The Sound of Silence

Non transparent technical regulations as obstacles to trade

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Abstract

This work investigates the protective nature of newly introduced technical regulations that are not properly disclosed at the international level. We begin by building a novel database which identifies the process of adoption of those Technical Barriers to Trade (TBTs) that have been contested to the WTO through a Specific Trade Concern (STC). We then cross-reference this database with a firm-level panel of French exporters. We find that in more than 1/3 of the studied cases, countries have adopted the underlying regulations without previously announcing the change to other members. In these cases, the new regulation determines a temporary halt of the exporting activity. This stop lasts from one to two semesters, and it is shorter if the content of the new TBT is eventually disclosed by governments. While large firms are able to wait until more information is available, small firms exit the market. We rationalize these results in a framework in which heterogeneous firms must incur in a sunk cost to adopt the new technical standard and the lack of transparency increases their uncertainty about the investment.

Keywords: Non Tariff Measures · TBTs · Trade policy uncertainty

Understanding how to comply with foreign technical regulations is not an easy task for exporters. The procedure of collecting information on the details of the new requirement, on the goods it targets, and on how to prove conformity with it can be very

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costly. If the access to this information is made particularly complicated for foreign firms, domestic regulations can hinder trade. While there is consent in the literature that countries can misuse technical regulations to protect domestic industries (Beverelli et al., 2014; Orefice, 2017), little is instead known about the role of transparency in the protective nature of these policies. This is surprising given that, over the last decades, technical regulations have gained relevance, becoming among the most reported trade barriers by exporters (OECD, 2005).[1] But this is all the more surprising given that exporters complain even more about procedural obstacles on how to comply with foreign regulations than about the content of the regulations itself (International Trade Center, 2016).

This work aims to fill this gap by providing a framework to investigate the nature of these trade barriers. First, we document the relevance of procedural obstacles among technical regulations. We then estimate the impact of newly introduced regulations that have not been properly disclosed internationally on exporters. To rationalise our results and guide additional understanding of the phenomenon we make use of a theoretical baseline model of investment under uncertainty (Dixit et al., 1994).

The object of this study are technical regulations that are trade restrictive because of the the non transparent way they have been enforced in the market. We consider those Technical Barriers to Trade (TBTs) that have been contested by exporting countries at the WTO through a soft law mechanism called Specific Trade Concern (STC).[2] Raising a STC against another WTO member is costly: trade representatives must allocate their resources in preparing the case among a potentially large arena of misconducts. Therefore, this set of TBTs should identify the most trade restrictive regulations. In order to define lack of transparency in the introduction of a new TBT, we make use of the timeline recommended by the WTO under the transparency provisions. According to this timeline, countries should announce the draft measure and codify its content through a document called "Notification", at least eight months before the enforcement. We define as non transparent the case in which governments fully elude this timeline and enforce the TBT without previously announcing it to the other WTO members. We

[1] In his farewell statement to the General Council in 2013 Pascal Lamy, former Director-General of the World Trade Organization (WTO), stressed the key role of non-tariff barriers in new trade policies. In particular, surveys of exporting firms across OECD countries document that "technical measures and customs rules and procedures ... are [consistently] among the five most reported categories of non tariff [trade] barriers" (OECD 2005, p. 24).

[2] STCs may be brought by any WTO member considering to be negatively affected by an SPS/TBT measure imposed by a WTO trading partner. They represent 'soft law' mechanisms to deal with NTMs, as they are based on diplomatic relations, rather than adjudication.

refer to these TBTs as *Surprise Measures*. The database on Specific Trade Concern, as coded by the WTO, does not, at least directly, provide information on the timeline of the underlying regulations. To fill this gap, we construct a novel database by using information from the content of the STCs and from Notifications, which have been parsed while detecting the dates of implementation of TBTs.[3] We then match this data with a panel of French exporters covering the period 1995-2007 to estimate the effects of Surprise Measures on firms' trade margins. Our identification relies on the common trend assumption across products that are exported to a certain destination within a certain sector by similar firms. We compare goods that are similar except for the fact that some have been object of the new regulation and others have not. In addition, the fact that our sample includes TBTs that are not Surprise, which we call *Announced Measures*, provide us with a benchmark to evaluate the effect of the lack of transparency itself.

In the first part of this work, we document the pervasiveness of transparency-related obstacles using the content of STCs. We show that 'lack of transparency and of information' are the most cited motivations for countries to a STC.[4] Coherently, using our new build data, we find that almost 40% of the TBTs d as STCs are Surprise Measures.[5] The importance of transparency emerges also by looking at the dynamics of French exports around the adoption of a TBT. Surprise Measures are associated to a substantial fall, of around 20%, in the export value for those products covered by the new regulation, while Announced do not.

We test further the distinction between Announced and Surprise measures by considering firms responses to their introduction. We identify two regimes for the effects of TBTs on firms' behavior, depending on how the regulation has been implemented. Announced TBTs cause exit of firms in the period before the TBT is introduced and an increase in the export value for those who stay. Surprise TBTs are instead associated to a substantial decrease, ranging between 20 and 30%, of the average export value in the semester in which the measure is enforced. On the other hand, they do not determine substantial exit. We interpret these differences in terms of the different timing in which

[3] This procedure is able to identify the history for more than 70% of the measures touched by a STC.

[4] This result is coherent with the evidence from International Trade Center's 2016 survey on EU exporters. Indeed, "information and transparency issues" are among the most reported procedural obstacles by European firms. These includes inaccuracy or information on the licensing and certification process.

[5] These issues are prevalent also recently. For example, in 2017, 56% of STCs raised for the first time concerned unnotified measures. See Note by the Secretariat, 'Twenty-Third Annual Review of the Implementation and Operation of the Agreement', G/TBT/40, at 24.

firms evaluate whether to adopt the new technical requirement as well as the information at disposal when taking this decision. Timing is crucial whenever the choice to comply with the new regulation implies an investment that is at least partly irreversible. In the case of Announced measures, the change in regulation affects firms' expected payoff before entering the market, when the per period sunk cost of exporting there has not yet been paid. This allows the firm to take into consideration the additional cost of adapting the new regulation in the decision to serve the market in that period. On the other hand, Surprise measures affect the instantaneous payoff once the firm has entered and already paid the per period sunk cost to serve the market. The different timing in which firms consider whether to implement the new requirement explains why the exit of firms is significant only when the change in regulation is announced. The access to information matters to decide not only whether but also when to invest. If firms are uncertain about their future payoffs, they have an option to wait and collect more data. In the case of Surprise TBTs, the lack of Notification about the new regulation s the real option value of postponing the investment decision.

