CESifo WORKING PAPERS

11829 2025

March 2025

Protection or Protectionism: The Effect of Technical Regulations on Input Sourcing

Irene Iodice, Camille Reverdy

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
· from the CESifo website: https://www.cesifo.org/en/wp

Protection or Protectionism: The Effect of Technical Regulations on Input Sourcing*

Irene Iodice§ Camille Reverdy †

April 15, 2025

Abstract

This paper examines how EU Technical Barriers to Trade (TBTs) reshape firms' global supply chains, extending Grossman et al. (2024) to incorporate adaptation costs between sourcing partners. To test the model's predictions, we construct a novel dataset linking EU TBTs to French firm-level import data, trade agreement depth, and a new text-based index of regulatory dissimilarity. We find that greater regulatory distance with the EU significantly reduces both the likelihood and volume of imports. EU TBTs trigger substantial trade diversion: firms shift sourcing toward harmonised suppliers (value +4.4%, quantity +2.1%, entry +2.1pp) and away from non-EU partners (quantity –4.3%, exit +1.3pp, entry –2.6pp). This diversion is significantly weaker for products with high relationship-specific investments, underscoring the role of switching costs in supply chain reconfiguration.

Keywords: NTMs, TBTs, Sourcing Decisions, Trade Diversion, Economic Integration
JEL Codes: F13, F14, F15

*We are grateful to Lionel Fontagné, Gianluca Orefice, Isabelle Méjean, Alessandro Nicita, Marcelo Olarreaga, Marc Muendler, Tibor Besedeš, Andrew Bernard, Daniel Trefler, Yoto Yotov, Gabriel Felbermayr, Anne Celia Disdier, Maria Bas, and participants at various seminars, workshops, and conferences for their valuable comments. Camille Reverdy gratefully acknowledges support from the SNSF Sinergia Project Number 205796, TAIT Project, H2020 Marie Skłodowska-Curie Actions (Grant Number: 721916), and French National Research Agency as part of the "Investissements d'Avenir" program (ANR-17-EURE-001). Access to some confidential data, has been made possible within a secure environment offered by CASD (Ref. 10.34724/CASD).

§University of Bielefeld, irene.iodice@uni-bielefeld.de

†Graduate Institute (IHEID), camille.reverdy@graduateinstitute.ch

1 Introduction

The evolution of regional and global value chains (GVCs) has fundamentally reshaped how firms and countries organise production. As of 2019, intermediate goods account for over 20 percent of global trade (WITS, World Bank). Advances in information technology, transportation, and logistics have facilitated the geographic dispersion of production stages. Nonetheless, international sourcing remains a costly and complex process, requiring significant search efforts to find compatible partners and maintain quality standards across distant locations. Technical standards play a critical role in addressing these challenges and are thus central to the efficient functioning of modern GVCs (Gereffi et al., 2005; Nadvi, 2008).

While standards can reduce information asymmetries and mitigate contractual frictions in sourcing decisions, they may also create barriers to GVC participation. Lamy (2015; 2016) highlights an international externality arising from regulatory heterogeneity: firms producing for multiple markets must comply with divergent standards, often sacrificing economies of scale. This raises adaptation costs for foreign producers and incentivises governments to use regulatory measures as a form of protectionism, inducing foreign firms to relocate (Grossman et al., 2021).

Despite the growing prominence of technical standards, referred to, in the World Trade Organization (WTO) terminology, as "Technical Barriers to Trade" (TBTs), empirical evidence on their impact on supply chains and firm performance remains scarce.[1] This is particularly striking in light of the documented shift in trade protection from final goods to intermediate inputs (Bown, 2018). In the past fifteen years, TBTs notified to the WTO affecting intermediate goods have increased at twice the rate of those targeting

[1]TBTs encompass standards, and technical regulations, typically aimed at health, safety, product quality, and environmental concerns.

other product categories (WTO, 2020).

This paper examines how technical standards enforced by the EU affect the sourcing decisions of French manufacturers. To guide our analysis we extend Grossman et al. (2024)'s model by incorporating adaptation costs related to TBT compliance. Unlike tariffs, which discriminate between foreign and domestic producers, TBTs apply universally across all suppliers, making them distinct in their effects on trade and supply chains. This non-discriminatory nature implies that even EU-based firms must adapt, creating a more complex reallocation process than what is typically observed under tariff-based protection. To capture these effects, we construct a novel index of regulatory distance, measuring how closely foreign standards align with those of the EU. This quantification enables us to link TBT announcements to firm-level import behaviour, providing insights into whether upstream producers absorb part of the adaptation burden or shift toward suppliers that are better positioned to meet EU regulatory requirements.

The EU provides an ideal setting to study these dynamics. The EU's stringent enforcement of technical regulations within its single market provides a natural setting to observe how French final goods producers shift sourcing toward EU countries. Crucially, our dataset identifies not only the last country from which a product was shipped, but also the country of manufacture, who bears compliance costs for the new standards. Our analysis spans from 2000 to 2017, a period marked by a substantial global increase in TBTs, with the EU accounting for roughly 15 percent of these measures.[2]

A central challenge involves accurately mapping TBTs to trade flows and systematically tracking their evolution. We tackle this by constructing a comprehensive TBT database

[2] One illustrative example is the recent EU regulation on batteries introduced under the European Green Deal. It imposes strict requirements on hazardous substances, minimum recycled content, carbon footprint standards, performance criteria, labelling mandates, and recycling targets (codified under TBT symbol "G/TBT/N/EU/775").

for 1995–2020, covering 1,242 products and 142 countries, leveraging a machine-learning algorithm to derive Harmonised System (HS) product codes from textual descriptions. We further link these data to the EU's preferential trade agreements, distinguishing fully harmonised sectors from those governed by mutual recognition. To measure adaptation costs, we apply text analysis to compare the descriptions of EU TBTs with corresponding domestic regulations in the source country, enabling us to quantify the degree of regulatory divergence at the HS4 level.

At the aggregate product level, we find that EU technical standards lead to trade diversion, favouring imports from EU sources rather than global ones. Notably, this shift is less pronounced for intermediate goods than for final goods, suggesting that modifying supply chains might present challenges. We formalise this mechanism in a theoretical model that extends on the input search frictions and Nash-in-Nash price bargaining framework of Grossman et al. (2024) to incorporate TBT adaptation costs. Since TBTs are non-discriminatory, compliance obligations apply to all suppliers, but these obligations vary according to each source country's regulatory distance from the EU. When a new TBT arises, firms weigh the cost of renegotiating with incumbent suppliers—sharing or absorbing these adaptation expenses—against the option of searching for new, better-aligned partners. The extent of supply chain restructuring depends on the relative adaptation costs across origins. Additionally, our model highlights how search frictions, supplier negotiation power, and importer size, shape the incidence of TBTs and reconfiguration of supply chains in response to new EU technical regulations.

Our identification strategy exploits within-firm-product-origin variation in imports, controlling for firm-product-origin fixed effects and narrow sector-origin-year fixed effects, thereby isolating the regulatory shock on specific products from broader sectoral trends. To address endogeneity, where French import patterns might influence which products become subject to a TBT, we test the robustness of our findings using an instrumental variable approach based on TBT changes in the United States, which are plausibly exogenous to French firms' behaviour.

Empirically, we find that the introduction of an EU TBT reallocates sourcing toward origins more closely aligned with EU technical standards, consistent with adaptation costs playing a key role. Specifically, we estimate that import value from fully harmonised origins increases by around 4.4 percent, while imports from origins with high regulatory dissimilarity with the EU decline by about 2.7 percent for a one-standard-deviation increase in our dissimilarity index. EU TBTs also increase the probability that firms drop non-EU suppliers by 1.3 percentage points and reduce the likelihood of establishing new links with non-EU origins by about 2.6 percentage points, while significantly encouraging entry from harmonised origins (+2.1pp). Furthermore, TBTs coincide with higher input costs, with import prices increasing by around 2% for EU imports and 2.6% for non-EU imports. The fact that price increases show no significant correlation with our continuous measure of adaptation costs (regulatory dissimilarity) suggests that suppliers, including relatively lower-cost EU producers, may wield bargaining power, enabling them to raise prices once a TBT is introduced regardless of the specific compliance burden.

Robustness checks, including accounting for TBT accumulation, for the development level of the origin country, using instrumental variables, and controlling for trade-facilitating regulations, confirm our core findings. Importantly, heterogeneity analyses reveal that the impact of TBTs is mediated by factors influencing adjustment costs and incentives. Lower switching costs (low product stickiness) enable greater reallocation towards EU suppliers. Bargaining power dynamics, proxied by buyer reliance on sourcing origins, determine the extent of cost pass-through, with high reliance leading to larger price hikes and quantity reductions. Firm scale also matters, as larger firms exhibit greater capacity and incentive to restructure supply chains aggressively towards lower-cost EU origins while abandoning higher-cost non-EU links. Collectively, these results highlight that TBTs serve as both barriers linked to adaptation costs and catalysts for reorganisation, with the outcome depending critically on firm, product and origin characteristics.

Related Literature This study contributes to three distinct strands of the literature. First, it builds on the growing theoretical work on trade policy and global value chains (Conconi et al., 2018, Antràs and De Gortari, 2020, Ornelas et al., 2021). Grossman et al. (2024) examine how unexpected input tariff changes disrupt supply chains, forcing domestic final goods producers, who face sunk supplier search costs, to either renegotiate with current partners or seek alternatives. These search-frictions are typically modelled as sunk investments that firms incur to match with GVC partners (Grossman and Helpman, 2005; Allen, 2014; Krolikowski and McCallum, 2021, Fontaine et al., 2023; Huang et al., 2024). Compared with tariffs, which are discriminatory and directly alter import prices, TBTs operate behind the border, imposing compliance costs on both domestic and foreign producers. Our framework extends Grossman et al. (2024) by incorporating TBT-induced production-cost increases that apply to all suppliers but vary according to the regulatory mismatch between origin and destination markets.

Beyond these theoretical insights, we add to the limited empirical evidence on how non-tariff measures, particularly TBTs and national standards, affect GVCs. Existing studies often rely on product-level or aggregate data (Blind et al., 2018; Chen & Mattoo, 2008; Ghodsi & Stehrer, 2019), whereas we follow Bas and Strauss-Kahn (2014) and use firm-level customs records to distinguish imported inputs from carry-along imports (Bernard et al., 2019).[3] While ideal analyses of supply-chain disruptions would leverage firm-to-

[3]Specifically, we match export and import data to identify goods that a firm imports for its own production (inputs), rather than for direct resale or distribution.

firm transactions, such data are only available for intra-EU flows in France (Martin et al., 2023). Consequently, we focus on the country of origin for manufactured inputs to examine how TBTs alter sourcing decisions. Several recent studies investigate firm-level responses to TBTs, although primarily from the exporter's perspective (Disdier et al., 2023; Fontagné & Orefice, 2018; Iodice, 2020; Navaretti et al., 2018). An exception is Singh and Chanda (2021), which find that higher TBTs on intermediate inputs compress markups for Indian manufacturing importers, suggesting incomplete pass-through of adaptation costs to final consumers. Our study instead examines how final-good producers adjust their sourcing decisions in response to TBTs, integrating both the search frictions as in Grossman et al. (2024) and the role of adaptation costs in reshaping firms' GVC decisions.

Finally, our work intersects with research on the political economy of trade and standardisation (Antràs and Staiger, 2012; Blanchard et al., 2025; Macedoni and Weinberger, 2021; Maggi and Ossa, 2021; Parenti and Vannoorenberghe, 2024; Bondi et al., 2025; Maggi and Ossa, 2023; Garcés and Vogt, 2024). While we do not directly examine the political drivers of TBTs, we build on the insight that adaptation costs to new standards grow with the regulatory distance between foreign and domestic norms as in Grossman et al. (2021). Unlike earlier studies that rely on broad typologies of NTMs (Cadot et al., 2015) or objectives of TBTs (Ghodsi & Stehrer, 2019), we employ text-analysis methods to measure the similarity in the actual legal content of domestic versus EU regulations over time, allowing a more precise estimation of "regulatory distance".

The remainder of the paper proceeds as follows. Section 2 provides new stylized facts on the growing use of TBTs by the EU and their impact on European imports, motivating our theoretical framework in Section 3. Section 4 describes our data sources, including the procedure for building the TBT database and our measure of adaptation costs. Section

5 lays out the empirical strategy, while Section 6 discusses the main results. Section 7 explores the underlying drivers of trade diversion, and Section 8 concludes.

2 Stylized Facts

This section outlines the institutional framework underpinning the EU's adoption of technical standards and presents key stylized facts regarding the evolution of TBTs and their impact on imports.

Institutional Framework The regulatory environment governing technical standards plays a crucial role in shaping trade flows and global value chains. At the multilateral level, the WTO sets the baseline for technical regulations through the TBT Agreement, which mandates that member states promote international standards whenever possible. Under Article 1.1, national standards are permissible only when international alternatives are unavailable or inadequate, prompting economies like the EU to rely extensively on regional regulatory frameworks.

Within the EU, the regulation of technical standards operates under two key regimes: *harmonisation* and *mutual recognition*. Approximately 70% of EU production falls under fully harmonised standards and conformity assessment procedures, ensuring uniform requirements across member states. The remaining sectors rely on the mutual recognition principle, which allows goods lawfully produced in one EU member state to be marketed in another without additional compliance burdens.[4] However, only 13% of eligible firms effectively benefit from mutual recognition, as regulatory complexities and administrative hurdles often lead exporters to adapt to national standards instead.[5]

[4]See the EU Website for details on harmonised and non-harmonised sectors.

[5]The European Commission (2017) report highlights that "This evaluation has concluded that mutual

Beyond its internal market, the EU extends its regulatory influence through trade agreements. It has signed numerous PTAs containing "WTO+" provisions, including agreements with Euro-Mediterranean partners, Chile, Turkey, and South Africa.[6]

These institutional arrangements are key to understanding how European TBTs influence firms' sourcing decisions. Because EU standards apply uniformly to both domestic and foreign firms, compliance costs vary based on the regulatory divergence between the EU and the importing countries. Consequently, firms may partially absorb the adaptation costs incurred by their suppliers, depending on whether they source inputs from within the EU, from countries with harmonisation agreements, or from third countries subject to distinct regulatory requirements.

Descriptive evidence Figure 1 illustrates the rising number of TBTs notified by the EU at the HS-4 level since the WTO's inception, using the BEC classification to differentiate between consumption, capital, and intermediate goods.[7] Notably, over the past 15 years, there has been a significant rise in TBTs regulating intermediate inputs, especially since 2008, where the rate of TBT notifications for intermediate goods has outpaced that of consumption and capital goods.

Table 1 further investigates how EU-TBTs shape intra-EU sourcing, showing regression estimates of the share of imports sourced from within the EU. Column 1 shows that goods regulated by TBTs have a 13% higher share of imports sourced within the EU compared to unregulated goods. However, when accounting for product fixed effects (Column 2),

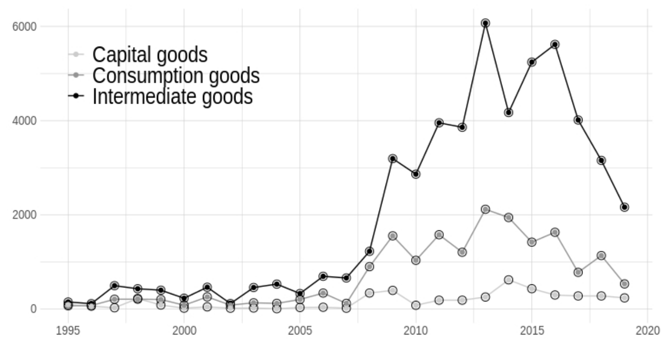
---

recognition is not functioning well and that the principle and the Regulation had limited effects in meeting the foreseen objectives."

[6] See Table A.3 for the complete list.

