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Industrial Policy and Competitiveness: Non-Tariff Barriers and Incentives to Innovate

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The Network Law Review is pleased to present a special issue on “Industrial Policy and Competitiveness,” prepared in collaboration with the International Center for Law & Economics (ICLE). This issue gathers leading scholars to explore a central question: What are the boundaries between competition and industrial policy?

Abstract: Countries use non-tariff barriers (NTBs) as instruments of industrial policy. NTBs often are difficult to observe and hard to adjust because they are part of national regulations. NTBs are inflexible in comparison to tariffs. The number of NTBs has expanded significantly. The article concludes that NTBs can impede technological change and harm incentives to innovate.

1. Introduction

Non-tariff barriers (NTBs) are like rocky reefs – hazardous for navigation because they are hidden underwater.¹ NTBs are embedded in laws and regulations, making them difficult to observe. Because of their complexity and technological restrictions, NTBs distort international trade more than tariffs and generate greater economic inefficiency. NTBs are harder to adjust than tariffs and complicate trade negotiations. In this article, I consider the implications of NTBs for industrial policy. I find that NTBs impede technological change and harm incentives to innovate.

Countries use industrial policy to provide competitive advantages to domestic industries in the international marketplace, sometimes referred to as national competitiveness. Industrial policies that use NTBs can impede international trade in

¹ The World Trade Organization notes, regarding standards and safety regulations affecting trade, that “some compare this to seabed rocks appearing when the tide goes down.” https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm4_e.htm#TRS

innovative products. Divergent technologies decrease international technology transfers and reduce incentives for innovation. This will increase the costs of establishing and participating in global value chains, decreasing economic efficiency. Expanding NTBs to address more advanced technology standards traditionally left to standards organizations thus could diminish national competitiveness.

NTBs, also called Non-Tariff Measures (NTMs), refer to government trade restrictions other than tariffs.² NTBs covered by World Trade Organization (WTO) agreements include Technical Barriers to Trade (TBTs) and Sanitary and Phytosanitary Measures (SPS). The WTO observes that the TBT Agreement “aims to ensure that technical regulations, standards, and conformity assessment procedures are non-discriminatory and do not create unnecessary obstacles to trade.”³ The WTO states that the Agreement on the Application of Sanitary and Phytosanitary Measures “sets out the basic rules on food safety and animal and plant health standards that governments are required to follow.”⁴

NTBs represent a shift from tariffs to trade regulations. The costs of trade, although substantial, have tended to fall since World War II.⁵ The number of NTBs, however, has grown steadily each year. The total number of notifications of TBTs and SPS has increased from 587 in 1995 to 6,481 in 2024, suggesting greater government use of industrial policy and efforts to restrict trade.⁶

TBTs and other NTBs tend to be mandatory regulations that specify basic product features. TBTs generally differ from voluntary technology standards established by Standards Development Organizations (SDOs) that include advanced technologies such as 5G in mobile communications.⁷ Replacing voluntary technology standards with mandatory TBTs would lead to divergent technologies rather than harmonization. This is because each country imposes its own TBTs

² Anne-Célia Disdier and Marco Fugazza, 2020, A Practical Guide to the Economic Analysis of Non-Tariff Measures, World Trade Organization, <https://unctad.org/webflyer/practical-guide-economic-analysis-non-tariff-measures-volume-3>, accessed May 26, 2020, at 7 (“Non-Tariff Measures (NTMs) are all policy interventions other than tariffs that can potentially affect the quantities and the prices of internationally traded goods.”)

³ WTO, Technical Barriers to Trade, https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

⁴ WTO, Sanitary and phytosanitary measures, https://www.wto.org/english/tratop_e/sps_e/sps_e.htm.

⁵ Anderson, James E., and Eric Van Wincoop. Trade costs. *Journal of Economic Literature* 42, no. 3 (2004): 691-751.; Dennis Novy, Gravity Redux: Measuring International Trade Costs with Panel Data. *Economic Inquiry* 51, no. 1 (2013): 101-121.

⁶ The WTO's ePing platform tracks the many SPS and TBT measures, including member notifications regarding regulatory changes. World Trade Organization, SPS & TBT Platform, <https://eping.wto.org/en/FactsAndFigures/Notifications>, accessed July 13, 2025.