In support of this interpretation, we find that the average semestral drop in export value is due to a significant fall in the export frequency rather than in the value of export per shipment. This reinforces the idea that firms undergo a temporary halt of their activity, which is observed as a reduction in the number of months in which exporters serve the market. The adverse effect of these TBTs is short-lasting, firms recover their export activity in a couple of semesters. However, not all firms are equally able to survive this shock. Small and medium size firms tend to exit definitely the market, while only large firms can afford to wait. We find that delayed Notifications, which provide late formal information on how to adopt the new requirement, reduces the persistence of the uncertainty. This finding further strengthens the idea that it is indeed by eluding transparency that countries affect the investment decisions of firms.

Previous empirical literature has found transparency in trade policy to boost trade and investment flows (Francois, 2001; Helble et al., 2009; Lejárraga and Shepherd, 2013). Metrics used in this type of works are very broad in scope – they are built on perception-based indices or on general transparency provisions within regional trade agreements. An exception, is a recent work by Ing et al. (2018) which proposes an index based on the use of Non Tariff Measures (NTMs). Their index includes for example the number of NTMs that are notified by a country. We share with this work the focus on Non Tariff Measures, since NTMs, and TBTs in particular, are complex legal instruments which can impose substantial procedural obstacles. We focus instead on the procedure of

implementation of these regulations, to capture not only whether, but also *how* countries announce and disclose these type of regulations. In doing so we provide transparency with a definition along one fundamental attribute: *predictability*.[6]

Our work thus refers to the literature that studies the role of trade policy uncertainty about investment decisions of international firms. Recent theoretical contributions (Handley and Limao, 2015; Coelli, 2018) have combined intuitions from trade models with firm heterogeneity (Melitz, 2003) with those from the real option literature (Dixit et al., 1994). In presence of an irreversible investment and the possibility to wait, uncertainty on the trade environment incentives firms to delay the investment decision on whether to enter a market (Handley and Limao, 2015) or to undergo technology upgrading (Handley and Limão, 2017; Coelli, 2018). These studies test their predictions by exploiting the enforcement of trade Agreements as episodes of changes in policy uncertainty and using variation in the gap between applied and bounds tariffs (similarly also Carballo et al. (2018)). Instead, little is known on the sources of uncertainty about NTMs. We believe this gap to be relevant given that, changes in technical regulation have been found to impose significant fixed cost on exporters (Fontagné and Orefice, 2018).[7]

We also contribute to the literature that studies the trade effects of NTMs. Previous literature has found that NTMs have been used to compensate reductions in applied tariffs.[8] However, while 'there is little question that governments sometimes do deploy regulations to favor domestic producers over foreign ones' (Rodrik, 2018), how they succeed is a rather unexplored field. The complex and heterogeneous nature of NTMs makes it particularly challenging to distinguish whether a measure pursues a legitimate policy objective rather than a disguised protectionist motive.[9] In addition, data on NTMs

[6] Helble et al. (2009) identify two dimensions of transparency: predictability (reducing the cost of uncertainty) and simplification (reducing information costs). As acknowledged by the authors, their indexes are not able to disentangle the two but instead try to account for both sources together.

[7] Caldara et al. (2020) shows that fixed cost are an important mechanism that amplify the effects of trade policy uncertainty.

[8] A non exhaustive sample of the literature that has studied the trade policy substitution between tariff and Non Tariff Measures includes Moore and Zanardi (2011) Beverelli et al. (2014) and Orefice (2017). The last two works have dealt specifically with TBTs. In particular, Beverelli et al. (2014) show that policy substitution between tariffs and TBTs prevails in developed countries. Orefice (2017) that TBTs (and also SPSs) become effective barriers to trade as a consequence of reductions in tariffs.

[9] An example is the different thresholds set by the US and EU regulation on the speed below which all hybrids and electric vehicles have to emit artificial warning sounds for pedestrians. The US National Highway Traffic Safety Administration issued in December 2010 this to be below the 30kph. The European Union issued in 2014 set, instead, a lower threshold, of 20 kph, motivating this as to be due to differential risk for noise pollution. However, engineer studies are far from unanimous on which

are notably scant (Ederington and Ruta, 2016). For example, data sources on NTMs, such as TRAINS from UNCTAD, are usually silent with respect to the time series of the underlying regulations. For these reasons, recent works as Fontagné et al. (2015) used NTMs contested at the WTO through STCs to identify those regulations that restrict trade, and the time of the concern to proxy the one of the underlying regulation.[10] Our contribution to this literature is therefore twofold. First, we shed new light on the nature of these trade barriers by looking at a recently added information on the database about STCs, i.e. the reasons why WTO members complain about other members' improper use of TBTs. Second, we build a new database on the history of these regulations and provide access to the source code. The same procedure can also be easily extendable to collect the timelines of other types of NTMs, such as for SPS.

This paper refers also to the literature that has studied the effects of TBTs on trade. An example is the work by Bao and Qiu (2012), which uses all the TBTs notified at the WTO, and finds that the presence of a TBT has a negative impact on exporter countries' extensive margin, while a positive on the intensive margin. They explain this as to be due to a in the fixed cost, which pushes out of the market some firms, leaving the incumbent ones enjoy less competition and thrive.[11] When considering, instead, only those TBTs that entail product standard harmonization, Schmidt and Steingress (2018) observe that these measures trade both through an increase in the sales volume of existing exporters as well as through entry of new exporters. They interpret this to be the result of a market size effects: harmonization works as a demand shifter, raising firms' incentives to produce those varieties. On the other hand, Fontagné and Orefice (2018) focus on TBTs that have been n as STCs by the EU to identify stringent TBTs and finds that they induce exit of exporters. The authors do not find, however, a significant effect on the intensive margin of firms. Our work reconciles these peculiar results. Within TBTs raised as STCs there are two regimes: when announced, restrictive TBTs produce effects that are similar to the ones observed by Bao and Qiu (2012) for the sample of notified measures. This effect is then offset at the average by the negative

is the best threshold that trades off noise pollution with efficacy of the sound in preventing injuries. [Regulation (EU) No 540/2014 of the European Parliament]

[10] For an exhaustive overview of this literature refer to Ederington and Ruta (2016). For example, Herghelegiu (2018) use a sample of developing countries and finds that only TBTs and SPSs that have been object to a concern are used to substitute tariffs.