[7] Since the BEC classification is provided at the HS-6 level, some HS-4 products are assigned to several BEC codes. This represents 16% of the products. When an HS-4 is made of an equal number of HS-6 that belong to different type of goods we assign a BEC class randomly. The figure is however robust to the exclusion of these HS-4 product codes.

Figure 1: Number of products affected by a new EU TBT



this figure drops to 5%, suggesting a time trend influencing both TBT introduction and extra-EU competition. With both year and product fixed effects (Column (3)), the coefficient stabilises at 1.2%, remaining positive and statistically significant. In Column (4), the interaction term shows that intermediate goods are less susceptible to TBT-driven reallocation than final goods, implying that adjusting supply chains for intermediate inputs is more complex than switching sources for final goods.

Table 1: Share of Intra-EU imports: Technical regulations and Intermediate goods

	Dependent variable:			
	log(Share of EU imports sourced intra-EU)			
	(1)	(2)	(3)	(4)
TBT	0.128^{***}	0.049^{***}	0.012^{**}	0.017^{**}
	(0.010)	(0.004)	(0.005)	(0.007)
TBT × *Intermediate*				-0.013^{*}
				(0.008)
Observations	21,768	21,768	21,768	21,606
R^2	0.014	0.862	0.867	0.877
Year FE	Yes	No	Yes	Yes
HS4 FE	No	Yes	Yes	Yes

Note: The share of intra-EU imports is computed using BACI for the period 2000-2017, as a share of imports value over all European destinations that originates from European origin countries over all European imports for those destinations. $*p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

3 Theoretical Framework

Motivated by the two main stylized facts highlighted in the previous section: (i) EU standards induce trade diversion and (ii) the effect is less pronounced for intermediate goods, we build on the GVC model of Grossman et al. (2024), hereafter referred to as GHR. In the GHR framework, final goods producers face a non-recoverable, upfront search cost when searching new suppliers. We extend this framework by incorporating input adaptation costs to the new standard, which vary by supplier location and influence the optimal configuration of supply chains.

While our setup largely follows GHR, we provide a concise overview below to establish notation, with additional details in Section A.4. Our discussion concentrates on the key modifications from the original GHR model and their implications for sourcing decisions.

Setup and notation In a monopolistically competitive market, firms produce differentiated products ω using labour and a composite intermediate good.[8] This intermediate good is made from a range of inputs indexed by j, combined in fixed ratios using Leontief technology. Firms have two options for each input: produce it internally using a standard technology or find an external supplier, located either domestically or abroad. A firm looking for a potential supplier can take a draw from a cumulative distribution $G(.)$. At a cost of F, the match-specific inverse productivity, a, is revealed. The supplier's productivity and the wage rates in their country determine the unit cost of production. With all suitable suppliers, the firm negotiates short-term, renewable contracts through Nash-in-Nash bargaining, with exogenous weights β for the buyer and $1-\beta$ for the seller. This negotiation sets the input price $\rho(a)$, and consequently, the perceived marginal cost

[8]The demand side of our model follows standard model of trade under monopolistic competition with preferences characterised by quasi-linear utility, where the sub-utility of the differentiated good is iso-elastic with $\epsilon > 1$. The elasticity of substitution among brands σ is also constant.

of the intermediate good.

If the match is unsatisfactory, the firm resumes its search for a new supplier, at an additional cost of F. The optimal search strategy involves a reservation-stopping rule denoted by $\bar{a}$, such that a firm takes another draw for the input if and only if all of its prior draws for that input had inverse match productivities that exceed $\bar{a}$. With this setup, the negotiated price represents a weighted average of the supplier's production cost and the buyer's outside option. Specifically, the cost of producing the input with the reservation match productivity, whose weights depend on the negotiation power of the two parties governed by β. Assuming the distribution of productivity takes the form $G(a) = a^{\theta}$, with $\theta > 1$, where θ seizes the spread, one can obtain an analytical form for the reservation rule as follows:

$$\bar{a}^{\theta+1} = \frac{f(\theta+1)}{\beta m w} \tag{1}$$

where m is the units of intermediate inputs, w is the wage and f is the expected flow cost of searching.[9] Intuitively, when search draws are more costly or when the distribution of productivities is more concentrated, the stopping rule is more tolerant, i.e., higher $\bar{a}$. On the contrary, when the foreign wage is higher, the scale of production is larger, or the buyers have more bargaining power, the search cost is greater, i.e., lower $\bar{a}$. In this situation, the producers have more incentive to find a better match.

[9] The expected capital cost is given by $S(\bar{a}) = F + [1 - G(\bar{a})]S(\bar{a})$, where $G(\bar{a})$ is the probability that the firm retains the match and thus does not incur in further search costs. The expected cost flows is instead given by $f = rS(\bar{a})$ where r is the constant interest rate.

3.1 Departing from Free Trade

To study the introduction of a TBT on input j, we assume that the enforcement of a TBT comes as a surprise to downstream producers who have already formed their supply chains in country A. Once the TBT is implemented, firms expect it to persist indefinitely. Let η^{TBT} be the adaptation cost to the new TBT that suppliers of the input have to incur to adjust their production. We assume that the size of η^{TBT} varies across countries, and might be small enough to only induce changes in the volume of imports for some countries or large enough to induce exit and to alter the preferred location for search of suppliers. Under free trade, the price distribution of inputs sourced from country A dominates that of any other country. However, the introduction of a TBT might raise the relative cost of sourcing from this country. This is particularly true if there exists another country (including the home country), B, from which η^{TBT} is lower such that $\eta_B^{TBT} w_B < \eta_A^{TBT} w_A$, where w_A and w_B denotes the wage in country A and B respectively, then country B becomes the new origin for all prospective searches once the TBT is enforced.[10]

A "small" relative adaptation cost of TBT satisfies $\eta_B^{TBT}/\eta_A^{TBT} < w_B/w_A$, while a "large" relative adaptation cost of TBT satisfies $\eta_B^{TBT}/\eta_A^{TBT} > w_B/w_A$.[11]

3.2 Small relative adaptation costs to a TBT

We first focus on the situation in which, even after the introduction of the TBT, country A still has the lowest efficiency-adjusted wage, i.e., $\eta_B^{TBT} w_B > \eta_A^{TBT} w_A$. Albeit the supply location does not change, the imposition of a TBT imposes a cost that is borne by

[10]Inputs are symmetric, thus it is always optimal for a firm to search for all of its suppliers in a single country, although that target country might change following the imposition of a new standard.

[11]We test in the empirical section, several reasons why the cost of implementation differs across countries, such as the presence of PTA with provision on TBT, differences in regulatory distance with the EU, or different level of relationship-specific investments.

both buyer and supplier depending on their negotiation power. In particular, $\rho(a, \eta_A^{TBT})$ denotes the renegotiated price that final firm ω pays to its supplier for input j, including the cost of adapting to the new standard, η_A^{TBT}.

The outside option for the producer is to conduct a new search in country A, with optimal stopping rule $\bar{a}(\eta_A^{TBT})$, and to pay a price to a new supplier of $\mu_\rho[\bar{a}(\eta_A^{TBT}), \eta_A^{TBT}]$, which is the mean of $\rho(a, \eta_A^{TBT})$ conditional on $a < \bar{a}(\eta_A^{TBT})$. The producer's net benefit from remaining with its original supplier amounts to $\mu_\rho[\bar{a}(\eta_A^{TBT}), \eta_A^{TBT}]m(\eta_A^{TBT}) + f/G[\bar{a}(\eta_A^{TBT})] - \rho(a, \eta_A^{TBT})m(\eta_A^{TBT})$, where $m(\eta_A^{TBT})$ is the quantity of the composite intermediate good that the firm assembles with the TBT enforced. For the supplier, the surplus is simply the difference between revenue and production cost, or, $[\rho(a, \eta_A^{TBT}) - wa\eta_A^{TBT})]m(\eta_A^{TBT})$.

The renewed Nash bargaining yields:

$$\rho(a, \eta_A^{TBT}) = \arg\max_q \left[\mu_\rho[\bar{a}(\eta_A^{TBT}), \eta_A^{TBT}] + \frac{f}{m(\eta_A^{TBT})G[\bar{a}(\eta_A^{TBT})]} - q\right]^\beta (q - wa\eta_A^{TBT})^{1-\beta}$$

whose solution gives that:

$$\rho(a, \eta_A^{TBT}) = \beta wa\eta_A^{TBT} + (1-\beta)w\eta_A^{TBT}\mu_a[\bar{a}(\eta_A^{TBT})] + \frac{1-\beta}{\beta}\frac{f}{m(\eta_A^{TBT})G[\bar{a}(\eta_A^{TBT})]}, \quad (2)$$

where $\mu_a[\bar{a}(\eta_A^{TBT})]$ is the is the conditional mean of a for $a \leq \bar{a}(\eta_A^{TBT})$ and

$$\mu_\rho[\bar{a}(\eta_A^{TBT}), \eta_A^{TBT}) = w\eta_A^{TBT}\mu_a[\bar{a}(\eta_A^{TBT})] + \frac{1-\beta}{\beta}\frac{f}{m(\eta_A^{TBT})G[\bar{a}(\eta_A^{TBT})]}. \quad (3)$$

A firm that conducts new searches once the "small-adaptation cost" TBT has been introduced chooses $\bar{a}(\eta_A^{TBT})$ to minimise $\mu_\rho[\bar{a}(\eta_A^{TBT}), \eta_A^{TBT}) + f/G[\bar{a}(\eta_A^{TBT})]$, the sum of procurement costs and the debt burden imposed by search costs. The new first-order condition becomes:

$$m(\eta_A^{TBT})w\eta_A^{TBT}\mu_a'[\bar{a}(\eta_A^{TBT})] = \frac{fg[\bar{a}(\eta_A^{TBT})]}{\beta G[\bar{a}(\eta_A^{TBT})]^2} \tag{4}$$

which, after rearranging terms, can be written as:

$$w\eta_A^{TBT}\{\bar{a}(\eta_A^{TBT}) - \mu_a[\bar{a}(\eta_A^{TBT})]\}G[\bar{a}] = \frac{f}{\beta m(\eta_A^{TBT})} \tag{5}$$

We can substitute (2) into (5) to derive the new expression for the negotiated price:

$$\rho(a, \eta_A^{TBT}) = \beta\eta_A^{TBT}wa + (1-\beta)\eta_A^{TBT}w\bar{a}(\eta_A^{TBT}) \tag{6}$$

Note that all input prices increase in preserved supply links for $\eta_A^{TBT} > 1$ and $\bar{a}(\eta_A^{TBT}) > \bar{a}$. The latter condition requires the stopping rule to become less stringent after the introduction of a TBT with "small" adaptation costs. Importantly, the benefit of continued search is proportional to the cost of the input bundle m: the smaller m, the larger $\bar{a}$. When the demand for final goods is elastic and the production function has constant returns to scale, the derived demand for inputs is elastic as well. Consequently, an increase in adaptation costs will lead to a reduction in m, thereby raising the marginal cost threshold.

3.3 Large relative adaptation costs to a TBT

For a larger adaptation cost, the optimal location for searching might be altered. If $w_A < \eta_B^{TBT}w_B < \eta_A^{TBT}w_A$, country B becomes the new optimal origin from which to search for a new supply link. We denote b the realisation of a draw from the (inverse) productivity distribution in country B and $\bar{b}^{TBT}$, the optimal rule in the equilibrium once the TBT is enforced. We assume that the distribution of the inverse supplier's productivity $G(.)$ is the same in B, and the cost of drawing a match is still F.

We denote with a_B, the inverse productivity of the marginal supplier that is retained after the TBT is enforced, so that firms renegotiate with suppliers in country A that have $a \in (0, a_B]$ and replace their original suppliers that have match productivities $a \in (a_B, \bar{a}]$ with new partners in B.[12] The negotiated prices for inputs imported from countries A and B can be re-written as follows:

$$\rho_A(a, \eta_A^{TBT}) = \beta\eta_A^{TBT} w_A a + (1-\beta)\eta_B^{TBT} w_B \bar{b}^{TBT} \tag{7}$$

and

$$\rho_B(b, \eta_B^{TBT}) = \beta\eta_B^{TBT} w_B b + (1-\beta)\eta_B^{TBT} w_B \bar{b}^{TBT}. \tag{8}$$

These TBT-inclusive prices, $\rho_A(a, \eta_A^{TBT})$ and $\rho_B(b, \eta_B^{TBT})$, are weighted averages of the unit cost of production and the unit cost of an input produced by a supplier in country B at the reservation level of productivity ($\bar{b}^{TBT}$).

The new stopping rule $\bar{b}^{TBT}$ identifies the worst match that a buyer would accept conditional on searching in the new country B. This worst match yields an opportunity to purchase an input at price $\eta_B^{TBT} w_B \bar{b}^{TBT}$. If $\eta_A^{TBT} w_A a < \eta_B^{TBT} w_B \bar{b}^{TBT}$, the original supplier offers a better deal than the reservation match. Conversely, if $\eta_A^{TBT} w_A > \eta_B^{TBT} w_B \bar{b}^{TBT}$, search in B yields a better negotiated price even at the worst possible match among the acceptable ones. Thus, $a_B = \min\{\eta_B^{TBT} w_B \bar{b}^{TBT} / \eta_A^{TBT} w_A, \bar{a}\}$ and producers retain suppliers with reservation level $a \leq \frac{\eta_B^{TBT}}{\eta_A^{TBT}} \frac{w_B}{w_A} \bar{b}^{TBT}$ and replace those with $a > \frac{\eta_B^{TBT}}{\eta_A^{TBT}} \frac{w_B}{w_A} \bar{b}^{TBT}$.

[12] If $a_B = \bar{a}$, no new searches are occurring.

3.4 Testable Implications

Whenever $w_A < w_B$ and $\eta_A^{TBT} w_A < \eta_B^{TBT} w_B$ there is no new search and no entry. However, an adaptation cost that raises the production cost reduces spending on intermediate inputs. A lower spending on m implies a lower marginal benefit from search, as shown in Equation (1), inducing producers to become more tolerant to mediocre matches. This in turn, improves the bargaining position of enduring suppliers. Renegotiation with the original suppliers leads to higher input prices following the introduction of a new technical standard with relatively small adaptation costs as shown in Equation (6).

In scenarios where $w_A < \eta_B^{TBT} w_B < \eta_A^{TBT} w_A$, the proportion of suppliers shifting from A to B increases with the relative adaptation costs $\left(\frac{\eta_A^{TBT}}{\eta_B^{TBT}}\right)$ but decreases with the reservation rule $\bar{b}$. In simpler terms, the larger the difference between adaptation costs, the more extensive the disruption in the supply chain. On the other hand, the more costly the search for new suppliers is, the lower the willingness of suppliers to switch from source A to source B. Input prices grow within ongoing relationships and their relative change with respect to prices in B is governed by the negotiation power. Specifically, a lower bargaining power of final goods producers leads to an improved bargaining position of enduring suppliers after the TBT is enforced and to a convergence in unit prices from both countries, A and B, aligning with the production cost at the reservation productivity level in country B.

4 Data Set and Key Variables

This section describes the data used to analyse how TBT-related adaptation costs influence firms' sourcing decisions. We begin by explaining how we address three core challenges: (i) identifying TBTs that could affect trade, (ii) determining their product coverage and timing, and (iii) measuring adaptation costs. We then present the firm-level data employed in our empirical analysis and conclude with descriptive statistics on French firms' sourcing behaviour.

4.1 Construction of a new Database on TBTs

While several NTM databases have recently emerged to capture rising non-tariff protection, their coverage is often limited to short periods or specific countries (UNCTAD, 2017). The WTO TBT Notification portal is the most comprehensive source, recording all TBTs notified by WTO members since 1995. However, product details are frequently incomplete, prompting us to create a more complete database of HS-4 product codes through a six-phase procedure.