⁷ See Daniel F. Spulber, Standard Setting Organizations and Standard Essential Patents: Voting and Markets, 2019, *The Economic Journal*, 129(619), April, 1477-1509, <https://doi.org/10.1111/eoj.12606>; Daniel F. Spulber, Licensing Standard Essential Patents with FRAND Commitments: Preparing for 5G Mobile Telecommunications, 2020, *Colorado Technology Law Journal*, 18(1), 79-159, http://ctlj.colorado.edu/wp-content/uploads/2021/02/18.1_4-Spulber-4.2.20.pdf

leading to differences in products. This contrasts with standards set by SDOs that reflect a consensus within the industry that seeks to promote standardization and interoperability.

The United States (U.S.), the European Union (EU), the People’s Republic of China (China), and others negotiate many technology standards through international trade agreements. The TBT Agreement and SPS Agreement seek to reduce some of the trade impacts of divergent national regulations.⁸

Countries applying TBTs risk developing and implementing incompatible technologies, a problem referred to as technological decoupling.⁹ Different national technology standards reduce or eliminate interoperability within industries. Technological differences increase manufacturing costs by decreasing economies of scale. Increases in manufacturing costs and problems with interoperability can reduce international trade. Reducing international trade will diminish economic returns for companies that rely on international trade and can diminish their incentives to innovate.

All governments pursue industrial policy. Governments intervene to various degrees in their countries’ domestic economies and international trade to promote particular industries. Governments apply industrial policy to achieve or maintain competitive advantages for domestic firms both at home and abroad. Governments use domestic policy instruments, such as taxes, subsidies, regulation, and antitrust, to reduce competition from foreign companies. Industrial policy often shelters emerging technologies and new industries. Governments design industrial policy to pursue increases in economic growth, development, employment, productivity, entrepreneurship, and innovation.

⁸ WTO Technical Barriers to Trade Agreement, https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm; WTO Agreement on the Application of Sanitary and Phytosanitary Measures, 1867 UNTS 493, 1995, https://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm. See also Technical Barriers to Trade Agreement: 10 key results from 2024, https://www.wto.org/english/res_e/publications_e/tbt10keys2024_e.htm; Technical Barriers to Trade – Third Edition, The WTO Agreements Series, https://www.wto.org/english/res_e/publications_e/tbt3rd_e.htm.

⁹ Garcia-Herrero, Alicia, and Junyu Tan, 2020, Deglobalisation in the Context of United States-China Decoupling, Policy Contribution 21, 1-16; Garcia-Macia, D. and R. Goyal, 2020, Technological and Economic Decoupling in the Cyber Era, International Monetary Fund, IMF Working Paper 20/257. Diego A. Cerdeiro, Johannes Eugster, Rui C. Mano, Dirk Muir, and Shanaka J. Peiris, 2021, Sizing Up the Effects of Technological Decoupling, International Monetary Fund, Working Paper; Jie Cai, Nan Li, and Ana Maria Santacreu. Knowledge Diffusion, Trade, and Innovation Across Countries and Sectors. American Economic Journal: Macroeconomics 14, no. 1 (2022): 104-145; Jon Bateman, U.S.-China Technological “Decoupling”: A Strategy and Policy Framework, 2022, Carnegie Endowment for International Peace, https://carnegieendowment.org/files/Bateman_US-China_Decoupling_final.pdf, Accessed August 13, 2022; Justin Feng, The Costs of U.S.-China Semiconductor Decoupling, May 25, 2022, Center for Strategic & International Studies, <https://www.csis.org/blogs/new-perspectives-asia/costs-us-china-semiconductor-decoupling>, Accessed August 13, 2022.

Governments also use industrial policy to support national security advantages over geopolitical rivals. Governments seek to protect defense industries and to stimulate domestic production of critical products, including mining, metals, and pharmaceuticals. Governments may subsidize manufacturing, investment, and research and development (R&D) in strategic industries. For example, the U.S. CHIPS and Science Act of 2022 sought to encourage domestic production of semiconductors.¹⁰ A problem with this type of industrial policy is that governments often try to pick technology winners and influence international standards development organizations. Governments may intervene in Intellectual Property (IP) licensing negotiations between innovators and adopters. Governments can face tradeoffs between the benefits of enhancing national defense and the costs of reducing incentives to innovate.