[11] This is because, in a model with firm heterogeneity á la Chaney (2008) the aggregate trade elasticity to fixed trade costs is predicted to be driven by the extensive margin, with a negligible role of the intensive margin. A sample of this literature includes Fontagné et al. (2015). In another interpretation, Maggi et al. (2018) prove that Red Tape Barriers might impose different firms' behaviors depending on whether the import demand is sufficiently concave.

effect of the Surprise measures. Our work confirms that depending on the reasons that lie behind the adoption and design of TBTs, trade effects of exporters may be very different.

The remainder of the paper proceeds as follows. Section 1 provides background on the institutional setting and presents how we measure the lack of transparency. Section 2 and 3 present the data, including the procedure we follow to collect the timelines of TBTs, and the research design to evaluate the effects of non transparent TBTs. Section 4 discusses the main results and section 5 rationalizes their interpretations. Section 6 presents the results on the heterogeneity of the effect along firm characteristics while section 7 discusses the persistence of the effects of uncertainty. Section 8 concludes.

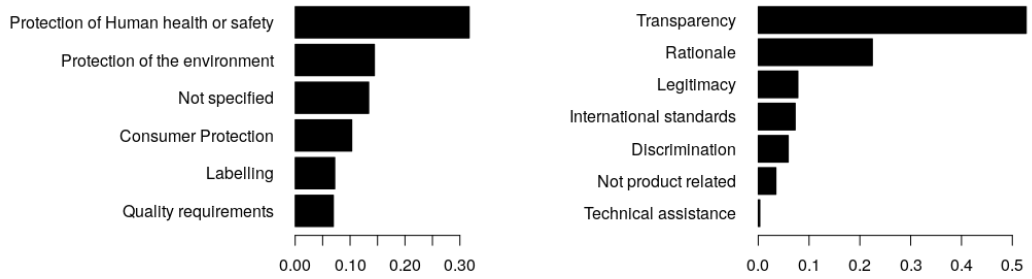
1 Institutional Framework

According to the TBT Agreement, WTO members can introduce in their domestic market, technical standards that differ from international ones to pursue legitimate policy objectives. Countries might aim, for example, to guarantee the quality of the imports, to protect human health or the environment, its national security, or to prevent deceptive practices. On the other hand, these measure should not create any arbitrary or unjustifiable discrimination between domestic and foreign competition. To do so, along with providing a legitimate rationale, governments must implement a TBT in the least trade-restrictive way.[12] For example, countries must announce the new measure to international partners enough in advance and disclose all relevant information to guarantee the transition within a predictable market environment. Whenever a WTO member believes that these principles have not been respected, she can contest the TBT by raising a Specific Trade Concern to the WTO and identifying the nature of the issue.[13] When looking at the objectives proposed by governments for those TBTs that have been contested to the WTO, the majority are legitimate ones. The most frequent being related to the protection of human health and safety, or of the environment (panel (a) of Figure 1).

[12] The TBT Agreement states that "Members shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade." (Art. 2.2)

[13] These are discussed within the TBT Committee that meets every four months.

Figure 1: Most frequent Objectives and Motivations of STCs



(a) Objectives (b) Motivations

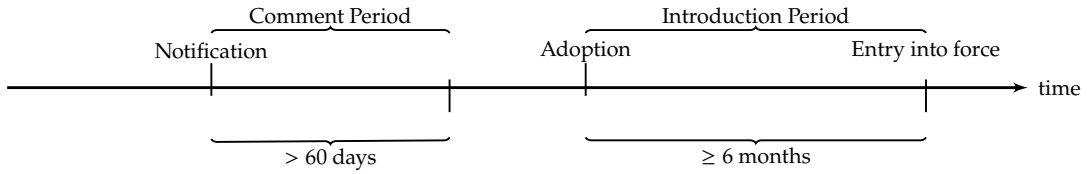
Sample of TBTs contained in the STC database. Each STC has one or more objectives (motivations). One occurrence is thus the combination STC-objective (motivations). The total number of occurrences in the dataset is 598 (478).[16]

The Mexican ban of the chlorofluorocarbon compounds (CFCs) for the manufacture and import of household refrigerators and air conditioners is an example of a TBT which has been contested despite a seemingly legitimate rationale. Indeed, the use of CFCs might have serious environmental consequences as their long lifetimes in the atmosphere can deplete the ozone layer. Raising concerns about the effects of CFCs, led to the signature of the Montreal Protocol (1989). In the 90s, this Protocol was further strengthened by calling for the complete elimination of CFCs by the year 2010. In Mexico, the ban has been adopted and enforced in the same day, under a status of emergency, on the 22th September 1998. Interestingly, the Mexican standard has been formally announced to international partners only on the 12th of October 1998, once the measure have already been implemented.[14] When the TBT Committee met in November 1998, the representative of the United States drew attention to the new Mexican standard through a STC, raising an issue on "transparency". In particular, the US delegate questioned the nature of emergency with which the measure has been implemented and claimed that exporters were uncertain on how to comply with the new regulation. For example, international partners were not provided with a list of accredited laboratories that perform conformity assessment tests.[15]

[14] One can find the full text of the formal announcement on the ITM database under the Symbol G/TBT/Notif.98.485

[15] "She questioned the nature of the emergency and indicated that, in order to comply with the Mexican regulations, products had to be tested by an accredited laboratories. Until today, however, not a single laboratory had been accredited to perform the required tests. Therefore, US exporters were uncertain about how to comply with the regulation." (G/TBT/M/14, par 35)

Figure 2: Ideal timeline of introduction of a new technical regulation



Notes: Elaboration from the The WTO Agreements Series on TBTs.