In the first phase, we retain all notifications that explicitly include HS codes. We then rely on the WTO I-TIP website to match HS codes when available. Next, we consult *addendum* documents, notification texts, and official national documents to extract missing codes. We then assign missing product codes from fully matched notifications with the same textual product description. In a further step, we link ICS codes to HS codes using official WTO correspondences and the Han et al. (2019) mapping. Finally, we apply a Support Vector Machine (SVM) classifier to infer HS codes for any remaining incomplete entries. This classifier compares TBT descriptions with known HS labels and achieves 95.7% accuracy on a held-out test set, as detailed in Section A.1.

By combining these steps, our new database covers 28,301 notifications, 142 countries, and 1,242 products over 1995–2020 (Table A.1). The steps beyond those previously used by Ghodsi et al. (2017) allow us to match an additional 10,788 notifications to HS codes over 1995–2019. We work at the HS-4 level because most regulations are specified at this broad category (73% of total notifications), compared with only 1.6% at HS-6. Although HS-4 aggregation may underestimate TBT coverage, it yields a cleaner control group of unaffected products as a counterfactual.

Table 2 reports the annual average share of new TBTs affecting products across sectors. Traditional industries such as animal and vegetable products, and foodstuffs have the highest TBT coverage; however, even sectors with more complex supply chains (e.g. machinery and electrical) see about 20% of products covered by new TBTs each year.

Table 2: Annual Average Share of HS4 Products Covered by New TBTs, by Sector

Sector	**Avg. (SD)**	**Sector**	**Avg. (SD)**
Animal Products	0.56 (0.08)	Plastics/Rubbers	0.27 (0.09)
Chemicals	0.24 (0.04)	Raw Hides, Skins, Leathers	0.52 (0.19)
Foodstuffs	0.51 (0.11)	Stone/Glass	0.25 (0.09)
Footwear/Headgear	0.48 (0.16)	Textiles	0.36 (0.12)
Machinery/Electrical	0.23 (0.05)	Transportation	0.27 (0.07)
Metals	0.20 (0.08)	Vegetables	0.59 (0.11)
Mineral Products	0.28 (0.10)	Wood Products	0.28 (0.10)
Miscellaneous	0.18 (0.07)		

Notes: Entries show the annual average share of HS4 product lines covered by new TBTs across countries in each sector, with standard deviation in parentheses.

4.2 Data source on Trade Agreements

Within the EU and the European Free Trade Association (EFTA), free movement of goods in harmonised sectors relies on uniform standards and conformity assessment procedures, whereas non-harmonised sectors follow the principle of mutual recognition.[13] In practice,

[13]See Tables A.5 and A.6 or the EU Website for a the list of non-harmonised sectors.

mutual recognition sometimes proves challenging to implement, leading many exporting firms to adapt directly to national standards. To identify these differences, we consult the European Commission's list of non-harmonised (or partly harmonised) NACE 2 sectors. To create the list of non-harmonised products, we follow Bolatto et al. (2023), and first adopt RAMON concordance from 6-digit HS 2002 to 6-digit CPA 2002 classification, and subsequently from CPA 2.1 to NACE Rev.2 at the 4-digit level. We rely on the UN correspondence tables between HS, ISIC and NACE classifications for the missing sectors.

Beyond the internal EU/EFTA framework, many countries deepen market integration with the EU through preferential trade agreements (PTAs). The World Bank PTA database covers 269 PTAs that entered into force between 1960 and 2017, indicating whether standards, technical regulations, and conformity assessments are harmonised or mutually recognised.[14] Merging this information with our TBT database identifies scenarios where a TBT introduced by one country extends to another via harmonised standards or mutual recognition. The EU, for instance, has signed PTAs with TBT harmonisation provisions that span all sectors (Chile, Jordan, Morocco, San Marino, Tunisia, Turkey).

4.3 Proxies for Adaptation Costs to TBTs

Our empirical analysis relies on two primary proxies to gauge the adaptation costs associated with TBT regulations, focusing on the "regulatory distance" between newly introduced EU TBTs and the corresponding regulations in the source country.

First, we distinguish sourcing from EU-based suppliers versus non-EU suppliers. Across sectors, we then account for whether technical standards are harmonised or subject to

[14] Standards and technical regulations specify product requirements; while conformity assessment procedures define the tests needed for legal compliance (Mattoo et al., 2020). Table A.2 details the variables used.

mutual recognition, reflecting how adaptation costs vary with the degree of regulatory alignment.

Second, we measure the textual similarity of a new EU-TBT to any existing active TBT regulation for the same product in the exporting country, using TF-IDF–weighted text analysis. In particular, we compute the average cosine dissimilarity across TBT descriptions.[15] Low dissimilarity reflects minimal regulatory divergence—and thus lower adaptation costs—while high dissimilarity points to greater mismatch between EU and the origin-country standards.[16]

Figure A.1 underscores how regulatory dissimilarity declines with both geographic proximity and smaller income differences, implying that countries closer in space or per-capita GDP are more likely to share comparable regulations. Appendix A.2 details the data sources and the text-processing steps used to build this measure.

4.4 French Firm Level Data

We rely on two primary sources for French firm-level data. The first is the administrative database *Sirene*, which tracks all active and discontinued firms in France. Sirene provides firm identifiers and classifies each firm's principal activity using the NAF system (broadly consistent with NACE). We use Sirene to identify manufacturing firms based on their primary NAF codes, ensuring consistency over time.[17]

The second data source comprises French Customs records covering 2000–2018, with

[15] TF-IDF (Term Frequency–Inverse Document Frequency) highlights discriminative terms, capturing subtler nuances in descriptions of product requirements.

[16] For example, consider the description of **G/TBT/N/EU/205**: the draft Commission Implementing Regulation sets requirements for food information regarding the absence or reduced presence of gluten ("gluten free" and "very low gluten" statements) compared to **G/TBT/N/AUS/23**: the draft requirements for gluten indications in food ("gluten free" and "very low gluten").

[17] We accessed Sirene in January 2020. To handle revisions in the NAF classification for 2003 and 2008, we rely on INSEE's official conversion tables.

firm-level details on imports and exports disaggregated by product (NC8 tariff lines) and partner country.[18] For each imported shipment, the database specifies both the country of shipment ($PAYP$) and the country of origin ($PYOD$), where the latter denotes the location of production or substantial transformation. We focus on $PYOD$ under the assumption that technical regulations affect the principal manufacturing site.[19]

To identify intermediate inputs, we build on Feenstra and Hanson (1996) and Bas and Strauss-Kahn (2014). Specifically, we compare each firm's imported HS4 codes with its main exported HS4 code (defined by total annual exports). Any imported HS4 code that differs from the main export code is treated as an intermediate.

4.5 Descriptive Statistics

We present two sets of descriptive statistics to illustrate firms' sourcing patterns and the relevance of TBTs. The first set examines sourcing behaviour, thereby validating our firm-level definition of intermediate inputs by demonstrating stability in both the types of inputs sourced and their geographical origins. The second set documents the frequency with which products and importers encounter changes in TBTs, underscoring the importance of these regulations for international trade.

Table 3 reports the sourcing behaviour of the average (mean) and median importer. On average, a firm retains about half of its intermediate inputs from one year to the next, whereas the median importer carries over approximately two-thirds, suggesting stable input mixes. The typical firm sources the same product from nearly two different

[18] To ensure product codes remain comparable despite periodic HS classification changes, we adopt CEPII's correspondence tables.

[19] Before 2010, imports with extra-EU origins were recorded only if they exceeded €1,000. Following Bergounhon et al. (2018), we apply this threshold uniformly throughout our sample to maintain consistent coverage across years and countries. Fortunately, this adjustment does not significantly affect the number of importing firms, the mix of HS codes, or the share of intra-EU trade in the data (Figure A.2).

countries, and this figure remains largely unchanged across the sample period, indicating limited variation in geographic diversification. Additionally, the average importer sources a given HS4 product from the EU about half the time, whereas the median importer relies on EU origins nearly two-thirds of the time. This difference points to a "size premium", whereby larger firms are more likely to import from outside the EU.

Table 4 provides a broader overview of key statistics, broken down into four time periods. Over these intervals, the total number of importing firms is around 35,000. Meanwhile, the share of imported goods covered by at least one TBT nearly doubles, rising from 0.53 to 0.99, indicating that regulatory measures increasingly encompass most traded products. Conversely, the average measure of regulatory dissimilarity declines from 0.71 to 0.66, suggesting gradual convergence or alignment of standards across markets. Overall, these figures highlight growing regulatory exposure and trade volumes, alongside a modest improvement in the harmonisation of technical requirements.

Table 3: Summary statistics on firms' sourcing

	Mean Importer							**Median Importer**						
	Intermediate Import Products			Sourcing Origins per Product				Intermediate Import Products			Sourcing Origins per Product			
year	Count	%New	%Cont.	Count	%New	%Cont.	%EU	Count	%New	%Cont.	Count	%New	%Cont.	%EU
2001	14.8	100	0	1.9	100	0	48.5	7	100	0	1.5	100	0	60
2002	14.9	51.3	48.7	1.9	57.6	42.4	47.6	7	46.2	53.8	1.5	51.3	48.7	57.8
2003	14.6	41.3	51.8	1.9	48.7	45.1	46.5	7	32.1	60	1.5	41.4	50	54.5
2004	14.9	37.7	51.3	1.9	45.5	44.7	50.9	7	26.9	58.3	1.5	37.5	50	65
2005	15	36.8	50.8	1.9	44.9	44.3	48.6	7	25	58.1	1.5	36.4	50	60
2006	15.5	37.5	49.2	1.9	45.4	43.1	49.2	8	25	56.2	1.5	35.7	50	61.4
2007	17.2	38.2	48.2	2	46.4	42.1	50	8	28.9	52.6	1.5	40	47.5	63.2
2008	17.3	33.2	52.6	2	41.9	45.9	49.8	9	21.1	60	1.5	33.3	50	62.6
2009	17.1	29.6	55.2	2	38.3	48.2	48.6	8	16.7	64.7	1.5	28.6	54.4	60
2010	18	28.8	52.4	2	37.4	45.9	51	9	16.7	60.1	1.6	28.2	50	66.3
2011	18.3	29	52.1	2	37.8	45.7	49.2	9	16.7	60	1.6	28.4	50	61.5
2012	18.9	27.5	54.6	2	36.4	48.1	50.2	9	14.5	63.9	1.5	26.8	53.8	63.5
2013	19.3	26.9	54.3	2	36	47.8	48.5	9	13.6	64.1	1.6	25	54.3	60
2014	19.8	26.8	55.1	2	35.1	48.8	48.3	9	13	65	1.5	25	55.6	60
2015	20.2	26.4	54.8	2	34.9	48.4	48.1	10	12.5	64.4	1.5	24.5	55	60
2016	20.7	26.2	55	2.1	34.6	48.5	48.2	10	12.5	64.8	1.5	24	55.3	59.5
2017	23.6	27.9	53.2	2.1	36.6	46.7	48.6	11	14.3	61.9	1.6	26.1	51.5	60

Notes: Products are classified at the HS4 level. Intermediate import products refer to goods imported by firms that do not constitute part of their core export activity. The 'Count' variable represents either the number of distinct HS4 products or the number of unique sourcing countries per HS4 product. %New reflects the average share of newly imported products (origins per product) within a firm's basket of intermediate imports. %Cont denotes the share of products that have been imported over consecutive years; the remainder is the share of imports that have been discontinued. %EU denotes the share of sourcing links originating from the European Union.

Table 4: Summary Statistics on the Estimation Sample

Statistic	2000–2002	2003–2005	2006–2009	2010+
# Importers	33,169	34,046	35,499	39,829
# HS4 Imported Intermediate Inputs	1,242	1,242	1,242	1,242
Total Imports	485.9	521.6	804.1	1,631.6
TBT (Binary Treatment)				
Mean	0.53	0.66	0.82	1.00
By Origin				
TBT in EU origins	0.35	0.45	0.55	0.68
TBT in Non-EU origins	0.18	0.21	0.26	0.32
By Regulatory Integration				
TBT with Harmonisation	0.17	0.21	0.26	0.33
TBT with Mutual Recognition	0.19	0.26	0.32	0.37
TBT without Har. & Mut. Rec.	0.17	0.19	0.23	0.29
Avg. Regulatory Dissimilarity (Cosine Measure)				
Mean	0.68	0.67	0.66	0.65
Std. Dev.	0.47	0.46	0.46	0.45

Notes: Total Imports are in billions of Euro. # Importers and # HS4 Codes represent the number of distinct importers and HS4 product codes in our estimation sample. The TBT binary treatment is a dummy variable equal to one if a TBT is enforced at time t (or earlier, unless withdrawn). The TBT treatment by origin and by regulatory integration represents the average value of the treatment variable interacted with indicators for whether the origin is EU or non-EU, and the type of regulatory integration (Harmonisation, Mutual Recognition, or neither). Regulatory Dissimilarity is measured as the average cosine dissimilarity between EU TBT regulations and those active in the origin market.

5 Empirical Strategy

This section details our empirical approach to estimate how new technical regulations affect firms' import activities. We begin by outlining our identification strategy, followed by an introduction of key variables and the main regression specifications.

5.1 Identification Strategy

Our goal is to isolate the causal effect of adaptation costs to TBT on firm-level import patterns. For this purpose, we estimate:

$$y_{fpot} \;=\; \alpha_0\, TBT_{pt} \;+\; \alpha_1 \left(TBT_{pt} \times \eta_{pot}^{TBT}\right) \;+\; \delta_{fop} \;+\; \delta_{o,t,HS2} \;+\; \epsilon_{fpot}, \tag{9}$$

where y_{fpot} is a measure of import margins by firm f of product p from origin o at time t (e.g., import value). The dummy variable TBT_{pt} equals 1 if a TBT has been enforced on product p in or before year t, while η_{pot}^{TBT} captures origin-specific adaptation costs.[20] We include sector–origin–year fixed effects, $\delta_{ot,HS2}$, to account for common macroeconomic or sectoral shocks, as well as firm–product–origin fixed effects, δ_{fop}, to absorb any time-invariant features of individual firm–origin–product combinations.

This approach exploits within firm, product, origin variation over time, netting out broader demand shifts, unobserved heterogeneity at the firm–product level, and general changes common to all firms operating in a sector HS2 from the same origin country. By doing so, we minimise concerns about omitted variables that could bias our estimation.

A potential concern is reverse causality if authorities implement TBTs in response to rising imports. While Bown et al. (2021) find a causal link between global value chain

[20] When only the date of adoption is available, we follow the WTO's recommendation by adding six months to approximate the actual enforcement date.

integration and trade barrier removal at the sector level, our focus on firm-level variation in TBT impacts across products and origins in narrowly defined sectors reduces the scope for such endogeneity.[21] We also control for potential substitution between non-tariff measures and tariffs by incorporating time-varying, product-level tariff rates (Beverelli et al., 2019; Orefice, 2017), cleaned and interpolated as in Teti (2024).

Finally, because a single TBT can simultaneously affect multiple firms importing the same product from the same origin, we cluster standard errors at the treatment-assignment level (p, o, t) (Abadie et al., 2023). This accounts for correlated outcomes among firms subject to the same regulatory shock.

5.2 Baseline Specifications

We estimate two main specifications, differing in how adaptation costs are measured. The first relies on categorical indicators:

$$y_{fpot} = \sum_{\kappa=0}^{1} \alpha_\kappa \Big(\text{TBT}_{pt} \times \mathbf{1}\{\text{EU}_{ot} = \kappa\}\Big) + \delta_{fop} + \delta_{ot,HS2} + \epsilon_{fpot}, \tag{10}$$

where EU_{ot} indicates whether the origin country o belongs to the EU at time t ($\kappa = 1$) or not ($\kappa = 0$). The key coefficients, α_0 and α_1, capture the average effect of a TBT on a firm's import margins—α_1 for imports from EU sources and α_0 for non-EU sources.

When the import price is the dependent variable, we expect both α_1 and α_0 to be positive. This indicates that higher adaptation costs translate into increased input prices, whether due to renegotiating supplier contracts, which has to incur the adaptation price, or by switching to less efficient suppliers who can more easily comply with new regulatory standards. Moreover, we expect α_0 to be even larger, since non-EU producers generally

[21] Likewise, Garcés and Vogt (2024) document that higher domestic value-added content in imports decreases incentives for restrictive NTM policies, similarly to tariffs.

face higher adaptation costs because of stricter compliance requirements.