2. International Trade Agreements and TBTs

International trade agreements rely on the knowledge and decisions of public policy makers in setting technology standards. This differs from technology standards organizations, which emphasize the contributions of specialized scientific and technical experts. Trade agreements involve unwieldy government negotiations that cannot adapt to rapid technological change. The trade agreements system addresses public policy tradeoffs rather than technological specifications. The trade agreements system is based on mandatory national trade regulations rather than international industry cooperation. This implies that reliance on trade agreements need not promote standardization of advanced technologies.

Bilateral and multilateral trade agreements often involve technical specifications for products. There are many other types of NTMs including quotas and subsidies.¹¹ TBTs refer to “mandatory technical regulations and voluntary standards that define specific characteristics that a product should have, such as its size, shape, design, labelling/marketing/packaging, functionality or performance.”¹² Governments introduce TBTs for purposes such as “protecting

¹⁰ Michael Pinkerton, Semiconductor Subsidies Signal Shift in U.S. Industrial Policy, T. Rowe Price Insights on U.S. Government Policy, September, 2022, <https://www.troweprice.com/content/dam/trp-ecl/global/en/ipc/assets/us-retail-intermediary/2022/september/semiconductor-subsidies-signal-shift-in-industrial-policy-id0005363/Semiconductor-Subsidies-Signal-Shift-in-US-Industrial-Policy.pdf>

¹¹ Jaime de Melo and Ben Shepherd, 2018, The Economics of Non-Tariff Measures: A Primer, Working Paper, Fondation Pour Les Études et Recherches sur le Développement International, <https://ferdi.fr/dl/df-jxZqUUuH8CqMrPfgG4onZRv/ferdi-p212-the-economics-of-non-tariff-measures-a-primer.pdf>. (“1. Tariff-like measures, such as contingent protection (anti-dumping and duty-based safeguards). 2. Quantitative restrictions (quotas and quantity-based safeguards). 3. Subsidies (production and export). 4. Rules of origin. 5. Frictional barriers to trade (poorly performing trade facilitation).”)

¹² European Commission, Technical Barriers to Trade, https://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_150987.pdf.

human health and safety, animal and plant life and health or the environment, or safeguarding consumers from deceptive practices.”¹³

The WTO states that the TBT Agreement “aims to ensure that technical regulations, standards, and conformity assessment procedures are non-discriminatory and do not create unnecessary obstacles to trade.”¹⁴ The WTO does not address technology standards, but rather “recognises WTO members’ right to implement measures to achieve legitimate policy objectives, such as the protection of human health and safety, or protection of the environment.”¹⁵ The TBT Agreement itself relies on standards organizations, and “strongly encourages members to base their measures on international standards as a means to facilitate trade.”¹⁶

The WTO does not develop technology standards. Instead, the WTO’s TBT Agreement and SPS Agreement rely on international standards organizations to harmonize technologies. Despite this reliance, the WTO does not defer to standards organizations. WTO agreements highlight exceptions to following international technology standards that are developed by organizations. Although they encourage standardization, WTO agreements negotiate departures from international technology standards.

The WTO’s TBT Agreement recognizes “the important contribution that international standards and conformity assessment systems can make in this regard by improving efficiency of production and facilitating the conduct of international trade.”¹⁷ The TBT Agreement expresses the desire “to encourage the development of such international standards and conformity assessment systems.”¹⁸ The TBT Agreement states that “[w]here technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them, or the relevant parts of them, as a basis for their technical regulations.”¹⁹ The TBT Agreements makes exceptions “when such international standards or relevant parts would be an ineffective or inappropriate means for the fulfilment of the legitimate objectives pursued, for instance because of fundamental climatic or geographical factors or fundamental technological problems.”²⁰

¹³ European Commission, Technical Barriers to Trade, https://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_150987.pdf.

¹⁴ Technical Barriers to Trade, World Trade Organization, https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

¹⁵ Technical Barriers to Trade, World Trade Organization, https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

¹⁶ Technical Barriers to Trade, World Trade Organization, https://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm.

¹⁷ TBT, https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm. Accessed December 24, 2022.

¹⁸ TBT, https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm. Accessed December 24, 2022.

¹⁹ TBT, https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm. Accessed December 24, 2022.

²⁰ TBT, https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm. Accessed December 24, 2022.