Interestingly, issues related to the procedure of how a TBT has been disclosed and implemented are the most pervasive. Indeed, the majority of the concerns are raised because of issues of transparency (panel (b) of Figure 1).[17] This is surprising in light of the fact that the international discipline codifies explicitly how countries should introduce a new TBT. This procedure is summarized in the timeline shown in Figure 2. Essentially, governments are required to announce other members about proposed measures which might have a significant effect on trade and which are not based on international standards. They should provide a formal document which discloses information on how to implement the new regulation, which is called *Notification*.[18] This formal announcement must take place at an early stage to allow exporters to adapt in time to the changing requirement. Then, a 60-day comment period begins, during which other members can look into the details of the draft, ask for further information and then provide written comments. Afterwards, countries can introduce the measure, leaving (at least) 6 months before it becomes compulsory. Thus, between notification and entry into force no less than 8 months should pass.

1.1 Surprise Measures

The fact that the procedure of introduction of a new TBT is codified and agreed among WTO members helps us in defining the lack of transparency. In particular, we define as non transparent the full avoidance of this procedure – the case in which a country enforces a TBT without previously announcing it. In such case, we call the underlying

[17] We group, similarly to what done in the ITC survey (2016), "transparency" with "missing information" and "unreasonable time".

[18] A notification is "a transparency obligation requiring member governments to report trade measures to the relevant WTO body if the measures might have an effect on other Members" (World Trade Organization, 2017).

TBT a *Surprise measure*. The Mexican case above represents an example a Surprise measure.

When measures are instead notified before being enforced we call them *Announced Measures*. This distinction becomes relevant for policymakers as far as it is informative of the source of trade obstacles.[19] Essentially, this is the case if it is the lack of transparency itself, which imposes idiosyncratic costs to exporters. For example, the introduction of a Surprise measure might be associated to delays in customs clearing or might increase the probability of a shipment to be rejected at the customs. In addition, the lack of transparency might also impose to exporters a cost of searching and screening the documentation since they have to inform autonomously about the new requirement. If these information are inaccessible, Surprise TBTs can prevent firms from undergoing an investment decision.

Figure 3 plots the log change in French exports for those products that are subject of a trade restrictive TBT, conditional on destination and product time-invariant characteristics. French exports are substantially hit by unexpected changes in foreign technical regulation. Interestingly, this type of regulations is enforced in presence of a positive trend in French exporting activity, suggesting that countries may have used these regulations as a shelter from import penetration. On the other hand, this adverse effect seems to be temporary, lasting on average no longer than a year. Similar patterns are not observed for other TBTs, where the aggregate export activity seems not to be substantially altered.

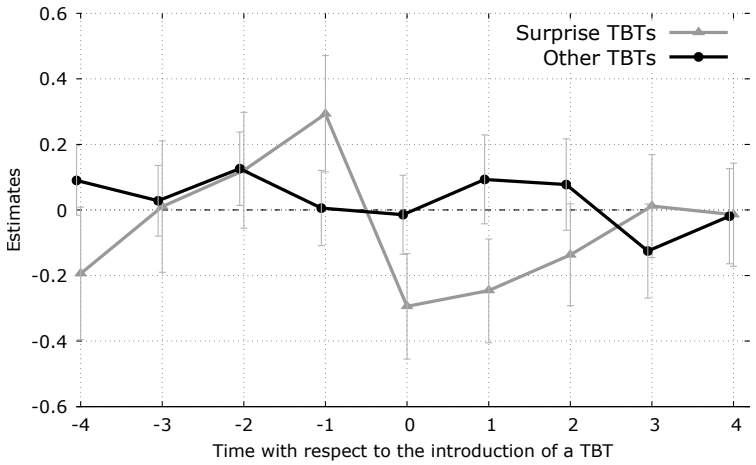
2 Data and Stylized facts

In order to study the role of the lack of transparency for TBTs we face two empirical challenges. First, given the extremely large number of regulations and their heterogeneous nature, it is difficult to classify which types of regulations are trade restrictive. For example, the same product might be touched by several regulations, that cover different aspects of it. Some of them might even be aiming at boosting trade, as episodes of harmonization to international standards.[20] Second, data on TBTs, and NTMs in

[19] Based on interviews with trade representatives from various WTO member countries, Holzer (2019) distinguishes STCs that contest how the measure has been implemented from STCs that challenge the content of the measure.

[20] This kind of measures are studied in Schmidt and Steingress (2018).

Figure 3: French exports dynamics around the introduction of a TBT



Notes: Time is a semester. The image plot the estimated coefficients, and relative 95% confidence bar, of a model where we regress the (log) value of French export in a (product, destination country, time) market over semestral dummies around the introduction of the TBT, for two type, Surprise and Other TBTs. The model includes (product,destination country) fixed effects and therefore exploits the time variability within markets TBTs. All TBTs information come from WTO STC database. In Appendix C the regression table.

general, usually lacks identification codes of the underlying regulation, which prevents to trace back the timeline of introduction of the measure.[21]

To identify the set of potentially trade restrictive TBTs we use the WTO database on TBT Specific Trade Concerns. This database records all the STCs raised between 1995-2011 and includes the dates in which concerns have been discussed at the TBT Committee.[22] However, it does not directly report the timeline of the underlying regulations. Previous literature has proxied the time of introduction of a TBT with a window around the period in which the concern is ongoing. We fill the gap in the data and create a new database with the timestamps of the regulation by parsing external documentation that come from the WTO repository on TBTs (Information Management System). This database is then merged with firm-product level data as well as with information on products' tariff rates.

[21] For example, Trains and Perinorm provide information which are snapshot of the existing regulations at the time the data were collected.

[22] A STC is active from the moment in which is d ad the TBT commitee until when the case is no longer discussed. Within the WTO an STC is considered to be no longer active if it is not raised in WTO committee for two years or more. The date of the last raising at the TBT committee is assumed to be the date of the resolution of the STCs.