In contrast, when input quantity is the dependent variable, two effects are anticipated. First, higher marginal production costs will reduce overall input demand. Second, there may be a shift from non-EU to EU suppliers, resulting in a negative α_0. Simultaneously, α_1 could be positive if the increased demand for inputs from new EU suppliers offsets the decline in demand for inputs from existing suppliers due to higher production costs.

For supply-chain reallocation (exit and entry), we expect that new links (entry) might appear with lower-cost (often EU) suppliers, implying a positive α_1 and negative α_0. For exit, the reverse patterns would hold.

We refine this analysis by introducing deeper integration indicators HAR_{pot} and MR_{pot} for harmonisation and mutual recognition, respectively. HAR_{pot} captures full regulatory alignment (e.g., with the EU in the harmonised sectors), which we expect to facilitate compliance and spur reallocation toward those suppliers. By contrast, MR_{pot} may entail less robust or incomplete regulatory equivalence.

The second specification uses a continuous variable to proxy adaptation costs, as follows:

$$y_{fpot} = \gamma_0 TBT_{pt} + \gamma_1 TBT_{pt} \times \text{Dissimilarity}^{Reg}_{pot} + \delta_{fop} + \delta_{o,t,HS2} + \epsilon_{fpot}. \tag{11}$$

Here, η^{TBT}_{pot} is replaced by our text-based regulatory distance measure, which captures the difference between the EU TBT on product p and the existing TBTs on p in the origin country at the time of enforcement. The coefficient γ_0 represents the average effect of a TBT on import margins for origins with zero $\text{Dissimilarity}^{Reg}_{pot}$, such as EU origins in fully harmonised sectors. In contrast, γ_1 captures the marginal effect of increasing adaptation costs, with interpretations consistent with those discussed for Equation 10.

6 Results and Discussion

6.1 Baseline results

Import Expenditures and Input Prices Table 5 reports how TBTs influence import expenditures (Columns 1–3) and input prices (Columns 4–6). Model 10 first distinguishes between EU and non-EU origins (Columns 1 and 4), then further refines product-origin pairs based on whether they are subject to harmonisation, mutual recognition of standards, or neither (Columns 2 and 5). Model 11 replaces categorical measures with the regulatory dissimilarity, our text-based proxy of adaptation costs (Columns 3 and 6).

Focusing on import expenditures (in logs), Column (1) indicates that TBTs increase imports from EU origins by approximately 1.8% $((e^{0.018}) - 1 \approx 0.018)$, while the effect on non-EU origins is statistically insignificant. Column (2) further disaggregates these results: imports from fully harmonised sectors (either within the EU or through deep integration agreements) increase significantly by 4.4%, whereas those from origins relying on mutual recognition drop by 1.8%, and those lacking harmonisation or MR drop by 2%. Consistently, Column (3) shows that origins with zero regulatory dissimilarity—i.e., fully harmonised sectors—increase import expenditures by 4.3%. By contrast, a one-standard-deviation rise in regulatory dissimilarity decreases expenditures by about 2.7% $((e^{-0.060\times0.45}) - 1 \approx (e^{-0.027}) - 1 \approx -0.0266)$, suggesting that TBTs reallocate spending toward suppliers with lower adaptation costs.[22]

Columns (4)–(6) turn to input prices (in logs). In Column (4), import prices rise significantly by 2% for EU imports and 2.6% for non-EU imports. Column (5) shows price increases across all non-harmonised categories, with the largest increase (2.6%) for origins with neither harmonisation nor MR. Column (6) confirms a positive baseline price

[22] One sd of dissimilarity in our sample is 0.45 (Table 4).

effect of 2.2% for origins with zero dissimilarity, but shows no significant additional price effect from higher adaptation costs (the coefficient on TBT x RegDissimilarity is small and insignificant). This suggests that while TBTs generally lead to higher prices, the extent of regulatory dissimilarity does not significantly exacerbate this effect, perhaps indicating that suppliers, including EU producers, possess bargaining power to raise prices irrespective of their own adaptation costs once a TBT is introduced.

Table 5: Estimation of the effect of TBT on import expenditures and prices

Dependent Variable	Import Value (ln)			Import price (ln)		
	(1)	(2)	(3)	(4)	(5)	(6)
$TBT_{pt} \times \mathbb{1}\{EU_{pt} = 1\}$	0.018**			0.020***		
	(0.008)			(0.005)		
$TBT_{pt} \times \mathbb{1}\{EU_{pt} = 0\}$	-0.018			0.026***		
	(0.012)			(0.006)		
$TBT_{pt} \times \mathbb{1}\{HAR_{pot} = 1\}$		0.043***			0.022***	
		(0.009)			(0.007)	
$TBT_{pt} \times \mathbb{1}\{MR_{pot} = 1\}$		-0.018*			0.016***	
		(0.010)			(0.006)	
$TBT_{pt} \times \mathbb{1}\{HAR_{pot} = 0, MR_{pot} = 0\}$		-0.020*			0.026***	
		(0.012)			(0.006)	
TBT_{pt}			0.042***			0.022***
			(0.009)			(0.007)
$TBT_{pt} \times RegDissimilarity_{pot}$			-0.060***			-0.002
			(0.010)			(0.007)
Observations	7,892,397	7,892,397	7,892,397	7,892,397	7,892,397	7,892,397
Firm-Origin-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Origin-Time-HS2 FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1), (2), and (3) report results for the logarithm of firm-product-origin-year *import value*, while columns (4), (5), and (6) refer to the logarithm of firm-product-origin-year *import price* as proxied by the unit value. TBT_{pt} denotes a technical regulation enforced by the EU on product p at or before time t. EU_{pt} identifies EU origins, while HAR_{pot} and MR_{pot} are used to denote cases where standards are harmonised or subject to mutual recognition. $RegDissimilarity_{pot}$ measures the regulatory distance between new EU TBTs and existing regulations in the origin. All regressions include firm–origin–product and origin–time–HS2 fixed effects, as well as tariff controls. Standard errors are clustered at the product–origin–time level. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Supply Chain Reallocation Table 6 examines how TBTs reshape supply chains by analysing import quantities (Columns 1–3), supplier exits (Columns 4–6), and the probability of forming new sourcing links (Columns 7–9).

Columns (1)–(3) focus on import quantities (in logs). Column (1) indicates that EU TBTs reduce import volumes from extra-EU sources significantly by roughly 4.3%; while the corresponding coefficient for EU origins is negligible and statistically insignificant (-0.002). Column (2) further disaggregates these effects: imports from origins with harmonised standards increase by 2.1%, while those from origins subject to mutual recognition or lacking any formal integration decline significantly by 3.3% and 4.5%, respectively. In Column (3), using regulatory dissimilarity as a continuous measure, an origin with zero dissimilarity experiences a 2% increase in import volume, whereas a one standard deviation increase in regulatory dissimilarity (0.45) is associated with a significant decline of about 2.6%. These results suggest that TBTs shift import volumes toward suppliers facing lower adaptation costs.

Columns (4)–(6) turn to supplier exits (extensive margin). Column (4) indicates that TBTs raise the probability of terminating sourcing links with non-EU origins by 1.3 percentage points, while the effect on EU links is statistically significant but smaller. Column (5) reveals that, when disaggregated by regulatory alignment, harmonised origins exhibit an insignificant effect on exit probability (0.004), whereas those under mutual recognition see exit probabilities rise by 0.8 percentage points and those with no formal arrangements see a significant increase of 1.4 percentage points. Column (6) shows that regulatory dissimilarity has a small and statistically insignificant effect on the exit probability (a one SD increase predicts a 0.3 percentage point increase).

Finally, Columns (7)–(9) assess the creation of new sourcing links (entry, extensive margin). Crucially, these results show a significant reallocation pattern operating through the entry margin. Column (7) implies TBTs lead to a 2.6 percentage point reduction in the probability of forming new sourcing links with non-EU sectors, while the effect for EU origins is negligible (-0.003). Column (8) starkly illustrates diversion through entry: TBTs significantly increase the probability of forming new links with suppliers in harmonised origins by 2.1 percentage points. Conversely, they significantly decrease the likelihood of establishing new relationships with suppliers in mutual recognition origins (by 3.5 percentage points) and those with no arrangements (by 2.7 percentage points). Similarly, Column (9) confirms this pattern using the continuous measure: TBTs significantly increase the probability of entry from origins with zero regulatory dissimilarity (baseline effect of +2.2 percentage points), but higher regulatory dissimilarity strongly deters entry. A one standard deviation increase in dissimilarity is associated with a significant 2.4 percentage point decrease in the probability of new link formation.

Overall, these findings demonstrate that TBTs drive supply chain reallocation through both intensive and extensive margins. Firms adjust quantities from existing suppliers, but also significantly alter their sourcing patterns by selectively forming new relationships. Specifically, TBTs promote entry from suppliers with lower adaptation costs (harmonised/low dissimilarity) while simultaneously discouraging entry from and increasing exit among suppliers facing higher adaptation costs (non-EU/MR/high dissimilarity). This highlights that diversion occurs not just through quantity adjustments but substantially through the creation and destruction of supply links based on regulatory alignment.

6.1.1 Patterns of Diversion under Varying Adaptation Costs

Our theoretical framework distinguishes between scenarios based on the magnitude of relative adaptation costs between sourcing partners: (i) *small relative costs*, where firms renegotiate with current suppliers to share compliance expenses, and (ii) *large relative costs*, where firms abandon high-cost suppliers for more cost-effective alternatives. To empirically test this distinction, we partition our text-based regulatory dissimilarity index into discrete bins, with higher bins indicating greater adaptation costs relative to EU TBTs.

Table 6: Estimation of the effect of TBT on supply chains reallocation

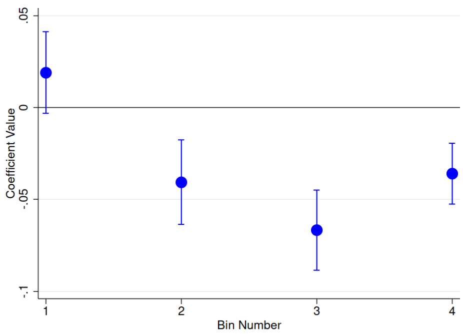
Dependent Variable	Import Quantity (ln)			Exit from old sourcing link			Entry in new sourcing link		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$TBT_{pt} \times \mathbb{1}\{EU_{ot} = 1\}$	-0.002			0.006*			-0.003		
	(0.009)			(0.003)			(0.006)		
$TBT_{pt} \times \mathbb{1}\{EU_{ot} = 0\}$	-0.044***			0.013***			-0.026***		
	(0.013)			(0.005)			(0.008)		
$TBT_{pt} \times \mathbb{1}\{HAR_{pot} = 1\}$		0.021*			0.004			0.021***	
		(0.011)			(0.004)			(0.005)	
$TBT_{pt} \times \mathbb{1}\{MR_{pot} = 1\}$		-0.034***			0.008*			-0.035***	
		(0.011)			(0.004)			(0.011)	
$TBT_{pt} \times \mathbb{1}\{HAR_{pot} = 0, MR_{pot} = 0\}$		-0.046***			0.014***			-0.027***	
		(0.013)			(0.005)			(0.009)	
TBT_{pt}			0.020*			0.004			0.022***
			(0.011)			(0.004)			(0.005)
$TBT_{pt} \times \text{Dissimilarity}_{pot}$			-0.058***			0.006			-0.055***
			(0.012)			(0.004)			(0.009)
Observations		7,892,397	7,892,397	7,892,397	4,587,521	4,587,521	4,587,521	4,702,059	4,702,059
4,702,059									
Firm-Origin-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin-Time-HS2 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variables are as follows: (1)–(3) correspond to the logarithm of firm-product-origin-year import quantity, (4)–(6) capture the probability of exiting an existing sourcing link for a given product from a specific origin, and (7)–(9) measure the probability of establishing a new sourcing link (i.e., a new product-origin pair). TBT_{pt} refers to technical regulations enforced by the EU on product p at or before time t. EU_{ot} identifies origins that are part of the EU in year t. HAR_{pot} denotes product-origin pairs subject to the harmonisation of standards within the EU or with the EU through a trade agreement at time t, while MR_{pot} represents those covered by mutual recognition. Standard errors are clustered at the origin-product-time level. Statistical significance is denoted as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

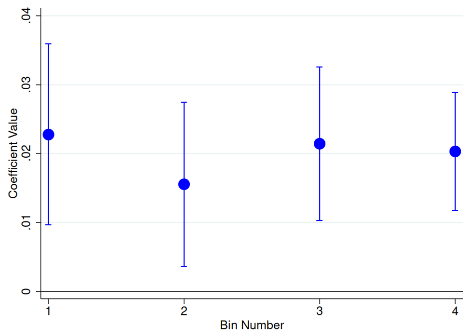
Figure 2 illustrates how the impacts of TBTs vary across these adaptation cost bins for key trade margins. Panel (a) shows that import volumes tend to decrease in higher-cost bins (except the lowest), suggesting that substantial compliance burdens reduce quantities demanded from these suppliers. Crucially, in the highest-cost bin, adaptation costs become sufficiently large to induce significant supplier exit (Panel (c)), aligning with the scenario where firms sever high-cost relationships. Conversely, Panel (d) reveals that new import relationships (entry) increase notably only in the lowest-cost bin, consistent with firms seeking new, easily compliant suppliers when adaptation costs are minimal, while entry drops significantly in higher-cost bins. Interestingly, import prices rise across all cost bins (Panel b), indicating that suppliers generally pass on at least some compliance costs, regardless of their relative ease of adaptation.

These findings empirically validate our theoretical distinction: small adaptation costs primarily influence prices and quantity adjustments, whereas large costs trigger significant supply chain disruption and reallocation away from high-cost suppliers.

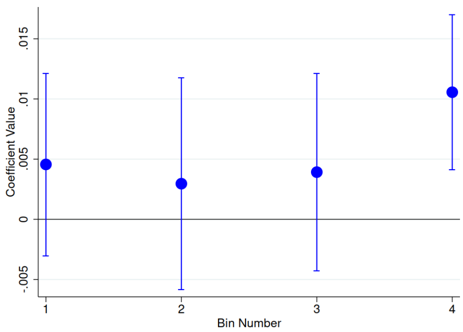
Figure 2: Heterogeneous Effects and Supply Chain Adjustments



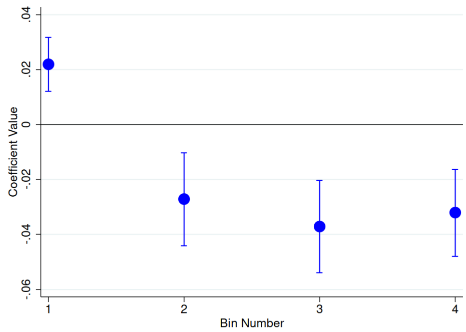
(a) Import Quantity Semi-Elasticities



(b) Import Price Semi-Elasticities



(c) Change in pr. of supplier exit (pp)



(d) Change in pr. of supplier entry (pp)

Notes. Regulatory dissimilarity is divided into four ascending bins. Panel (a) reports TBT semi-elasticities for import quantities, Panel (b) for import prices, and Panels (c) and (d) display the estimated coefficients for supplier exit and new supplier entry probabilities, respectively. Coefficients are estimated from regressions interacting TBT treatment with bin dummies. Details are provided in the main text.

6.2 Robustness of baseline results

6.2.1 Number of TBTs

Our baseline specifications treat a product as covered by a TBT once the first regulation is in force. However, in reality, multiple TBTs often accumulate over time. Likely, each additional TBT can raise adaptation costs, thereby reinforcing the reallocation patterns we observe.

To capture this, we construct a measure of "TBT intensity" defined as the logarithm of one plus the cumulative number of active EU TBTs for product p in year t: $\log(1 + \#\text{TBT}_{pt})$. Tables A.7 and A.8 report the corresponding results.