According to the WTO, the SPS Agreement seeks “[t]o harmonize sanitary and phytosanitary measures on as wide a basis as possible, Members shall base their sanitary or phytosanitary measures on international standards, guidelines or recommendations, where they exist.”²¹ The SPS recognizes two types of exceptions. First, the SPS recognizes divergent standards provided for in the agreement itself, noting that “[s]anitary or phytosanitary measures which conform to international standards, guidelines or recommendations shall be deemed to be necessary to protect human, animal or plant life or health, and presumed to be consistent with the relevant provisions of this Agreement and of GATT 1994.”²² Second, the SPS states that “[m]embers may introduce or maintain sanitary or phytosanitary measures which result in a higher level of sanitary or phytosanitary protection than would be achieved by measures based on the relevant international standards, guidelines or recommendations, if there is a scientific justification.”²³

A policy shift away from standards organizations and toward greater reliance on trade agreements risks reducing technological interoperability. The WTO handles general trade policies rather than complex technological subjects. The members of the organization are national governments. This generates an unwieldy trade agreement system that cannot address complicated details of technological standardization. According to the WTO, “All major decisions are made by the membership as a whole, either by ministers (who usually meet at least once every two years) or by their ambassadors or delegates (who meet regularly in Geneva).”²⁴

The WTO has a broad mandate that is not well adapted to developing technology standards. The objectives of the WTO differ from those of standards organizations, which are focused on interoperability and performance of advanced technologies. According to the WTO, its overall objective is “to help its members use trade as a means to raise living standards, create jobs and improve people’s lives.”²⁵

The WTO focuses on trade rules rather than innovation and technological change. The WTO “operates the global system of trade rules and helps developing countries build their trade capacity.”²⁶ The WTO “provides a forum for its members to negotiate trade agreements and to resolve the trade problems they face with each other.”²⁷ Some observers are concerned that WTO trade promotion will prevent

²¹ SPS, https://www.wto.org/english/docs_e/legal_e/15sps_01_e.htm, Accessed December 24, 2022.

²² SPS, https://www.wto.org/english/docs_e/legal_e/15sps_01_e.htm, Accessed December 24, 2022.

²³ SPS, https://www.wto.org/english/docs_e/legal_e/15sps_01_e.htm, Accessed December 24, 2022.

²⁴ https://www.wto.org/english/thewto_e/whatis_e/what_we_do_e.htm

²⁵ https://www.wto.org/english/thewto_e/whatis_e/who_we_are_e.htm

²⁶ https://www.wto.org/english/thewto_e/whatis_e/who_we_are_e.htm

²⁷ https://www.wto.org/english/thewto_e/whatis_e/who_we_are_e.htm

countries from imposing national standards to meet domestic regulatory objectives.²⁸

The WTO is concerned with basic product features rather than advanced technologies.²⁹ The WTO states that “[i]n certain cases, the way a product is produced can affect these characteristics, and it may then prove more appropriate to draft technical regulations and standards in terms of a product’s process and production methods rather than its characteristics per se.”³⁰ According to the WTO, “[t]he difference between a standard and a technical regulation lies in compliance. While conformity with standards is voluntary, technical regulations are by nature mandatory.”³¹ The WTO distinguishes between the implications of standards and technical regulations for international trade: “If an imported product does not fulfil the requirements of a technical regulation, it will not be allowed to be put on sale. In case of standards, non-complying imported products will be allowed on the market, but then their market share may be affected if consumers prefer products that meet local standards such as quality or colour standards for textiles and clothing.”³²

The WTO favors several standards organizations that make limited contributions to standards development.³³ According to the WTO, “[f]or many years, technical experts have worked towards the international harmonization of standards. An important role in these efforts is played by the International Standardization Organization (ISO), the International Electrotechnical Commission (IEC) and the International Telecommunication Union (ITU).”³⁴ The WTO has a cooperation agreement with the ITU.³⁵ Under the GATS agreement, “the two

²⁸ Jan McDonald, 2005, Domestic Regulation, International Standards, and Technical Barriers to Trade. *World Trade Review* 4, No. 2: 249-274.

²⁹ WTO, Technical Information on Technical barriers to trade, https://www.wto.org/english/tratop_e/tbt_e/tbt_info_e.htm, accessed June 26, 2022. The WTO provides the following definition: “[t]echnical regulations and standards set out specific characteristics of a product – such as its size, shape, design, functions and performance, or the way it is labelled or packaged before it is put on sale.”

³⁰ WTO, id.

³¹ WTO, id.

³² WTO, id.

³³ Raymund Werle, 2001, Standards and Standards Organizations in the International Free Trade Regime. *Knowledge, Technology & Policy* 14, no. 3: 127-140. (“At the international level only the ITU, the ISO and the IEC are recognized entities. But they issue no more than a fraction of relevant standards in communication and information technology.”)