2.1 STC Database

The database is managed by the WTO and contains information about all the concerns raised between 1995 and 2011, for a total of 318 STCs.[23] These concerns regard 403 different TBTs, since within the same STC countries might complain about one or more measures, proposed or adopted by another WTO member. Interestingly, concerns might also be raised over TBTs that have never been formally notified by countries, a circumstance that is not envisaged under the TBT Agreement.

For each concern, the database reports the country that has introduced the measure (maintaining country), the HS product codes affected by the measure, the objective of the regulation provided by the maintaining country, the date of initiation (and further dates if prolonged), the country(-ies) that has (have) complained about the measure (raising country-ies) and the motivation of its (their) complaint (the issue).[24]

2.2 New Database about Timelines of TBTs

We capture the timeline of a TBT through three dates: notification, adoption and entry into force. The latter two are used to identify the period over which the TBT is introduced in a market: after the adoption, firms may start to implement the measure, and they have to comply to it by the date of enforcement. The notification date will be used to identify when the country informs the WTO about the new regulation. Note that there are some contested TBTs that have never been notified.

To collect these dates we use two sources of information: i) the documents provided by the country introducing the TBT, including possibly the Notification and ii) the content of the STC from the records of the Meetings of the TBT Commitee also called Minutes. We access the first type of information through an identification code provided in the STC database.[25] For each code, we download the documentation available by web

[23] The dataset is freely available at https://www.wto.org/english/res_e/publications_e/wtr12_dataset_e.htm

[24] While there is no official information on the specific HS product concerned by each STC on TBT, the WTO computes an HS mapping through text documentation.

[25] This is called "Document Symbol". In most of the cases, it has a standard format, which includes "G/TBT/N/" followed by the country isocode at 3 digit plus the number of the notification. For example, on December 11^{th} 2018 Turkey has reported a notification, whose "Document Symbol" is "G/TBT/N/TUR/142" .

scraping the WTO online repository on TBTs.[26] There are two main types of document: the Notification and the Revision.[27] From the Notification we retain i) the date of notification, ii) the proposed date of adoption and iii) the proposed date of entry into force. The format of this document is standard and therefore we could automatize its reading.[28] From the Revision we collect information on whether a TBD date has been added afterwards, or whether the initial proposed dates have been modified.[29] Unfortunately, these documents are not standardized, thus information were collected manually. We then text parse the information of the Minutes, which are the documents recorded by the Secretariat during the meetings, to see whether further dates are provided by the concerned country.[30] The Minutes are particularly useful to collect information for those cases in which the country has not notified the measure or has later updated them.[31]

Figure 4 shows how the final sample is obtained. Note that revised dates are those that have been modified with respect to the proposed ones. Added dates are those that have been found, either in Minutes or in later Revisions, in case the notification misses these information.[32] On overall, we identify the timeline for 301 out of the 403 measures, almost the 75%.

A potential concern with this data collection is the selection bias introduced in our sample due to the fact that the timeline of less transparent measures, by their nature, are more difficult to identify.[33] However, this possibility is mitigated by the fact that the sources of documentation from which we retrieve the dates are heterogeneous.

[26] This is accessed through the TBT Trade-Information Management System at "http://tbtims.wto.org/en/Notifications/Search" through the "requests" package from Python libraries. Note that the same program might also be used to download documentation for other NTMs, e.g. the SPSs, by providing a list of identification keys. We will soon make it available on my website at https://ioire.github.io

[27] Potentially, there is also the Addendum and the Corrigendum, but these two sources of information are less relevant to us, since they provide information such as the availability of translated documents or the correction of typos.

[28] An example of this document is provided in the Appendix Figure 10, Soon I will upload on my web page all the program written in Python 3.6 to replicate the database. The same code can be used for different type of notifications, as well as SPS documents. Note also that, while the date of notification is always present, the other two may be left "To be decided".

[29] In two cases, this document informs about the withdrawal of the measure.

[30] Appendix provides details on how information from the Minutes are treated.

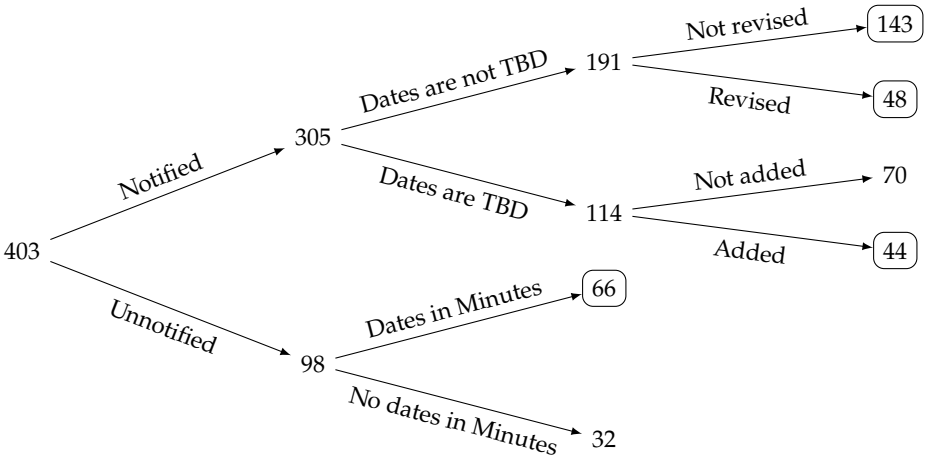
[31] In case divergent dates are found from the various sources, we apply the following ranking: we first pick the dates in the minute, then the ones in the revision and lastly the proposed dates in the notification. The information of the minute is the preferred one because countries might modify the proposed date of adoption or enforcement without providing documentation that formalize this.

[32] For further details please refers to A

[33] A sampling bias could be due to the varying probability of being included in the sample due to the transparency with which the measure has been introduced.

In particular, the fact that we can collect information from the Minutes, which are produced by a third country, reduces issues of this selection. In support of this, note that our ability to retrieve dates is not substantially different between TBTs that are and are not notified: the share of notified measure for which we can identify the timeline is 77%, while is 67% for not notiied ones.