We find that higher TBT intensity amplifies the baseline effects. The shift in import value and quantity towards EU/harmonised/low-dissimilarity suppliers becomes more pronounced. Price increases also intensify, especially with greater regulatory dissimilarity, consistent with cumulative adaptation costs being passed on. Extensive margin adjustments are similarly reinforced: TBT accumulation further encourages entry from HAR/low-dissimilarity origins while deterring entry from non-EU/MR/high-dissimilarity sources, and increases exits primarily from non-EU and non-integrated suppliers.

Overall, this analysis confirms that our baseline findings are robust, indicating that the observed reallocation and cost effects become stronger as the cumulative TBT burden increases.

6.2.2 Regulatory Dissimilarity Index Validation - Origin characteristics

We further validate our regulatory distance index by using the development level of the origin country as an alternative proxy. Technical regulations tend to be more stringent in high-income countries—either de jure or de facto through stronger enforcement (Disdier et al., 2015)—making it relatively harder for developing countries to comply with EU standards. This is consistent with evidence from Otsuki et al. (2001), who show that EU harmonised aflatoxin standards severely restricted food exports from Africa.

Table A.12 presents results for non-EU origins, split by development level.[23] Following the enforcement of an EU TBT, import quantities fall more sharply for developing countries. On the extensive margin, supplier exit increases significantly only for developing countries, suggesting higher compliance costs. Similarly, the probability of forming new sourcing links declines more for developing (–2.8pp) than for developed (–2.5pp) non-EU countries. These patterns support the idea that development level is a relevant proxy for regulatory adaptation costs, providing external validation for our text-based dissimilarity measure.

6.2.3 Instrumental Variable Strategy

A potential concern with our baseline estimates is endogeneity: the adoption of an EU TBT for a specific product might be influenced by import trends from French firms. Although EU trade policy is set collectively, influential members like France could conceivably shape TBT decisions. To address this potential bias, we employ an instrumental variable (IV) approach using TBTs adopted by the United States, a jurisdiction with relativity high regulatory similarity to the EU according to our index.

Specifically, we treat the baseline interaction terms representing the TBT effect for EU origins ($TBT_{pt} \times \mathbf{1}\{EU_{ot} = 1\}$) and for Non-EU origins ($TBT_{pt} \times \mathbf{1}\{EU_{ot} = 0\}$) as potentially endogenous. We instrument these using two variables derived from US TBT adoption (TBT^{US}_{pt}) and firm-specific exposure to the US market (Exp^{US}_{f}, a dummy for firms ever exporting to the US): $IV_{US\_EU} = TBT^{US}_{pt} \times \mathbf{1}\{EU_{ot} = 1\} \times Exp^{US}_{f}$ and

[23] We rely on the World Bank's income-level classification to categorise countries as developed, developing, or least developed.

$IV_{US\_NonEU} = TBT_{pt}^{US} \times \mathbf{1}\{EU_{ot} = 0\} \times Exp_f^{US}$.

The exclusion restriction assumes that US TBT decisions are exogenous to French firm-level import dynamics. The relevance relies on the correlation between US and EU standards (due to global trends or regulatory dialogue) and the idea that these tailored instruments, conditioned on origin type (EU/Non-EU) and firm US experience, capture relevant exogenous variation predicting the respective endogenous TBT effects.

First-stage results are reported in Tables A.9 (Columns 1-2) and A.10 (Columns 1-4). They confirm the instruments' relevance. Both IV_{US_EU} and IV_{US_NonEU} significantly predict both endogenous variables (TBT_{pt}^{EU} and TBT_{pt}^{Non-EU}). As expected, the predictive power is strongest for the "matching" instrument (e.g., IV_{US_NonEU} has a larger coefficient when predicting TBT_{pt}^{Non-EU}). Furthermore, the Kleibergen-Paap Wald F-statistics for each endogenous variable (reported at the bottom of the tables) are well above conventional thresholds (e.g., >79), mitigating concerns about weak instruments.

The second-stage least squares (2SLS) results (Tables A.9, Cols 3-5 and A.10, Cols 5-6) largely confirm that our baseline findings are robust to potential endogeneity. The IV estimates uphold the intensive margin diversion pattern: TBTs significantly increase import value and quantity from EU origins while decreasing them from Non-EU origins. However, the positive price effects found in OLS become statistically insignificant. On the extensive margin, the IV estimates show reinforced ties with EU suppliers (significantly lower exit, higher entry). In particular, the effects on Non-EU exit and entry become insignificant. Overall, the core finding of TBT-induced reorganisation favouring EU sources appears robust to an endogeneity bias.

6.2.4 Control for Trade Enhancing TBTs

Not all TBTs act as barriers to trade; some are explicitly designed to facilitate imports by reducing regulatory fragmentation. To account for such trade-enhancing measures, we leverage the stated objective(s) provided in TBT Notifications.[24] In particular, we flag two key objectives: harmonisation and trade facilitation. These categories capture regulatory measures aimed at aligning EU standards with international norms or streamlining trade procedures.[25]

Empirical evidence suggests that trade-facilitating TBTs have expansionary effects. As shown by Ghodsi (2024) and corroborated in Table A.11, such measures tend to increase trade volumes, reduce import prices, lower supplier exit rates, and increase entry—consistent with the market-size effects documented by Schmidt and Steingress (2022). Importantly, our key estimates remain stable after controlling for these alternative types of TBTs, confirming that the effects documented in our baseline results stem from adaptation costs rather than regulatory harmonisation efforts.

7 Exploring differential drivers of diversion

This section investigates the heterogeneous responses of firms' supply chains to TBTs by examining three key drivers: product-specific search costs, buyers' reliance on particular suppliers, and the scale of final goods producers.

[24] Countries often report multiple objectives for a single regulation.

[25] For a full list of objectives and their relative frequencies, see Table A.4.

7.1 Search Costs and Trade Diversion

The estimates in Table 7 distinguish between products facing high stickiness (Columns 1–4) and those facing low stickiness (Columns 5–8), where stickiness captures the difficulty or cost of switching suppliers, as defined by Martin et al. (2023).[26] In the high-stickiness subsample (Columns 1–4), the introduction of a technical regulation reduces import quantities from both EU and non-EU origins, suggesting limited scope for re-optimisation when relationship-specific investments are large. The propensity to exit or form new links does not change significantly, implying that high search costs offset any potential savings or efficiencies from switching suppliers. By contrast, in the low-stickiness subsample (Columns 5–8), imports from EU sources rise significantly after the imposition of an EU TBT, while imports from non-EU suppliers decline. These patterns indicate that trade diversion toward relatively lower-cost sources occurs only when search costs are small enough to permit supplier reassignment. Import prices also increase for EU origins in low-stickiness sectors, suggesting that existing EU suppliers can command higher prices once the regulation is introduced. At the same time, the higher probability of exiting non-EU supply links reinforces the view that stricter product customisation amplifies the importance of switching costs, ultimately governing the extent of firms' ability to reconfigure their sourcing strategies.

7.2 Import reliance on specific suppliers

Our theoretical framework suggests that buyers' bargaining power influences how adaptation costs are passed on to import prices. We proxy this bargaining power by France's initial reliance on a specific supplier, with higher reliance indicating fewer available alter-

[26] High-stickiness products have a stickiness value larger than the median.

Table 7: Estimation of the effect of TBT by product stickiness

	High Stickiness				Low Stickiness			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Import Price (ln)	*Quantity (ln)*	*Exit*	*Entry*	*Import Price (ln)*	*Quantity (ln)*	*Exit*	*Entry*
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{pt} = 1\}$	0.015**	-0.044***	0.006	0.005	0.025***	0.032**	0.013**	0.000
	(0.007)	(0.012)	(0.004)	(0.006)	(0.009)	(0.015)	(0.005)	(0.006)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{pt} = 0\}$	-0.003	-0.056***	0.002	-0.011*	0.047***	-0.047**	0.032***	-0.024***
	(0.008)	(0.017)	(0.007)	(0.007)	(0.009)	(0.019)	(0.007)	(0.008)
Observations	4,130,277	4,130,277	2,360,260	2,430,381	3,725,778	3,725,778	2,146,096	2,180,990
Firm–Origin–Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin–Time–HS2 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1)–(4) report estimates for high stickiness products, while columns (5)–(8) report estimates for low stickiness products. The dependent variables are defined as follows: *Import Price (ln)* is the logarithm of the import price; *Quantity (ln)* is the logarithm of firm–origin–product–year import quantity; *Exit* is the exit probability; and *Entry* is the entry probability of a product-origin sourcing link. TBT_{pt} denotes a technical regulation imposed on product p at time t. The indicator $\mathbb{1}\{\text{EU}_{pt} = 1\}$ equals one if the product originates from an EU country, and zero otherwise. Product stickiness is measured following Martin et al., 2023 and is defined as high if the product's stickiness measure is above the median (computed separately by year) and low otherwise. Standard errors are clustered at the origin-product-time level. Statistical significance is denoted as follows: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

natives and thus weaker bargaining power (i.e., a lower β). We measure reliance using aggregated product-level import data from BACI for the year 2000. If a narrowly defined French sector sources most of its products from a single origin, the scope for substitution is limited; in contrast, lower reliance implies greater flexibility in switching suppliers when compliance costs increase.

Table 8 categorises product–origin pairs into tertiles (Q1, Q2, Q3) based on France's initial import market share, and interacts these with the TBT indicator and an EU dummy. For non-EU origins in the highest reliance quartile (Q3), TBTs are associated with an 7.9% decline in import quantities and a 3.6% increase in import prices. These results suggest that suppliers with a dominant market position can leverage their captive status to pass on a larger share of adaptation costs, leading buyers to reduce volumes more sharply. In moderately relied-upon non-EU origins (Q2), price increases are smaller, but exit rates are higher, implying that buyers can more easily substitute suppliers when alternatives are available. In the EU subsample, import volumes remain relatively stable or contract slightly, while unit values rise markedly across tertiles, consistent with the idea that even lower adaptation costs are partially passed on when buyer power is limited. Finally, new sourcing (Column 4) is more constrained in low-reliance tertiles, indicating that prospective entrants without an established foothold face higher barriers to market entry.

Overall, these results underscore the importance of bargaining power (proxied by reliance) in determining how adaptation costs are borne by suppliers, paid by buyers through higher unit prices, or lead to more frequent exit and sourcing reconfiguration.

Table 8: Effect of TBTs on import margins by French import reliance tertiles

Dependent Variable	*Import Price (ln)*	*Quantity (ln)*	*Exit*	*Entry*
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 1\} \times Q1$	0.022***	0.020	0.016***	-0.036***
	(0.007)	(0.012)	(0.004)	(0.011)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 1\} \times Q2$	0.019***	-0.016	0.007*	-0.003
	(0.006)	(0.011)	(0.004)	(0.006)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 1\} \times Q3$	0.019***	-0.002	0.002	0.009
	(0.007)	(0.012)	(0.004)	(0.008)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 0\} \times Q1$	0.026***	-0.042***	0.020***	-0.047***
	(0.007)	(0.014)	(0.005)	(0.011)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 0\} \times Q2$	0.019**	-0.016	0.012**	-0.010
	(0.007)	(0.017)	(0.006)	(0.008)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 0\} \times Q3$	0.035***	-0.082***	0.002	-0.006
	(0.010)	(0.020)	(0.009)	(0.013)
Observations	7,892,397	7,892,397	4,587,521	4,702,059
Firm–Origin–Product FE	Yes	Yes	Yes	Yes
Origin–Time–HS2 FE	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes

Notes: The dependent variables are defined as follows: *Import Price (ln)* is the logarithm of the import price; *Quantity (ln)* is the logarithm of import quantity; *Exit* is the exit probability; and *Entry* is the entry probability of an importing firm. TBT_{pt} denotes a technical regulation imposed on product p at time t, and $\mathbb{1}\{\text{EU}_{ot} = 1\}$ equals one if the origin country o is an EU member. The tertiles (Q1, Q2, and Q3) are defined using import values in 2000 by product origin, measured in terms of French import market share in that year. Standard errors are clustered at the origin-product-time level for robustness. Statistical significance is denoted as follows: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

7.3 Scale of Final Good Producers and Incentives for Diversion

Our theoretical framework proposes that reduced spending on intermediate inputs leads to a lower marginal benefit from search, encouraging producers to become more tolerant to sub-optimal matches. As a result, we expect that smaller firms are more inclined to retain their existing suppliers in order to avoid the costs associated with the search for new ones. While larger final goods' producers have more incentive to restructure their supply chains and renew their efforts in searching for new, improved supplier matches. To reduce potential endogeneity, we account for the initial size of each firm at the start of the period, based on their import levels.[27]

Table 9 displays the heterogenous results for different firm size. The lower marginal benefit of searching for a better supplier improves the bargaining position of enduring suppliers leading to an increase of prices both from EU and non-EU origins. However, larger final goods producers are able to renegotiate input prices with their EU suppliers (Column (1)). The quantity imported by the average firm is not affected by the introduction of a TBT. While, the quantity imported by larger firms from non-EU sources decreases, and the quantity imported from EU-sources increases (Column (2)).

We find that the introduction of a new TBT increases the probability of exiting by 1.4 percentage points if the source is not part of the EU and by 0.8 percentage points if the source is a European country, for the average firm. Its probability to start importing from a non-EU origin decreases by 3.1 percentage points (Column (4)). On the other hand, the probability to create a new sourcing link within or outside the EU increases for larger firms, suggesting that larger firms are the ones that divert.

[27] We use the first year the firm imports to measure its initial size to avoid dropping firms that do not import from the first year available in our data.

Table 9: Effect of TBTs on imports margins by firms' size (import expenditure)

	(1) *Import Price (ln)*	(2) *Import Quantity (ln)*	(3) *Exit*	(4) *Entry*
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 1\}$	0.022***	-0.007	0.008**	-0.007
	(0.005)	(0.009)	(0.003)	(0.006)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 1\} \times Size_f$	-0.002***	0.004***	-0.002***	0.003***
	(0.000)	(0.001)	(0.000)	(0.000)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 0\}$	0.026***	-0.021*	0.014***	-0.031***
	(0.006)	(0.013)	(0.005)	(0.008)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 0\} \times Size_f$	-0.000	-0.010***	-0.000*	0.002***
	(0.001)	(0.001)	(0.000)	(0.000)
Observations	7,892,397	7,892,397	4,587,521	4,702,059
Firm-Origin-Product FE	Yes	Yes	Yes	Yes
Origin-Time-HS2 FE	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes

Notes: The dependent variables are defined as follows: *Import Price (ln)* is the logarithm of the import price; *Quantity (ln)* is the logarithm of firm–origin–product–year import quantity; *Exit* is the exit probability; and *Entry* is the entry probability of an importing firm. TBT_{pt} denotes a technical regulation imposed on product p at time t. The indicator $\mathbb{1}\{\text{EU}_{pt} = 1\}$ equals one if the product originates from an EU country, and zero otherwise. $Size_f$ measures the scale of the firm and is defined as import value (quantity) the first time the firm imports. Standard errors are clustered at the origin-product-time level. Statistical significance is denoted as follows: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

8 Conclusion

This study investigates how technical standards and their associated adaptation costs, driven by regulatory diversity, shape firms' global sourcing strategies. We extend the theoretical framework of Grossman et al. (2024) by incorporating heterogeneous adaptation costs, highlighting the trade-off firms face between absorbing these costs within existing supplier relationships versus seeking new, potentially lower-cost partners elsewhere. This decision hinges on the relative costs of compliance across different geographical origins and markets.