³⁴ Technical Information on Technical barriers to trade, https://www.wto.org/english/tratop_e/tbt_e/tbt_info_e.htm, accessed June 26, 2022.

³⁵ Uruguay Round Agreement, 1995, General Agreement on Trade in Services (GATS), Annex 1B: General Agreement on Trade in Services, https://www.wto.org/english/docs_e/legal_e/26-gats_02_e.htm#annbas, accessed June 26, 2022. (“Members recognize the role played by intergovernmental and non-governmental organizations and agreements in ensuring the efficient operation of domestic and global telecommunications services, in particular the International Telecommunication Union.”)

organizations participate as observers in each others' meetings and collaborate at the staff level on such activities as research, publications, conferences and workshops."³⁶

Trade agreements also include rules that apply to the system of technology standards. The WTO Agreement on TBTs includes rules for the preparation and application of standards that apply to member states and national or regional standards organizations.³⁷ The WTO Agreement on TBTs relies on basic definitions of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).³⁸ These two standards bodies "form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest."³⁹ The WTO ISO Standards Information Gateway identifies 194 standards organizations from 154 countries and territories.⁴⁰

3. Economic Effects of TBTs

Evaluating the economic effects of TBTs can be difficult because of various measurement issues. Anne-Célia Disdier and Marco Fugazza observe that measurement of NTMs "is more complex than any other trade policy instrument such as tariffs given their variety and the difficulty of assessing their restrictiveness."⁴¹ According to a joint report of the United Nations Conference on Trade and Development (UNCTAD) and the World Bank, NTMs "inhabit the grey zone where trade policy meets national regulation. ... While tariffs are relatively transparent and have been regularly compiled into public databases, non-tariff measures are not always easy to identify and have only been sporadically collected for

³⁶ https://www.wto.org/english/thewto_e/coher_e/wto_itu_e.htm, accessed June 26, 2022.

³⁷ Code of Good Practice for the Preparation, Adoption and Application of Standards, Annex 3, The Agreement on Technical Barriers to Trade, https://www.wto.org/english/res_e/publications_e/ai17_e/tbt_art4_oth.pdf

³⁸ According to the WTO Agreement on TBTs: "The terms presented in the sixth edition of the ISO/IEC Guide 2: 1991, General Terms and Their Definitions Concerning Standardization and Related Activities, shall, when used in this Agreement, have the same meaning as given in the definitions in the said Guide taking into account that services are excluded from the coverage of this Agreement." https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm.

³⁹ ISO and IEC Guide 2, Standardization and related activities – General vocabulary, https://isotc.iso.org/livelink/livelink/fetch/2000/2122/4230450/8389141/ISO_IEC_Guide_2_2004_%28Multilingual%29_-_Standardization_and_related_activities_-_General_vocabulary.pdf?nodeid=8387841&vernum=-2

⁴⁰ <https://tbtcode.iso.org/sites/wto-tbt/home.html>, accessed June 28, 2022.

⁴¹ Disdier and Fugazza, *supra* note 2. See also Carrère, Céline, And Jaime De Melo. Non-Tariff Measures: What Do We Know, What Might Be Done?. *Journal Of Economic Integration* (2011): 169-196; Deardorff, Alan V. and Robert M. Stern. 1998. Measurement of Nontariff Barriers. Ann Arbor: U. Michigan Press; James Anderson and Eric van Wincoop, 2004, Trade Costs. *Journal of Economic Literature*, 42, 691-751; at 696 ("Nontariff barriers (NTBs) are much more problematic than tariff barriers.")

relatively few countries.”⁴² The report concludes that the cost of NTMs “is arguably higher than tariffs, and relatively independent from the price of the good.”⁴³

The TBT Agreement makes clear the importance of standards in international trade. Referring to member countries, the TBT Agreement states that “[m]embers shall ensure that in respect of technical regulations, products imported from the territory of any Member shall be accorded treatment no less favourable than that accorded to like products of national origin and to like products originating in any other country.”⁴⁴

The TBT Agreement emphasizes that “[m]embers shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade. For this purpose, technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment would create.”⁴⁵ According to the TBT Agreement, such legitimate objectives include: “national security requirements; the prevention of deceptive practices; protection of human health or safety, animal or plant life or health, or the environment. In assessing such risks, relevant elements of consideration are, inter alia: available scientific and technical information, related processing technology or intended end-uses of products.”⁴⁶