Figure 4: Data sources for the database on TBT timelines



Notes: Frequency of TBTs by the source from which their timeline information is retrieved. The edges of the tree represent attributes that identify whether a certain source of information can be used. Final nodes with rectangular frames highlight those cases in which we could identify the timeline.

2.3 Stylized Facts about Timelines of TBTs

Among the sample of regulations for which we have identified the timeline of introduction, 40% have been introduced as Surprise Measures. Table 1 shows the frequency of Surprise TBTs by country and number of HS4 products within HS2 categories. Surprise measures are common in developed countries and they are also relatively very used by the two giant developing economies, China and India. China has introduced unattended regulations frequently, particularly so if one considers that she is a recent member of the WTO. In the case of India, Surprise TBTs are even more frequent than Announced ones. Surprise TBTs are mostly common among food products, with wine and spirits being by large the most touched category.

Figure 5: Types of Surprise measures

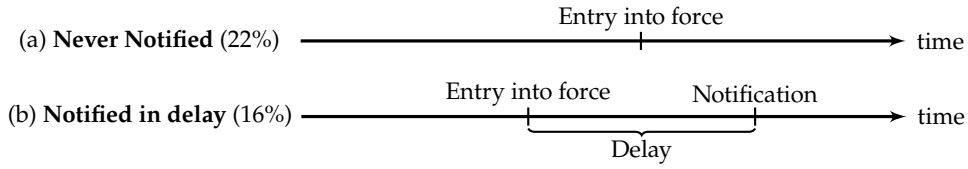


Table 1: Top 5 countries and products by Surprise TBTs

Country	#(Surprise TBTs)	Share (%)	Sector (HS2)	#(Surprise TBTs)	Share (%)
EU	17	26	Beverages & Spirits (22)	29	40
Korea	10	48	Meat (02)	18	50
China	10	27	Edible Preparations (21)	17	35
India	7	70	Fish (03)	15	47
USA	7	50	Electrical Machinery (85)	13	33

Notes: The share of Surprise is the ratio between the number of contested TBTs introduced by a country (within an HS2 catgory) as Surprise measures over the total number of contested TBTs introduced by the same country. Results are shown for the first ten countries in terms of Surprise share and only for those countries with at least 3 contested TBTs.

Among Surprise Measures we distinguish two cases, illustrated in Figure 5, (a) Never Notified and (b) Notified in delay. The former are measures for which the Notification will never be provided. This means that WTO members will not receive any formal documents with the details of the new requirement. For example, this is the case of a measure introduced by Mexico in 1997, regarding the labelling of spirits. The requirement has not be formally disclosed to the WTO through a Notification even after the enforcement. The European Union has therefore re-raised a STC on this measure in a following meeting of the TBT Commission in an attempt to receive clarifications on it.[34] In other cases, the regulation is enforced and notified thereafter - this is the case of the Mexican ban on CFCs, where the notification occurred with a delay of one month from the enforcement. On average, the Notification is provided within three months, and in almost all the cases, the regulation is to the latest notified within a year.

[34]Details on this example can be found in the WTO Database on STCs, item 20.

2.4 French Firm Level Data

The firm-level data comes from two different sources: (i) the French customs, which reports exports for each firm by destination, product and month for the period between 1995 and 2007 and (ii) BRN (*Régime du bénéfice réel normal*), the French firm level administrative database which provides information on firms' balance-sheets, over the same period.[35] The link to BRN, while it reduces the sample to relatively larger firms, allows us to identify the principal activity of enterps and to have information on the domestic activity of firms. In this way, we can select the manufacturing industries, which are the ones directly interested by changes in technical requirements of production. Note that this dataset has been used in several trade related papers dealing with French data (Eaton et al., 2011; Mayer et al., 2014).

We aggregate the monthly trade data at the semester level so that our panel includes 26 periods. The choice of using a semestral panel comes from a trade off between the possibility to look at the specific dates (months) in which measures are enforced and the fact that there is both seasonality and lumpiness in the export behavior. The median exporter ships a certain HS4 product in a destination twice a semester.

2.5 Construction of the Estimating Sample

Since we have detailed data on French firm exports in the period 1995-2007, we use a sample of 123 TBTs that have been object of a STC by the European Union and that have been introduced in the same period.[36] These 123 contested TBTs have been raised against a total of 31 different countries, with China being the largest target. Table 2 shows that there is a large variability in terms of HS4 categories covered by each TBT. The one that covers the largest number of products is the Mexican "Mandatory standard on Labelling of Industrial Products", which interests several products across a large number of different HS2 sections from textile to food. The length of the introduction period is instead rather homogeneous across regulations, with the majority having

[35] Firms are obliged to comply with BRN status if they earn annual revenues larger than 763K €. The dataset is accessed through facilities provided by the INSEE (the French Statistical Institute) and were made available for analysis after careful screening to avoid disclosure of individual information.

[36] Ideally, one would want to identify those TBTs that are trade restrictive specifically to French exporters, however, European countries participate as a single entity within the TBT Commitee. On the other hand, technical regulation are homogeneous across EU countries and TBT measures are applied in a non-discriminatory way to all trading partners. Therefore, we can plausibly assume that a TBT contested by the EU proxies an obstacle for French firms.

Table 2: Summary statistics for STC database

	Mean	Median	Min	Max
#(TBT) by Country	4	5.2	1	27
#(HS4 categories) by TBT	32	3	1	314
#(months) in the Introduction Period by TBT	1.3	1	1	6

Notes: Each STC can cover on or more TBTs. The last two rows of the table gives figures at the TBT level.

been introduced within just one semester. The longest introduction period regards the Korean "Mandatory Emission standard for Automobiles", which was adopted in April 2000 and enforced 3 semesters thereafter, in June 2002.[37]

We restrict the firm-level sample to export flows towards extra EU-27 destinations since concerns might be raisen by the EU against extra-EU countries. Concerning the products, the WTO STC database records them at the 4-digit Harmonized System, therefore we aggregate at this level the export data, which is originally at the Combined Nomenclature at 8 digits.[38] We calculate total export flows by destination market, retaining markets with above-10 percentile exports. Destinations in the bottom 10 percentile of total French exports can be considered less relevant for French exporters.[39] Then, this data has been joined with tariff data from TRAINS, which contains information on the effectively applied tariffs (defined as the lowest available tariff between preferential and MFN) at the HS 4-digit.[40]

Table 3 reports the average number of exporters, of product-country pairs and of the value of exports for the full sample as well as for those markets touched at least once

[37] G/TBT/N/KOR/4

[38] Actually, the STC database contains 6% of HS2s products, 62% HS4s and the remaining 32% are HS6 goods. We keep the level of the analysis at 4-digit HS and we therefore drop the concerns that refers to HS2 goods, to avoid imputing to all HS4 subcategories, while we aggregate the HS6 at the HS4 level.