To test the model's predictions, we develop a novel database mapping EU TBTs over 25 years and construct a text-based measure of regulatory distance between EU standards and those of exporting countries, serving as a proxy for adaptation costs. Analysing detailed French firm-level import data from 2000-2017, our empirical findings reveal significant supply chain reorganisation following the introduction of EU TBTs. We find clear evidence of trade diversion towards suppliers facing lower adaptation costs: import expenditures and quantities rise for suppliers in origins with harmonised standards (value up approx. 4.4%) or low regulatory dissimilarity relative to the EU (value up approx. 4.3% at zero dissimilarity), while imports from non-EU origins decline (quantity down approx. 4.3%). Furthermore, higher regulatory dissimilarity significantly dampens import value (a one standard deviation increase reduces value by approx. 2.7%). This reallocation occurs on the extensive margin as well: TBTs significantly deter entry from non-EU origins (probability down by 2.6pp) and increase exit probability from these sources (+1.3pp), while strongly encouraging entry from harmonised origins (+2.1pp).

Regarding prices, we find that TBTs lead to increases for imports from both EU (approx. +2.0%) and non-EU (+2.6%) origins. However, these price hikes show limited correlation with our measure of regulatory dissimilarity, suggesting that market power allows suppliers, including lower-cost EU ones, to raise prices when new regulations are imposed. Our heterogeneity analysis further underscores the importance of channel characteristics: trade diversion is more pronounced for products with low switching costs, high initial reliance on specific non-EU suppliers leads to stronger price pass-through and larger quantity reductions, and larger importing firms restructure their supply chains more actively.

By systematically documenting the impact of EU technical standards on firm-level sourcing decisions and quantifying the role of adaptation costs via regulatory distance, this paper contributes to the understanding of trade policy in a world shaped by global value chains, and highlight important policy implications. As non-tariff measures like TBTs become central to trade policy, our results demonstrate that regulatory divergence acts as a significant driver of supply chain structure, potentially leading to substantial trade diversion even amidst tariff liberalisation. Understanding the adaptation costs imposed by different regulatory approaches is crucial for assessing the true impact of modern trade agreements and domestic regulations on global value chains. Future research could delve deeper into the welfare consequences of these reallocations for consumers, firms, and sourcing countries.

References

Abadie, A., Athey, S., Imbens, G. W., & Wooldridge, J. M. (2023). When should you adjust standard errors for clustering? *The Quarterly Journal of Economics*, *138*(1), 1–35.

Allen, T. (2014). Information frictions in trade. *Econometrica*, *82*(6), 2041–2083.

Antràs, P., & De Gortari, A. (2020). On the geography of global value chains. *Econometrica*, *88*(4), 1553–1598.

Antràs, P., & Staiger, R. W. (2012). Offshoring and the role of trade agreements. *American Economic Review*, *102*(7), 3140–83.

Bas, M., & Strauss-Kahn, V. (2014). Does importing more inputs raise exports? firm-level evidence from france. *Review of World Economics*, *150*(2), 241–275.

Bergounhon, F., Lenoir, C., & Mejean, I. (2018). A guideline to french firm-level trade data. *Unpublished Manuscript*.

Bernard, A. B., Blanchard, E. J., Van Beveren, I., & Vandenbussche, H. (2019). Carry-along trade. *The Review of Economic Studies*, *86*(2), 526–563.

Beverelli, C., Boffa, M., & Keck, A. (2019). Trade policy substitution: Theory and evidence. *Review of world economics*, *155*, 755–783.

Blanchard, E. J., Bown, C. P., & Johnson, R. C. (2025). Global value chains and trade policy. *Review of Economic Studies*, rdaf017.

Blind, K., Mangelsdorf, A., Niebel, C., & Ramel, F. (2018). Standards in the global value chains of the european single market. *Review of International Political Economy*, *25*(1), 28–48.

Bolatto, S., Naghavi, A., Ottaviano, G., & Zajc Kejžar, K. (2023). Intellectual property and the organization of the global value chain. *Economica*, *90*(359), 707–745.

Bondi, A., Baccini, L., Fiorini, M., Hoekman, B., Altomonte, C., & Colantone, I. (2025). Global value chains and the design of trade agreements. *The Review of International Organizations*, 1–33.

Bown, C. P. (2018). Trade policy toward supply chains after the great recession. *IMF Economic Review*, *66*(3), 602–616.

Bown, C. P., Erbahar, A., & Zanardi, M. (2021). Global value chains and the removal of trade protection. *European Economic Review*, *140*, 103937.

Cadot, O., Asprilla, A., Gourdon, J., Knebel, C., & Peters, R. (2015). *Deep regional integration and non-tariff measures: A methodology for data analysis*. UN.

Chen, M. X., & Mattoo, A. (2008). Regionalism in standards: Good or bad for trade? *Canadian Journal of Economics/Revue canadienne d'économique*, *41*(3), 838–863.

Conconi, P., García-Santana, M., Puccio, L., & Venturini, R. (2018). From final goods to inputs: The protectionist effect of rules of origin. *American Economic Review*, *108*(8), 2335–2365.

Disdier, A.-C., Fontagné, L., & Cadot, O. (2015). North-south standards harmonization and international trade. *The World Bank Economic Review*, *29*(2), 327–352.

Disdier, A.-C., Gaigné, C., & Herghelegiu, C. (2023). Do standards improve the quality of traded products? *Canadian Journal of Economics/Revue canadienne d'économique*, *56*(4), 1238–1290.

Feenstra, R. C., & Hanson, G. H. (1996). Globalization, outsourcing, and wage inequality. National Bureau of Economic Research Cambridge, Mass., USA.

Fontagné, L., & Orefice, G. (2018). Let's try next door: Technical barriers to trade and multi-destination firms. *European Economic Review*, *101*, 643–663.

Fontaine, F., Martin, J., & Mejean, I. (2023). *Frictions and adjustments in firm-to-firm trade*. Centre for Economic Policy Research.

Garcés, I., & Vogt, A. (2024). Global value chain integration and non-tariff measures. *Economics Letters*, 111518.

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of international political economy*, *12*(1), 78–104.

Ghodsi, M, & Stehrer, R. (2019). Non-tariff measures in the presence of global value chains and their impact on productivity. *Behind-the-Border Policies: Assessing and Addressing Non-Tariff Measures*, 65–99.

Ghodsi, M. (2024). Regulatory convergence within technical barriers to trade. *The World Economy*, *47*(5), 1870–1915.

Ghodsi, M., Grübler, J., Reiter, O., & Stehrer, R. (2017). *The evolution of non-tariff measures and their diverse effects on trade* (tech. rep.). wiiw Research Report.

Grossman, G. M., & Helpman, E. (2005). Outsourcing in a global economy. *The Review of Economic Studies*, *72*(1), 135–159.

Grossman, G. M., Helpman, E., & Redding, S. J. (2024). When tariffs disrupt global supply chains. *American Economic Review*, *114*(4), 988–1029.

Grossman, G. M., McCalman, P., & Staiger, R. W. (2021). The "new" economics of trade agreements: From trade liberalization to regulatory convergence? *Econometrica*, *89*(1), 215–249.

Han, S., Xinfen, Julia, & Steingress, W. (2019). *Constructing a concordance table between harmonized system (hs) and international classification for standards (ics)*. http://julia-schmidt.org/Han_Schmidt_Steingress_ICS_HS.pdf

Huang, H., Manova, K., Perello, O., & Pisch, F. (2024). Firm heterogeneity and imperfect competition in global production networks. *Available at SSRN 4723282*.

Iodice, I. (2020). *Three essays on firms in international markets* (Doctoral dissertation). Université Panthéon-Sorbonne-Paris I; Scuola superiore Sant'Anna di studi universitari e di perfezionamento (Pise, Italie).

Krolikowski, P. M., & McCallum, A. H. (2021). Goods-market frictions and international trade. *Journal of International Economics*, *129*, 103411.

Lamy, P. (2015). Looking ahead: The new world of trade (jan tumlir lecture). ECIPE Conference, Brussels. Retrieved from https://ecipe. org/wpcontent ...

Lamy, P. (2016). The changing landscape of international trade. *The Frank D. Graham Lecture, https://pascallamyeu. files. wordpress. com/2017/02/2016-04-07-lamyprinceton-graham-lecture-final. pdf.*

Macedoni, L., & Weinberger, A. (2021). Quality misallocation, trade, and regulations.

Maggi, G., & Ossa, R. (2021). The political economy of deep integration. *Annual Review of Economics*, *13*, 19–38.

Maggi, G., & Ossa, R. (2023). The political economy of international regulatory cooperation. *American Economic Review*, *113*(8), 2168–2200.

Martin, J., Mejean, I., & Parenti, M. (2023). Relationship stickiness, international trade, and economic uncertainty. *Review of Economics and Statistics*, 1–45.

Mattoo, A., Rocha, N., & Ruta, M. (2020). *Handbook of deep trade agreements*. World Bank Publications.

Nadvi, K. (2008). Global standards, global governance and the organization of global value chains. *Journal of economic geography*, *8*(3), 323–343.

Navaretti, G. B., Felice, G., Forlani, E., & Garella, P. G. (2018). Non-tariff measures and competitiveness. *Centro Studi Luca d'Agliano Development Studies Working Paper*, (438).

Orefice, G. (2017). Non-tariff measures, specific trade concerns and tariff reduction. *The World Economy*, *40*(9), 1807–1835.

Ornelas, E., Turner, J. L., & Bickwit, G. (2021). Preferential trade agreements and global sourcing. *Journal of International Economics*, *128*, 103395.

Otsuki, T., Wilson, J. S., & Sewadeh, M. (2001). Saving two in a billion: Quantifying the trade effect of european food safety standards on african exports. *Food policy*, *26*(5), 495–514.

Parenti, M., & Vannoorenberghe, G. (2024). A simple theory of deep trade integration. *Journal of the European Economic Association*, jvae046.

Schmidt, J., & Steingress, W. (2022). No double standards: Quantifying the impact of standard harmonization on trade. *Journal of International Economics*, 103619.

Singh, R., & Chanda, R. (2021). Technical regulations, intermediate inputs, and performance of firms: Evidence from india. *Journal of International Economics*, *128*, 103412.

Teti, F. (2024). Missing tariffs. *CESifo Working Paper Series 11590.*

The European Commission. (2017). *Evaluation of mutual recognition* (tech. rep.). The European Commission.

UNCTAD. (2017). *Unctad trains: The global database on non-tariff measures* (tech. rep.). UNCTAD.

A Appendix

A.1 Construction of the Machine Learning Algorithm

The final step of the TBT database construction implements a Support Vector Machine (SVM) classifier to recover the missing HS code using word-similarity between TBT's product description and a set composed of the descriptions from the HS classification and the entries from Step 1. In order to perform this text classifier, we have trained and tested a model on labelled entries, which are those text descriptions that have either been associated with an HS4 by the WTO or that are contained in the HS4 nomenclature provided by UNCTAD. We start by transforming the text description of HS4 products into vector representations. To this aim, we assign a fixed integer id to each word occurring in any product description of the training set. For each product text description i, we count the number of occurrences of each word w and store it in $X[i, j]$, where j represents the index of word w in a dictionary that includes all words found across HS4 product descriptions. This approach is known as a bag-of-words representation. Before vectorising we have processed the texts using text pre-processing, tokenizing and filtering of stop-words, which are all included in the function 'CountVectorizer' of the sci-kit learn package. Since long HS4 description will have a higher average count of words than shorter ones, even though they describe products at the same level of disaggregation, we normalise the number of occurrences of each word in a description by the total number of words in that product description: these new values of $X[i, j]$ are called 'tf' for Term Frequencies. Another refinement on top of 'tf' is to reduce weights for words that occurs in many HS4 descriptions and are therefore less informative than those that are rarer. For example, the word 'product' is likely to appear in many HS4 headings, while we expect the word 'engine' to be in the text description of fewer goods. This down-scaling of the weight of common words is called 'tf–idf'

for "Term Frequency times Inverse Document Frequency". The matrix that stores the 'tf–idf' values is called $\mathbf{X}$ and has size $p \times n$, where p is the number of labelled entries, i.e., product description for which we know the HS4 product category, and n is the total number of words in the vocabulary. Using this matrix of feature, we train a linear SVM, which is widely regarded as one of the best text classification algorithms. It consists in a minimisation of a hinge loss function with a penalty term as follows:

$$\min_{\mathbf{w}\in\mathbb{R}^p} \left\{ \frac{1}{n}\sum_{i=1}^{n} \underbrace{\max\{0, 1 - y_i \mathbf{w}^\top \mathbf{x}_i\}}_{\text{'Hinge' loss function on } (\mathbf{x}_i, y_i)} + \lambda \|\mathbf{w}\|_2^2 \right\}$$

where $\lambda \geq 0$ adjusts the margin (or 'complexity') of the solution (typically chosen using a held-out sample). Our problem is a multiclass type and we apply a one-versus-one approach solving $\binom{K}{2}$ SVMs, where K are the number of HS4 categories, each of which compares a pair of HS4 categories. For example, one such one-versus-one SVM might compare the kth class, coded as $+1$, to the $k\ th + 1$ class, coded as -1. We classify a test observation using each of the $\binom{K}{2}$ classifiers, and we tally the number of times that the test observation is assigned to each of the K classes. The final classification is performed by assigning the test observation to the class to which it was most frequently assigned in these K pairwise classifications. We have also experiment with a naive Bayes classifier. We evaluate the predictive accuracy of the classifier on a test set, which represents around 30% of the labelled HS4 product descriptions, which have not been used to train the classifier and we achieve 95.7% of accuracy.

A.2 Construction of an Index for Regulatory Dissimilarity

We begin by converting the EU TBT's description into a numerical representation using TF-IDF weights. This involves assigning a weight to each word based on its frequency within the TBT's description and its overall rarity across all TBT descriptions. The resulting vector, $\mathbf{DESC^{EU}_{pt}}$, represents the EU TBT at time t.

Simultaneously, we create a matrix, $\mathbf{DESC_{opt}}$, containing TF-IDF representations of all active TBTs in market o at time t. Each column of this matrix corresponds to a TBT.

To assess the similarity between the EU TBT and those in market o, we calculate the cosine dissimilarity between $\mathbf{DESC^{EU}_{pt}}$ and each column in $\mathbf{DESC_{opt}}$. This metric measures the angle between the vectors, with larger angles indicating greater dissimilarity.

Rather than focusing on the most similar TBT, we compute the average cosine dissimilarity across all TBTs in market o. This provides a comprehensive measure of how different the EU TBT's description is from the overall regulatory landscape in market o.

A higher average cosine dissimilarity suggests that the EU TBT's description is less representative of the typical TBT in market o, based on their word usage patterns.

The cosine dissimilarity is calculated as follows:

$$\text{CosineDissimilarity}(\mathbf{DESC^{EU}_{pt}}, \mathbf{DESC_{opt}}) = 1 - \frac{\mathbf{DESC^{EU}_{pt}} \mathbf{DESC_{opt}}}{\|\mathbf{DESC^{EU}_{pt}}\| \cdot \text{colNorms}(\mathbf{DESC_{opt}})} \tag{12}$$

where $\text{colNorms}(\mathbf{DESC_{opt}})$ is a vector containing the Euclidean norms (or lengths) of each column in $\mathbf{DESC_{opt}}$. The denominator is used to normalise with respect to the length of the TBTs (both the EU's and the origin countries' TBTs). The division in the formula is carried out element-wise.

The average cosine dissimilarity is calculated as follows:

$$\text{RegDissimilarity}_{pot} = \frac{1}{n_{opt}} \sum_{i=1}^{n_{opt}} \text{CosineDissimilarity}(\mathbf{DESC}^{\mathbf{EU}}_{\mathbf{pt}}, \mathbf{DESC}_{\mathbf{opt}\cdot,i}) \tag{13}$$

A.3 Tariff Database

WITS database contains information on the effectively applied tariffs (defined as the lowest available tariff between preferential and MFN). To be consistent with the import data, micro-level French data aggregated at the legal unit, HS-4 and year level, we use HS 4-digit tariff data as a weighted average tariff within HS-4 headings (directly provided by WITS).[28]

A.4 Theoretical Framework

In this section we detail the model of global value chains developed by Grossman et al. (2024).