There is extensive international data on TBTs. UNCTAD’s trade analysis information system (TRAINS) database provides information about trade-related regulations and NTMs.⁴⁷ UNCTAD’s database covers 109 countries and over 65000 NTMs.⁴⁸ According to UNCTAD, “NTMs can increase the cost of doing business through increased compliance costs, high information costs, procedure costs among others which will eventually reduce productivity and growth.”⁴⁹ UNCTAD has developed a classification system that “comprises technical measures, such as sanitary or environmental protection measures, as well as others traditionally used as commercial policy instruments. These include, for example, quotas, price control, export restrictions and contingent trade protective measures, as well as other behind-the-border measures, such as competition- and trade-related investment measures

⁴² United Nations Conference on Trade and Development and The World Bank, 2018, *The Unseen Impact of Non-Tariff Measures: Insights from a New Database*, at 1, <https://unctad.org/webflyer/unseen-impact-non-tariff-measures-insights-new-database>

⁴³ UNCTAD id. at 20.

⁴⁴ TBT, Article 2: Preparation, Adoption and Application of Technical Regulations by Central Government Bodies, §2.1, WTO, https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm.

⁴⁵ Article 2: Preparation, Adoption and Application of Technical Regulations by Central Government Bodies, §2.1, WTO, https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm.

⁴⁶ Article 2: Preparation, Adoption and Application of Technical Regulations by Central Government Bodies, §2.1, WTO, https://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm.

⁴⁷ <https://trainsonline.unctad.org/home>.

⁴⁸ <https://trainsonline.unctad.org/about>.

⁴⁹ <https://trainsonline.unctad.org/about>.

and government procurement or distribution restrictions.”⁵⁰ Alexey Kravchenko et al. provide a guide to a concordance between NTMs in the TRAINS database and Sustainable Development Goals (SDGs).⁵¹ The World Integrated Trade Solution (WITS) Trade Stats database provides access to data on international merchandise trade, tariffs and NTMs.⁵²

Economists recognize that tariffs and NTBs, including TBTs, can increase transaction costs and reduce the volume of trade.⁵³ There are various approaches to measuring the economic effects of NTBs. The economic effects of TBTs correspond to the effects of tariffs under some conditions.⁵⁴ Looi Kee et al. calculate the ad-valorem tariff equivalent of NTBs.⁵⁵ Gianluca Orefice tests whether NTMs are barriers to trade by examining when exporting countries raise a Specific Trade Concern (STC) at the WTO.⁵⁶ Olivier Cadot and Julien Gourdon consider regional trade agreements (RTAs) with harmonization of technology regulations mitigate the price increases that result from NTMs.⁵⁷ Lionel Fontagné and Gianluca Orefice show that TBTs have greater negative effects on exports by multi-destination firms and affect trade flows more in homogeneous product industries.⁵⁸

The TBT Agreement is unlikely to produce technology standards because it provides limited coordination. Even within the context of international trade agreements, the TBT agreement does not harmonize national regulations. The WTO’s SPS Agreement offers a benchmark. According to Chris Downes, it is

⁵⁰ International Classification of Non-Tariff Measures 2019 Version, at vi, https://unctad.org/system/files/official-document/ditctab2019d5_en.pdf.

⁵¹ Alexey Kravchenko, Semenova, Maria, Lee, Seul, and Duval, Yann, 2019, Exploring linkages between non-tariff measures and the Sustainable Development Goals: A global concordance matrix and application to Asia and the Pacific. Trade, Investment and Innovation Working Paper No. 04/19, ESCAP: Bangkok. Available at <http://www.unescap.org/resource-series/tiid-working-papers>.

⁵² See <https://wits.worldbank.org/>.

⁵³ Bao, Xiaohua, and Larry D. Qiu. How do technical barriers to trade influence trade?, *Review of International Economics* 20, no. 4 (2012): 691-706, Marco Fugazza, 2013, *The Economics Behind Non-Tariff Measures: Theoretical Insights and Empirical Evidence*, Policy Issues in International Trade and Commodities Study Series No. 57, UNCTAD, Geneva; Maskus, Keith E., John S. Wilson, and Tsunehiro Otsuki. Quantifying the impact of technical barriers to trade: a framework for analysis. (2000). Policy Research Working Paper, World Bank Development Group.