[39] A similar cleaning procedure is applied in Fontagné and Orefice (2018). This makes our sample comparable to theirs. Note that the number of countries in the sample is reduced from 168 Non-EU countries to 151.

[40] HS 4-digit tariff data is a simple average tariff within HS-4 headings of the HS-6 tariff level data, this aggregation is directly provided by TRAINS. Unfortunately, the database has many empty entries, in the literature there are various algorithm that have been used proposed to increase the number of observations. In this chapter, we apply the interpolation procedure suggested in Beverelli et al. (2014). In addition, since TRAINS provides tariffs in percentage points (i.e. 10% ad-valorem tariff listed as 10), we divide tariff by 100 and then compute the price equivalent transformation.

Table 3: Summary statistics of the estimation sample

	SEMESTRAL AVERAGE	
	Full sample	Touched by TBT
#(HS4, country)	35964	1122
#(exporters)	17131	2580
Total Export	3.26e+10	2.44e+09

by one TBT in our sample. Interestingly, these markets are the 3% of (destination-HS4) pairs, still, their value represents around 7.5% of the total export value, suggesting that these are relevant markets for French exports.

3 Research Design

This Section describes how we estimate the effects of the introduction of a new regulation on the exporting activity of firms. We first present the variables of interest, we then illustrate the empirical strategy and we finally discuss how we test the validity of our strategy.

3.1 Definition of Variables

We identify with $A_{p,d}$ and $E_{p,d}$ the dates of adoption and entry into force of the TBT regulations, respectively; where p, d denotes 4-digit HS product category and destination country. These dates contain the day, month and semester of the event. We call introduction period ($I_{p,d}$) the semester(-s) from the one in which the measure is adopted to the one in which it is enforced. We then identify an indicator which takes value 1 when a TBT is introduced in the (p, d) market, i.e. $\text{TBT}_{p,d,t} = 1[\text{if t} \in I_{p,d}]$. Note that $A_{p,d}$ and $E_{p,d}$ are not available in those markets where a restrictive TBT has never been introduced, thus the indicator TBT is zero over the full time span. We then call $N_{p,d}$ the notification date and use this to define Surprise measures as:

$$\text{SurpriseTBT}_{p,d,t} = 1[\text{if } (N_{p,d} = NA \text{ or } N_{p,d} > E_{p,d}) \text{ and } TBT_{p,d,t} = 1]. \quad (1)$$

SurpriseTBT$_{p,d,t}$ takes value 1 during the period in which the measure is introduced, if by the time of the enforcement there is no previous notification. This includes both the cases in which the TBT will never been notified, and therefore $N_{p,d}$ is Not Available, as well as those cases in which the notification occurs later than the enforcement. Similarly, we define Announced measures as

$$\text{AnnouncedTBT}_{p,d,t} = 1[\text{if } N_{p,d} \leq tE_{p,d} \text{ and } TBT_{p,d,t} = 1]. \tag{2}$$

Figure 6 illustrates the behavior of our indicator functions for some representative timelines. Each timeline is (p-country) specific, but the index (p, d) is dropped from the notation. Panel (a) shows a case in which adoption and entry into force occur in the same semester t. The TBT indicator takes value one in that period while zero in the others. Since the notification occurs before the enforcement, Surprise is zero while Announced is one. Panel (b) shows a case in which adoption and entry into force occur in two consequent semesters. Also in this case, the notification precedes the introduction, so in the two periods $AnnouncedTBT = 1$. On the contrary, Panel (c), depicts a case in which the notification occurs after the enforcement, therefore when $TBT = 1$ also $SurpriseTBT = 1$. There are some (p,d) that have been touched by more than one TBT over time. For these markets the introduction period contains multiple windows over which the TBT dummy switches on and off. For example, Korea has introduced three regulations on passenger cars that have been contested by EU, in 1998, 2002 and 2006 respectively. Each episode might be either Surprise or Announced, depending of whether the underlying measure has been notified before the relative enforcement.

As a measure of firms' trade margins we use (i) the firm's export value (in logs) to capture the intensive margin of trade and (ii) a dummy variable for a firm exiting a certain market to proxy the extensive margin, which we define as follows:

$$\text{exit}_{i,p,d,t} = \begin{cases} = 1 \text{ if i exports p in d in t and t-1 but never in t+1 and t+2} \\ = 0 \text{ if i exports p in d in t and t-1, and at least once in t+1 and t+2.} \end{cases} \tag{3}$$