Setup Firms in a monopolistically competitive industry combine labour and a composite intermediate good to produce differentiated products. The intermediate good requires a continuum of inputs, that are combined using a Leontief technology in fixed proportions. Each firm can produce any input it needs using a backstop technology or it can search for an external supplier of that input at home or in a foreign market of its choice. When firms locate a supplier, it learns the productivity of the potential match by undergoing an investment which entails a sunk cost. It can then bargain with the supplier over a

[28]HS-4 digit tariff data is a weighted average tariff within HS-4 headings of the HS-6 tariff level data, this aggregation is directly provided by WITS, using EU import data as a weight. Unfortunately, the database has many empty entries, to avoid mis-interpolation Teti (2024) we download data without interpolation and we only perform carry-forward interpolation.

short-term (but renewable) contract, or it can choose to resume its search.

Preferences and demand Consumers demand a homogeneous good and an array of differentiated products. Preferences are characterised by:

$$\Omega(X,Y) = Y + U(X) \tag{14}$$

Where $\Omega(X,Y)$ is the quasi-linear utility of the representative individual, Y is its consumption of the homogeneous good, and X is an index of consumption of differentiated varieties. We take the mass of consumers to measure one and the sub-utility $U(.)$ to have constant utility:

$$U(X) = \begin{cases} \dfrac{\varepsilon}{\varepsilon - 1}\left(X^{\frac{\varepsilon-1}{\varepsilon}} - 1\right) & \text{for } \varepsilon \neq 1 \\ \log X & \text{for } \varepsilon = 1 \end{cases} \tag{15}$$

The consumption index takes the form:

$$X = \left[\int_o^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{1}{1-\sigma}} \tag{16}$$

where $x(\omega)$ is the consumption of variety ω, n is the measure of varieties available in the home country, and σ is the constant elasticity of substitution between any pair of brands. The corresponding real price index is:

$$P = \left[\int_o^n p(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}} \tag{17}$$

where $p(\omega)$ denotes the per-unit price of brand ω. In order to focus most sharply on the supply chains, we assume that the differentiated final goods are not tradable; allowing us to ignore the determinants of foreign demand for home brands. The representative home consumer purchases differentiated products up to the point where $U'(X) = P$ or $X = \chi(P)\left[\frac{p(\omega)}{P}\right]^{-\sigma}$. Each individual demands variety ω as a function of its price and aggregate price index as follows:

$$x[p(\omega), P] = \chi(P)\left[\frac{p(\omega)}{P}\right]^{-\sigma} \tag{18}$$

The demand for brand ω declines with its own price and increases with the price index for competitor brands, i.e.: $\sigma > \varepsilon$.

Production The homogeneous good is produced competitively with labour alone and is freely tradable. By choice of units and numeraire, one unit of good Y requires one unit of labour and bears a normalised price of one. This fixes the home wage rate at one in units of the homogeneous good. Firms in the imperfectly-competitive sector produce unique varieties of the differentiated final good using labour, l, and bundles of a composite intermediate good, m, subject to a constant-returns-to-scale production function $z(l, m)$. The composite intermediate good comprises a unit continuum of inputs indexed by j in fixed proportions, with one unit of each input needed for each unit of the composite. Following GHR, we assume that the marginal cost of any differentiated product takes the form $c(\phi) = \phi^{\alpha}$, with $0 < \alpha < 1$.
In addition to variable costs, a firm producing any variety ω bears a one-time entry cost of F_e units of home labour, as well as recurring fixed operating cost of f_o. Moreover, it bears a cost of finding partners for its global value chain.

Search and match The creation of supply chains requires that producers locate suppliers. We suppose that firms can search for potential suppliers in one or more countries

$i \in \{1, ..., I\}$. One value of i represents the home country, so that producers of differentiated products might seek out domestic outsourcing relationships. With the symmetry that we impose across inputs, it is always optimal for a firm to search for all of its suppliers in a single country, although that target country might change following the imposition of a TBT. With free trade, the optimal location for any supply chain is the country that has the lowest (efficiency-adjusted) wage.

Search requires home labour. A firm ω seeking for a supplier for input j can take a draw from a cumulative distribution $G(.)$ at a capital cost of F. The realisation of this draw, a, reveals the quality of the match between the producer and a supplier. A potential supplier with match-specific productivity a can produce a unit of j for brand ω at a cost of aw. The firm producing ω decides whether to negotiate a short-term but renewable contract to buy input j from the potential supplier or whether to continue its search by taking another, independent, draw from $G(.)$ at an additional cost of F. For simplicity, we abstract from the time that may elapse between draws and assume that all search takes place in an instant. We assume that $g(a) \equiv G'(a) > 0$ for all $a \in (0, 1]$ and $g(a) = 0$ for all $a > 1$.

The optimal search strategy involves a reservation stopping rule that we denote with $\bar{a}$, such that firm takes another draw for the input j if and only if all of its prior draws for that input had inverse match productivities that exceed $\bar{a}$. Thus, all of a firm's suppliers will have inverse productivities in the range $[0, \bar{a}]$, with densities given by $\dfrac{g(a)}{G(\bar{a})}$. Given the continuum of inputs and the independence across them, the search process leads to a deterministic cost for a given quantity of the composite intermediate, m.

We can calculate the total cost of a firm's search effort, $S(\bar{a})$, as a function of the stringency of its stopping rule. When a firm takes its first draw, it pays F. Then, with probability $G(\bar{a})$, it achieves at least its reservation level of match productivity, in which case there are no further search costs. With the remaining probability, $1 - G(\bar{a})$, it encounters a supplier with $a > \bar{a}$, in which case it finds itself facing again a search cost of $S(\bar{a})$. It follows that:

$$S(\bar{a}) = \frac{F}{G(\bar{a})} \tag{19}$$

Bargaining We assume Nash bargaining with exogenous weights β for the buyer and $1 - \beta$ for the seller and define $\rho(a)$ the agreed price per unit of an input produced with inverse productivity a.[29]

The seller has no outside option. Therefore, a seller with match productivity a earns a surplus from the relationship equal to the difference between its revenues $\rho(a)m$ and its production costs, wam, considering that the m units of the composite require m units of each of its components.

The buyer's outside option is to resume its search for an alternative supplier.[30] Thus, the outside option for the buyer is the expected cost of finding a new supplier plus the payment it would expect to make to this new supplier. Continued search engenders an expected capital cost of $S(\bar{a})$. The expected payment to an alternative supplier is $\mu_\rho(\bar{a})m$, where

$$\mu_\rho(\bar{a}) = \frac{1}{G(\bar{a})} \int_0^{\bar{a}} \rho(a) g(a) da \tag{20}$$

is the expected price of an input drawn randomly from the truncated distribution with domain $[0, \bar{a}]$. Then the Nash bargaining consists in solving

[29] We assume negotiation occurs only over prices, since quantities demanded of the intermediate inputs are fixed by the Leontief technology. This means, that once the once a firm has decided to purchase m units of every input from its many other suppliers, it has no use for any more than this amount from the individual supplier with whom it is bargaining.

[30] The firm could also choose to produce input j domestically.

$$\rho(a) = \arg\max_q (qm - wam)^{1-\beta}[\mu_\rho(\bar{a})m + S(\bar{a}) - qm]^\beta. \tag{21}$$

The Nash bargaining solution implies that

$$\rho(a) = \beta wa + (1-\beta)w\mu_a(\bar{a}) + \frac{1-\beta}{\beta}\frac{F}{mG(\bar{a})} \tag{22}$$

and

$$\mu_\rho(\bar{a}) = w\mu_a(\bar{a}) + \frac{1-\beta}{\beta}\frac{F}{mG(\bar{a})} \tag{23}$$

Where $\mu_a(\bar{a})$ is the conditional mean of a for $a \leq \bar{a}$. When the producer follows the same search strategy and bargaining process for all of its inputs, it pays $\mu_\rho(\bar{a})$ per unit for its composite intermediate good plus the fixed cost of search, $F/G(\bar{a})$.

To minimise cost, the firm chooses the optimal search strategy $\bar{a}$ for producing m units of the intermediate, and the optimal factor mix, m and l, producing x units of its brand. The factor mix minimises $l + w\mu_a(\bar{a})m + F/\beta G(\bar{a})$, subject to $z(l,m) \geq x$, where $c(\omega) = w\mu_a(\bar{a})$ is the perceived marginal cost of a unit of m. Shephard's Lemma then gives us the factor demands, so that $m = xc'$ and $l = x(c - w\mu_a c')$

Regarding the optimal search strategy, each firm chooses $\bar{a}$ to minimise the aggregate payment to suppliers and the cost of search, $\bar{a} = \arg\min_a [mw\mu_a(a) + F/\beta G(a)]$. The first-order condition implies

$$mw\mu_a'(\bar{a}) = \frac{Fg(\bar{a})}{\beta G(\bar{a})^2} \tag{24}$$

Substituting (24) into (23), we can re-write the negotiated price of an input with inverse productivity a:

$$\rho(a) = \beta w a + (1-\beta) w \bar{a} \tag{25}$$

It represents a weighted average of the supplier's production cost and the cost of producing the input with the reservation match productivity.

To derive an expression for the stopping rule, we follow GH and assume the distribution function takes the form $G(a) = a^{\theta}$, $\theta > 1$, where θ seizes the inverse spread of productivities. We can re-write the conditional mean as $\mu_a(\bar{a}) = \frac{\theta}{\theta+1}\bar{a}$ and $g(\bar{a})/G(\bar{a})^2 = \theta/\bar{a}^{-\theta+1}$. Then first-order condition (24) can be written as:

$$\bar{a}^{\theta+1} = \frac{F(\theta+1)}{\beta m w} \tag{26}$$

Intuitively, when search draws are more costly or when the distribution of productivities is more concentrated, the stopping rule is more tolerant, i.e.: higher $\bar{a}$. On the contrary, search costs are greater, i.e.: lower $\bar{a}$, when the foreign wage is higher, the scale of production is larger, or the buyers have more bargaining power. In this situation, the producers have more at stake in the search process. The greater is the search effort, the lower are the resulting transaction prices of all inputs.

Profit Maximisation The firms in the differentiated-products sector face a constant elasticity of demand. They maximise profits, by charging a proportional markup over marginal cost,

$$p = \frac{\sigma}{\sigma - 1} c(\phi) \tag{27}$$

In a symmetric equilibrium, all firms charge the same price, p, re-writing equation (17) implies

$$P = n^{-\frac{1}{\sigma-1}} p \tag{28}$$

The index increases linearly with the price of a brand, but decrease with the number of brands.

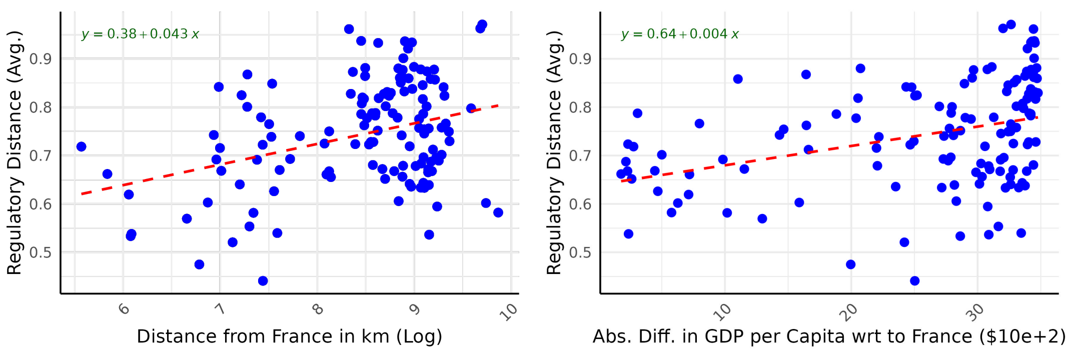
In a monopolistically-competitive equilibrium with free entry, the present value of operating profits matches the fixed costs of entry and of search:

$$\pi_o = F_e + \frac{F}{G(\bar{a})} \tag{29}$$

where F_e denotes the one-time entry cost and $F/G(\bar{a})$ represents the debt service on the sunk search costs. The model determines along with n, x and p, the demand for intermediate m, and the search intensity $\bar{a}$, which results from the creation of supply chains.

A.5 Additional Figures

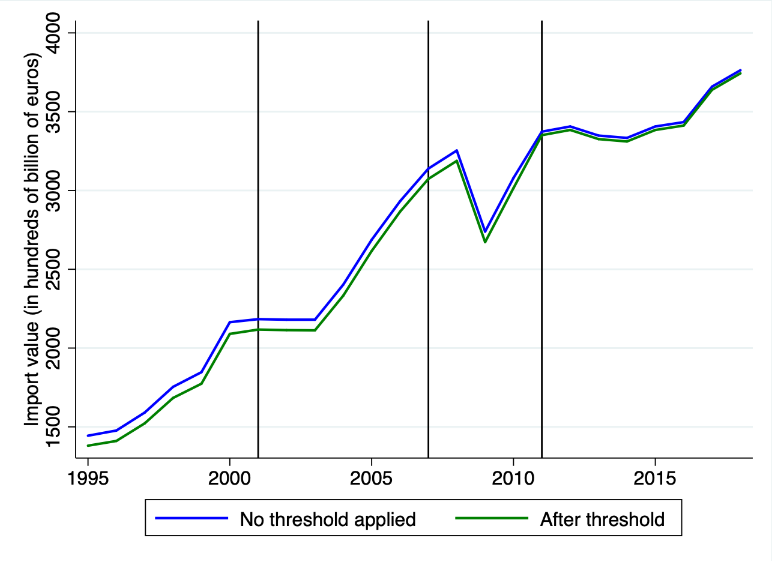
Figure A.1: Regulatory Dissimilarity vs. Geographical and GDP per Capita Distances



(a) vs. Distance (km)

(b) vs. Distance in *GDPPC*

Figure A.2: Evolution of imports by year - With and without $> 1,000$ Euro threshold



A.6 Additional Tables

Table A.1: Coverage comparison

	Pronto Database	Our Database
Original notifications	7,989	8,262
WTO-interpreted	8,635	9,251
Pre-processing	36	**3,546**
Product description	3176	**2,492**
ICS/CAS Matching	894	**1,945**
String set/ Algorithm	1,585	**2,805**

Table A.2: PTA Database Variables

<table>
<tr><th>Variable</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">Mutual recognition</td><td>Standards
Technical regulations</td><td>Is mutual recognition/Equivalence in force?</td></tr>
<tr><td>Standards
Technical regulations</td><td>Is there a time schedule for achieving mutual recognition?</td></tr>
<tr><td rowspan="3">Harmonisation</td><td>Standards
Technical regulations</td><td>Are there specified existing standards to which countries shall harmonise?</td></tr>
<tr><td>Standards
Technical regulations</td><td>Is the use or creation of regional standards promoted?</td></tr>
<tr><td>Standards
Technical regulations</td><td>Is the use of international standards promoted?</td></tr>
<tr><td rowspan="2">Conformity assessment</td><td>Mutual recognition</td><td>Is mutual recognition/Equivalence in force?</td></tr>
<tr><td>Harmonisation</td><td>Are there specified existing standards to which countries shall harmonise?
Is the use or creation of regional standards promoted?
Is the use of international standards promoted?</td></tr>
</table>

Table A.3: List of countries with whom the EU have harmonised TBTs

Country	Year
Chile	2003
Jordan	2002
Morocco	2000
San Marino	2014
Tunisia	1998
Turkey	1996

Table A.4: Number of times the objective appears in lists and notifications

Objective	**Frequency**
Protection of human health or safety	1,875
Protection of the environment	743
Labelling	738
Prevention of deceptive practices and consumer protection	672
Food standards	529
Quality requirements	329
Consumer information	309
Other	270
Harmonisation	154
Protection of animal or plant life or health	124
Metrology	101
Trade facilitation	96
Nutrition information	45
Packaging	34
Organic agriculture	27
National security requirements	25
Cost saving and increasing productivity	16
Genetically modified organisms	12
Animal welfare	5