⁵⁴ Anderson, J. and Neary, P. (1994). Measuring the Restrictiveness of Trade Policy, *World Bank Economic Review*, vol. 8(2) (May), pp. 151-69. Anderson, J. and Neary, P. (1996). A New Approach to Evaluating Trade Policy, *Review of Economic Studies*, vol. 63(1) (January), pp. 107-25.

⁵⁵ Looi Kee, Hiau, Alessandro Nicita, and Marcelo Olarreaga. Estimating trade restrictiveness indices. *The Economic Journal* 119, no. 534 (2009): 172-199.

⁵⁶ Orefice, Gianluca. Non-Tariff Measures, Specific Trade Concerns and Tariff Reduction. *The World Economy* 40, No. 9 (2017): 1807-1835. See also Cassehgari Posada, Kian, Emmanuelle Ganne, and Roberta Piermartini. The role of WTO committees through the lens of specific trade concerns raised in the TBT committee. No. ERSD-2020-09. WTO Staff Working Paper, 2020.

⁵⁷ Olivier Cadot and Julien Gourdon. Non-Tariff Measures, Preferential Trade Agreements, And Prices: New Evidence. *Review Of World Economics* 152, No. 2 (2016): 227-249.

⁵⁸ Fontagné, Lionel and Gianluca Orefice. Let’s try next door: Technical Barriers to Trade and multi-destination firms. *European Economic Review* 101 (2018): 643-663.

generally believed that the SPS Agreement is more restrictive than the TBT Agreement.⁵⁹ Downes argues, however, that it may be difficult for countries to “forum shop” by switching from the SPS Agreement to the TBT Agreement.⁶⁰

Cristina Herghelegiu finds that “beyond their legitimate purposes, NTMs adopted by developing countries are also driven by political and economic motivations.”⁶¹ Herghelegiu observes that “[p]roducts that have experienced reductions in tariffs and sectors confronted with import competition and characterised by high levels of employment are the ones with a higher probability of receiving NTM protection.”⁶² Zhaohui Niu et al. find that over the period 1997-2015, the effects of NTMs increased substantially and were a dominant source of trade protection.⁶³

Regional trade agreements in which countries adopt common standards have mixed effects. Maggie Xiaoyang Chen and Aaditya Mattoo find that “[r]egional harmonization significantly increases intra-regional trade, raising both the likelihood and the volume of trade between participating countries in affected industries. Exports of excluded countries to the region, however, decline on average.”⁶⁴ Ben Shepherd demonstrates that “the negative impact of standards on foreign exporters is stronger for exporting countries with lower levels of per capita income; and those negative impacts can be attenuated through the adoption of internationally harmonized standards by importing countries.”⁶⁵

Market outcomes with international trade reflect differences among firms in terms of technology, costs, and size.⁶⁶ Tariffs and NTBs affect market outcomes often by reducing outputs of goods subject to trade restrictions. This can affect intensive margins by reducing the output of individual firms. Lionel Fontagné et al. show that SPS measures affect the extensive margins of international trade by reducing the number of firms.⁶⁷ Distortions in intensive and extensive margins due to NTBs can

⁵⁹ Downes, Chris. Worth Shopping Around? Defending Regulatory Autonomy under the SPS and TBT Agreements. *World Trade Review* 14, no. 4 (2015): 553-578.

⁶⁰ Downes, id.

⁶¹ Herghelegiu, Cristina. The Political Economy of Non-Tariff Measures. *The World Economy*, 41, No. 1 (2018): 262-286, at 264.

⁶² Herghelegiu, id.

⁶³ Niu, Zhaohui, Chang Liu, Saileshsingh Gunessee, and Chris Milner. Non-tariff and overall protection: evidence across countries and over time. *Review of World Economics* 154, no. 4 (2018): 675-703.

⁶⁴ Chen, Maggie Xiaoyang and Aaditya Mattoo. Regionalism in standards: good or bad for trade?. *Canadian Journal of Economics/Revue canadienne d'économie* 41, no. 3 (2008): 838-863, at 840.

⁶⁵ Shepherd, Ben. Product standards and export diversification. *Journal of Economic Integration* (2015): 300-333, at 301.

⁶⁶ See Melitz, Marc J., 2003, The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*. 71(6):1695-1725; Spearot, Alan C., Variable Demand Elasticities and Tariff Liberalization. *Journal of International Economics* 89, no. 1 (2013): 26-41.

