailable, I used references to the final regulation in articles from a reputable government source, media source, academic paper, or international organization. For several regulations, I reached out to the relevant national TBT enquiry points for confirmation.

Overall, I confirmed that 138 of the notifications—86.8 percent of the sample—were in force. Thus, around 86.8 of overall population of measures notified by WTO members that contained HS information but no date of entry into force have been placed in force, with a margin of error of ±5.2 percent at the 95 percent confidence level.