Table A.5: List of non-harmonised or partially harmonised sectors

Nace Code	Description
10.89	Manufacture of other food products n.e.c.
12.00	Manufacture of tobacco products
13.10	Preparation and spinning of textile fibres
13.20	Weaving of textiles
13.30	Finishing of textiles
13.91	Manufacture of knitted and crocheted fabrics
13.93	Manufacture of carpets and rugs
13.94	Manufacture of cordage, rope, twine and netting
13.95	Manufacture of non-woven and articles made from non-woven, except apparel
13.96	Manufacture of other technical and industrial textiles
13.99	Manufacture of other textiles n.e.c.
14.11	Manufacture of leather clothes
14.20	Manufacture of articles of fur
15.11	Tanning and dressing of leather; dressing and dyeing of fur
15.12	Manufacture of luggage, handbags and the like, saddlery and harness
15.20	Manufacture of footwear
16.10	Saw-milling and planing of wood
16.21	Manufacture of veneer sheets and wood-based panels
16.22	Manufacture of assembled parquet floors
16.23	Manufacture of other builders' carpentry and joinery
16.24	Manufacture of wooden containers
16.29	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
17.11	Manufacture of pulp
17.12	Manufacture of paper and paperboard
17.21	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
17.22	Manufacture of household and sanitary goods and of toilet requisites
17.23	Manufacture of paper stationery
17.24	Manufacture of wallpaper
17.29	Manufacture of other articles of paper and paperboard
18.11	Printing of newspapers
18.12	Other printing
18.13	Pre-press and pre-media services
18.14	Binding and related services
18.20	Reproduction of recorded media
19.10	Manufacture of coke oven products
23.19	Manufacture and processing of other glass, including technical glassware
23.41	Manufacture of ceramic household and ornamental articles
23.44	Manufacture of other technical ceramic products
23.49	Manufacture of other ceramic products

Table A.6: List of non-harmonised or partially harmonised sectors

Nace Code	Description
23.69	Manufacture of other articles of concrete, plaster and cement
23.70	Cutting, shaping and finishing of stone
23.91	Production of abrasive products
23.99	Manufacture of other non-metallic mineral products n.e.c.
24.31	Cold drawing of bars
24.32	Cold rolling of narrow strip
24.33	Cold forming or folding
24.34	Cold drawing of wire
25.12	Manufacture of doors and windows of metal
25.40	Manufacture of weapons and ammunition
25.50	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
25.71	Manufacture of cutlery
25.72	Manufacture of locks and hinges
25.73	Manufacture of tools
26.52	Manufacture of watches and clocks
26.70	Manufacture of optical instruments and photographic equipment
26.80	Manufacture of magnetic and optical media
27.52	Manufacture of non-electric domestic appliances
29.20	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
29.31	Manufacture of electrical and electronic equipment for motor vehicles
29.32	Manufacture of other parts and accessories for motor vehicles
30.99	Manufacture of other transport equipment n.e.c.
31.01	Manufacture of office and shop furniture
31.02	Manufacture of kitchen furniture
31.03	Manufacture of mattresses
31.09	Manufacture of other furniture
32.11	Striking of coins
32.12	Manufacture of jewellery and related articles
32.13	Manufacture of imitation jewellery and related articles
32.20	Manufacture of musical instruments
32.91	Manufacture of brooms and brushes
33.11	Repair of fabricated metal products
33.12	Repair of machinery
33.13	Repair of electronic and optical equipment
33.14	Repair of electrical equipment
33.15	Repair and maintenance of ships and boats
33.16	Repair and maintenance of aircraft and spacecraft
33.17	Repair and maintenance of other transport equipment
33.19	Repair of other equipment
33.20	Installation of industrial machinery and equipment

A.7 Robustness Tests of Baseline Specification

A.7.1 Number of TBTs

Table A.7: Estimation of the effect of the Number of TBTs on import expenditures and prices

Dependent Variable	*Imports Value (ln)*			*Import Price (ln)*		
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{EU}_{ot}=1\}$	0.007*			0.009***		
	(0.003)			(0.002)		
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{EU}_{ot}=0\}$	-0.010*			0.015***		
	(0.005)			(0.002)		
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{HAR}_{pot}=1\}$		0.016***			0.007***	
		(0.004)			(0.003)	
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{MR}_{pot}=1\}$		-0.008*			0.013***	
		(0.004)			(0.002)	
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{HAR}_{pot}=0, \text{MR}_{pot}=0\}$		-0.011*			0.015***	
		(0.005)			(0.003)	
$\ln(1+\#\text{TBT}_{pt})$			0.016***			0.008***
			(0.003)			(0.002)
$\ln(1+\#\text{TBT}_{pt}) \times \text{Dissimilarity}_{pot}$			-0.024***			0.006***
			(0.004)			(0.002)
Observations	7,892,397	7,892,397	7,892,397	7,892,397	7,892,397	7,892,397
Firm-Origin-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Origin-Time-HS2 FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1), (2), and (3) report estimates for the logarithm of firm–origin–product–year import value, while columns (4), (5), and (6) report estimates for the logarithm of the import price. $\ln(1+\#\text{TBT}_{pt})$ denotes the natural logarithm of one plus the number of TBTs imposed on product p at time t by the EU. The indicator $\mathbb{1}\{\text{EU}_{ot}=1\}$ equals one if the origin country o is an EU member, and zero otherwise. HAR_{pot} and MR_{pot} indicate whether an origin-product combination is subject to harmonisation or mutual recognition standards, respectively, with $\mathbb{1}\{\text{HAR}_{pot}=0, \text{MR}_{pot}=0\}$ corresponding to origin-product combinations not subject to either. $\text{Dissimilarity}_{pot}$ measures the regulatory dissimilarity between new EU TBTs and the existing regulations in the origin country. Standard errors are clustered at the product–origin–time level. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A.8: Estimation of the effect of the Number of TBTs on supply chains reallocation

Dependent Variable	*Import Quantity (ln)*			*Exit Probability*			*Entry Probability*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{EU}_{ot}=1\}$	-0.003			0.001			-0.002		
	(0.004)			(0.001)			(0.003)		
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{EU}_{ot}=0\}$	-0.025***			0.005*			-0.010***		
	(0.005)			(0.002)			(0.003)		
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{HAR}_{pot}=1\}$		0.009***			0.001*			0.005***	
		(0.002)			(0.001)			(0.001)	
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{MR}_{pot}=1\}$		-0.020***			0.001			-0.012***	
		(0.003)			(0.001)			(0.001)	
$\ln(1+\#\text{TBT}_{pt}) \times \mathbb{1}\{\text{HAR}_{pot}=0, \text{MR}_{pot}=0\}$		-0.026***			0.005***			-0.011***	
		(0.004)			(0.001)			(0.001)	
$\ln(1+\#\text{TBT}^{\text{enf}}_{pt})$			0.008*			0.002			0.006***
			(0.004)			(0.001)			(0.002)
$\ln(1+\#\text{TBT}_{pt}) \times \text{Dissimilarity}_{pot}$			-0.030***			0.001			-0.018***
			(0.004)			(0.002)			(0.003)
Observations	7,892,397	7,892,397	7,892,397	4,587,521	4,587,521	4,587,521	4,702,059	4,702,059	4,702,059
Firm–Origin–Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origin–Time–HS2 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1), (2), and (3) report estimates for the logarithm of firm–origin–product–year import quantity; columns (4), (5), and (6) report estimates for the exit probability of an importing firm; and columns (7), (8), and (9) report estimates for the entry probability. $\ln(1+\#\text{TBT}_{pt})$ denotes the natural logarithm of one plus the number of TBTs imposed on product p at time t. The indicator $\mathbb{1}\{\text{EU}_{ot}=1\}$ equals one if the origin country o is an EU member and zero otherwise. HAR_{pot} and MR_{pot} indicate whether an origin-product combination is subject to harmonisation or mutual recognition standards, respectively. $\text{Dissimilarity}_{pot}$ measures the regulatory dissimilarity between new EU TBTs and the existing regulations in the origin country. Standard errors are clustered at the product–origin–time level. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A.7.2 Instrumental Variable

Table A.9: IV Estimation of the effect of TBT on the intensive margin

	First Stage		*Second Stage*		
Dependant Variable	TBT_{pt}^{Non-EU}	TBT_{pt}^{EU}	*Imports Value (ln)*	*Import Price (ln)*	*Import Quantity (ln)*
	(1)	(2)	(3)	(4)	(5)
$\text{TBT}_{pt}^{US} \times \mathbb{1}\{\text{EU}_{pt} = 1\} * Exp_f^{US}$	0.005***	0.159***			
	(0.001)	(0.013)			
$\text{TBT}_{pt}^{US} \times \mathbb{1}\{\text{EU}_{pt} = 0\} * Exp_f^{US}$	0.164***	0.015***			
	(0.012)	(0.003)			
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{pt} = 1\}$			0.315***	-0.002	0.317***
			(0.078)	(0.061)	(0.094)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{pt} = 0\}$			-0.265**	-0.028	-0.237*
			(0.114)	(0.061)	(0.130)
Observations	7,373,795	7,373,795	7,373,795	7,373,795	7,373,795
Firm-Origin-Product FE	Yes	Yes	Yes	Yes	Yes
Origin-Time-HS2 FE	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes
First-stage F-Stat - TBT_{pot}^{Non-EU}	139.15				
First-stage F-Stat - TBT_{pot}^{EU}		152.25			

Notes: The dependent variables are defined as follows: *Imports Value (ln)* is the natural logarithm of firm-origin-product-year import value; *Import Price (ln)* is the logarithm of the import price and *Quantity (ln)* is the logarithm of firm–origin–product–year import quantity. $\text{TBT}_{pt}^{Non-EU} \equiv TBT_{pt} \times \mathbf{1}\{EU_{ot} = 0\}$, denotes the interaction between a technical regulation imposed by the EU on product p at time t and a dummy equals one if the product originates from an EU country, while $\text{TBT}_{pt}^{EU} \equiv TBT_{pt} \times \mathbf{1}\{EU_{ot} = 1\}$, denotes the interaction between a technical regulation imposed by the EU on product p at time t and a dummy equals one if the product originates from a non-EU country. TBT_{pt}^{US} denotes a technical standard imposed by the US on product p at time t. The indicator $\mathbb{1}\{\text{EU}_{pt} = 1\}$ equals one if the product originates from an EU country, and zero otherwise. Exp_f^{US} indicates if firm f exports at least once to the US. Standard errors are clustered at the origin-product-time level. Statistical significance is denoted as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A.10: IV Estimation of the effect of TBT on the extensive margin

	First Stage				*Second Stage*	
Dependant Variable	TBT_{pt}^{Non-EU}	TBT_{pt}^{EU}	TBT_{pt}^{Non-EU}	TBT_{pt}^{EU}	*Exit*	*Entry*
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{TBT}_{pt}^{US} \times \mathbb{1}\{\text{EU}_{pt} = 1\}_f^{US}$	0.005***	0.159***	0.006***	0.170***		
	(0.001)	(0.014)	(0.001)	(0.014)		
$\text{TBT}_{pt}^{US} \times \mathbb{1}\{\text{EU}_{pt} = 0\}_f^{US}$	0.148***	0.022***	0.172***	0.023***		
	(0.012)	(0.003)	(0.013)	(0.003)		
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{pt} = 1\}$					-0.182***	0.318***
					(0.033)	(0.040)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{pt} = 0\}$					-0.024	0.011
					(0.050)	(0.041)
Observations	4,244,264	4,244,264	4,355,170	4,355,170	4,302,447	4,414,063
Firm-Origin-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Origin-Time-HS2 FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-Stat - TBT_{pot}^{Non-EU}	79.16		99.05			
First-stage F-Stat - TBT_{pot}^{EU}		90.35		93.51		

Notes: The dependent variables are defined as follows: *Exit* is the exit probability; and *Entry* is the entry probability of an importing firm. TBT_{pt}^{Non-EU} denotes the interaction between a technical regulation imposed by the EU on product p at time t and a dummy equals one if the product originates from an EU country, while TBT_{pt}^{EU} denotes the interaction between a technical regulation imposed by the EU on product p at time t and a dummy equals one if the product originates from a non-EU country. TBT_{pt}^{US} denotes a technical standard imposed by the US on product p at time t. The indicator $\mathbb{1}\{\text{EU}_{pt} = 1\}$ equals one if the product originates from an EU country, and zero otherwise. Exp_f^{US} indicates if firm f exports at least once to the US. Standard errors are clustered at the origin-product-time level. Statistical significance is denoted as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A.7.3 Trade Enhancing TBTs

Table A.11: Control for Trade Facilitation TBTs on Import Margins

	Imports Value (ln)	*Import Price (ln)*	*Import Quantity (ln)*	*Exit*	*Entry*
	(1)	(2)	(3)	(4)	(5)
TBT_{pt}	0.044***	0.016**	0.028**	0.003	0.022***
	(0.009)	(0.007)	(0.011)	(0.004)	(0.005)
TBT_{pt} × $\text{Dissimilarity}_{pot}$	-0.060***	0.000	-0.061***	0.006	-0.054***
	(0.010)	(0.007)	(0.012)	(0.004)	(0.009)
TBT_{pt} × TradeFacil_{pt}	0.007	-0.038***	0.045***	-0.011***	0.006*
	(0.006)	(0.004)	(0.007)	(0.002)	(0.003)
Observations	7,892,397	7,892,397	7,892,397	4,521,868	4,631,112
Firm–Origin–Product FE	Yes	Yes	Yes	Yes	Yes
Origin–Time–HS2 FE	Yes	Yes	Yes	Yes	Yes
Control for Tariffs	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variables are defined as follows: column (1) reports the logarithm of firm–origin–product–year import value; column (2) the logarithm of the import price; column (3) the logarithm of import quantity; column (4) the exit probability; and column (5) the entry probability of an importing firm. Here, TBT_{pt} denotes a technical regulation imposed on product p at time t. $\text{Dissimilarity}_{pot}$ measures the regulatory dissimilarity between new EU TBTs and existing regulations in the origin country, while TradeFacil_{pt} is an indicator capturing trade facilitation-related TBTs. The variable log(Applications) refers to WA-level applications. Standard errors are clustered at the product–origin–time level. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A.7.4 Origin characteristics

Table A.12: Estimation of the effect of TBT by development level

	(1)	(2)	(3)	(4)
	Import Price (ln)	*Import Quantity (ln)*	*Exit*	*Entry*
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 1\}$	-0.003	0.019***	0.006*	-0.003
	(0.009)	(0.005)	(0.003)	(0.006)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 0, \text{Developed}_{ot} = 1\}$	0.029***	-0.048***	0.010	-0.025**
	(0.008)	(0.017)	(0.006)	(0.012)
$\text{TBT}_{pt} \times \mathbb{1}\{\text{EU}_{ot} = 0, \text{Developing}_{ot} = 1\}$	0.018**	-0.030	0.019***	-0.028***
	(0.009)	(0.019)	(0.007)	(0.008)
Observations	7,858,576	7,858,576	4,570,640	4,682,852
Firm-Origin-Product FE	Yes	Yes	Yes	Yes
Origin-Time-HS2 FE	Yes	Yes	Yes	Yes
Control for tariffs	Yes	Yes	Yes	Yes

Notes: The dependent variables are defined as follows: *Import Price (ln)* is the natural logarithm of the import price; *Quantity (ln)* is the natural logarithm of firm–origin–product–year import quantity; *Exit* is the exit probability; and *Entry* is the entry probability of an importing firm. TBT_{pt} denotes a technical regulation imposed on product p at time t. The indicator $\mathbb{1}\{\text{EU}_{pt} = 1\}$ equals one if the product originates from an EU country, and zero otherwise. $\mathbb{1}\{\text{EU}_{ot} = 0, \text{Developed}_{ot} = 1\}$ equals one if the product originates from a developing non-EU country, and zero otherwise. $\mathbb{1}\{\text{EU}_{ot} = 0, \text{Developing}_{ot} = 1\}$ equals one if the product originates from a developing non-EU country, and zero otherwise. Standard errors are clustered at the origin-product-time level. Statistical significance is denoted as follows: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.