⁶⁷ Fontagné, Lionel, Gianluca Orefice, Roberta Piermartini, and Nadia Rocha. Product Standards and Margins of Trade: Firm-level Evidence. *Journal of International Economics* 97, no. 1 (2015): 29-44.

reduce economic efficiency in comparison to market outcomes with less regulation. Such market distortions also can reduce incentives to invent and innovate relative to market outcomes with less regulation.

4. TBTs, Intellectual Property, and Technological Change

WTO trade agreements do not recognize the connections between IP and technology standards. There is no mention of the technology standards in the WTO TRIPS Agreement.⁶⁸ The TRIPS agreement does not consider inclusion of SEPs in technology standards or commitments by companies to license their SEPs on FRAND terms.

TBT agreements do not address IP. Christopher Gibson points out that the TBT Agreement and the Committee on Technical Barriers to Trade (CTBT) principles “are silent on the issue of IP.”⁶⁹ Gibson further observes that “there is a ‘disconnect’ between TBT Agreement responsibilities to use international standards and the IP rights that are embedded in those standards, particularly in the ICT sector.”⁷⁰ Gibson argues that to reconcile standards harmonization with compensation for IP holders, WTO agreements should include IP policies.⁷¹

The TBT Agreement’s Code of Good Practice for the Preparation, Adoption and Application of Standards (hereafter “the Code”) addresses technology standards. The Code refers to “any standardizing body within the territory of a Member of the WTO, whether a central government body, a local government body, or a non-governmental body; to any governmental regional standardizing body one or more members of which are Members of the WTO; and to any non-governmental regional standardizing body one or more members of which are situated within the territory of a Member of the WTO.”⁷² According to the Code, “[i]n respect of standards, the standardizing body shall accord treatment to products originating in the territory of any other Member of the WTO no less favourable than that accorded to like products of national origin and to like products originating in any other country.”⁷³

The Code requires that “[t]he standardizing body shall ensure that standards are not prepared, adopted or applied with a view to, or with the effect of, creating

⁶⁸ Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (as amended January 23, 2017), Annex 1C, of the 1994 Marrakesh Agreement Establishing the World Trade Organization, https://www.wto.org/english/docs_e/legal_e/31bis_trips_01_e.htm.

⁶⁹ Christopher S. Gibson, 2007, *Globalization and the Technology Standards Game: Balancing Concerns of Protectionism and Intellectual Property in International Standards*. Berkeley Technology Law Journal 22, no. 4: 1403-1484, at 1408.

⁷⁰ Gibson, 2007, *id.* at 1475.

⁷¹ Gibson, 2007, *id.* at 1408.

⁷² Code of Good Practice for the Preparation, Adoption and Application of Standards, Annex 3, The Agreement on Technical Barriers to Trade, https://www.wto.org/english/res_e/publications_e/ai17_e/tbt_art4_oth.pdf

⁷³ The Code, *id.*, https://www.wto.org/english/res_e/publications_e/ai17_e/tbt_art4_oth.pdf

unnecessary obstacles to international trade.”⁷⁴ Also, the Code states “[w]ith a view to harmonizing standards on as wide a basis as possible, the standardizing body shall, in an appropriate way, play a full part, within the limits of its resources, in the preparation by relevant international standardizing bodies of international standards regarding subject matter for which it either has adopted, or expects to adopt, standards.”⁷⁵

5. Conclusion

Industrial policies that impose mandatory product standards can reduce national competitiveness for several reasons. Countries that impose NTBs can cause retaliatory tariffs that restrict domestic firms’ access to international markets. TBTs can decouple a country’s technology from international technology standards. This reduces the interoperability of a country’s technologies, further limiting domestic firms’ access to international markets. Reduced access to international markets can diminish domestic firms’ incentives to innovate.

Industrial policies that rely on NTBs are likely to have unintended consequences. The economic effects of a country’s NTBs are hard to evaluate. Even with international notifications and trade negotiations, NTBs are difficult to monitor because they are part of national regulations. In contrast to tariffs, NTBs are not readily adjustable in response to market forces. Shifting international technology standards to TBTs can decrease innovation and technological change.

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⁷⁴ The Code, id., https://www.wto.org/english/res_e/publications_e/ai17_e/tbt_art4_oth.pdf

⁷⁵ The Code, id., https://www.wto.org/english/res_e/publications_e/ai17_e/tbt_art4_oth.pdf