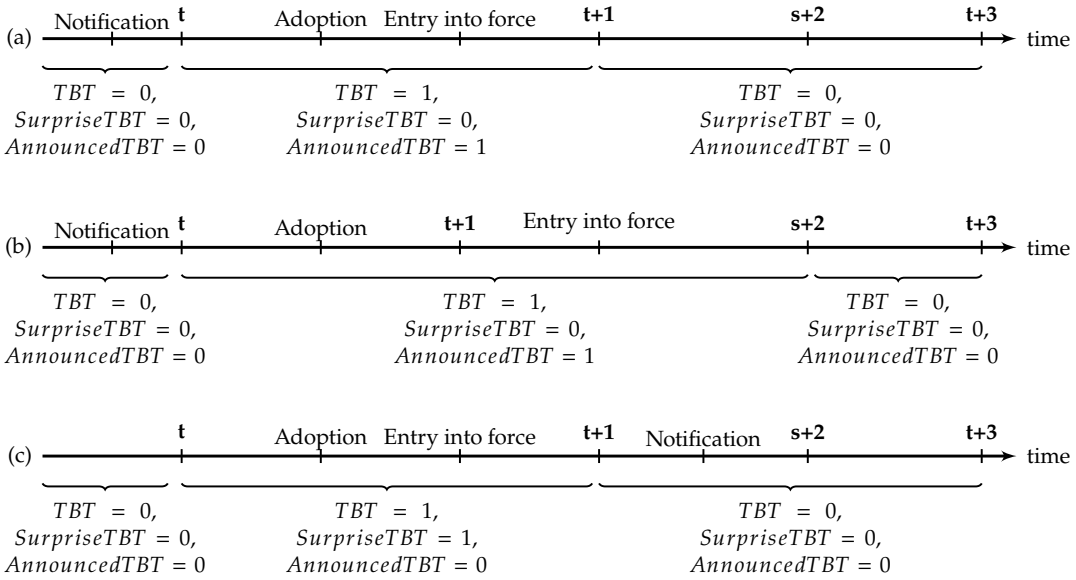
An exiting firm has therefore sold product p in destination d in this period as well as in the last one but will not export it in the following two.[41] We use two lags because of semestral data, to avoid confounding the effect of exit with the absence of the market due to seasonality.[42] Note that the probability of exit a market is a lagged proxy of the

[41] In the Appendix we discuss alternative definitions of exit.

[42] We also control that the firm still exports something or somewhere else to rule out the possibility to

extensive margin there. This means that, conditional on zero entry, if firms exit a market today, one records a reduction in the number of firms in the market tomorrow.

Figure 6: Illustration of the indicator functions for three ideal timelines



Notes: Illustration of three ideal timelines. Each timeline is (product-country) specific, but we drop the index p, d. Timeline (a): $TBT = 1$ in one period since and the measure is adopted and enforced in the same semester; $Surprise = 0$ because the notification is before the enforcement. Timeline (b): $TBT = 1$ in two periods since the TBT is enforced the semester after the one of the adoption; $Surprise = 0$ since notification is before the enforcement. Timeline (c): $TBT = 1$ in one period since and the measure is adopted and enforced in the same semester; $Surprise = 1$ because the notification is after the enforcement.

3.2 Empirical Strategy for Firm Level Estimation

To investigate the differential impact of Announced and Surprise TBTs we estimate the following linear regression model:.

$$y_{i,p,d,t} = \alpha_0 \text{AnnouncedTBT}_{p,d,t} + \beta_0 \text{SurpriseTBT}_{p,d,t} + \mu_{HS2,d,t} + \mu_i + \epsilon_{i,p,d,t}. \quad (4)$$

where $y_{i,p,d,t}$ denotes the HS4 product trade margin of firm i in destination d. We include a set of HS2-destination country-semester ($\mu_{HS2,d,t}$) fixed effects. These fixed effects

confound a firms' exit with the complete termination of her export activity, for example in case of her death.

controls for factors such as business cycles, import-demand shocks and multilateral trade resistance (Head and Mayer, 2014). We also add firm dummies (μ_i) to control for firm unobserved, time invariant characteristics that are likely to shape idiosyncratic exporters' behavior.

The identification strategy of model 5 consists in comparing changes in trade margins across HS4 products sold by similar firms, operating in initially similar market conditions except for the introduction of a TBT.[43] More specifically, we make two assumptions for our identification. The first assumption requires that the shocks affecting a firm must be mean independent of the TBTs sequence in that p, d. The second assumption requires that the expectation of the product trade margins without TBT follows a similar trend over time for all firms that sell in a $HS2, d$ market.

We define with $(Y_{i,pdt}(0), Y_{i,pdt}(1))$ the random variables that represent the potential trade margins without and with a new TBT, which we also treat as a RV; an p' a product that belongs to the same 2-digit HS classification of p. The two assumptions are:

1. Strong Exogeneity: For all (i, pdt),
   $E(Y_{i,pdt}(0) - Y_{i,p'dt-1}(0)|\ TBT_{pd}) = E(Y_{i,pdt}(0) - Y_{i,p'dt-1}(0))$
2. Parallel Trends: For $t \geq 2$, $E(Y_{i,pdt}(0) - Y_{i,p'dt-1}(0))$ does not vary across firms.

The first assumption tells that an external shock should not induce correlation between the probability of imposing a new technical regulation on certain goods and firms' margins of trade on that goods.[44] This happens, for example, if countries couple TBTs with other policies that target the same commodities. There is evidence that countries have used TBTs as a policy substitute of tariff cuts (Beverelli et al., 2014; Orefice, 2017). Then, in our preferred specification we add the applied tariff rate at the product level, in order to avoid confounding the effects of changes in regulation with those of changes in tariffs[45],

[43] A similar identification strategy has been used in Fontagné and Orefice (2018), where, however, the time of the effect of a TBT is proxied by the period in which a concern is ongoing.

[44] This is related to the strong exogeneity condition in panel data models, which, as is necessary to obtain the consistence of the fixed effects estimator (Wooldridge 2002).

[45] The tariff level is transformed through the hyperbolic arcsine (asinh). This is because the asinh function is close to the logarithm while still allowing to include observations with zero tariff in the analysis.

$$y_{i,p,d,t} = \alpha_0 \text{AnnouncedTBT}_{p,d,t} + \beta_0 \text{SurpriseTBT}_{p,d,t} + \\ + \delta asinh(\text{tariff}_{p,d,t}) + \mu_{HS2,d,t} + \mu_i + \epsilon_{i,p,d,t}. \quad (5)$$

The second assumption is required to avoid issues of reverse causality. This happens if the government of a certain destination market introduces a TBT in response to import penetration from some specific French firms, or if a STC is raised by the EU against a regulation in a market because French firms are loosing market shares there. Regarding the latter case, this issue should be mitigated by the fact that we use concerns raised by the EU as a whole and not raised specifically by France. In addition, Figure 3 suggests this not to be our case. Instead, the positive trend detected before the introduction of a Surprise measure in Figure 3 makes the former a more plausible threat to our identification. To avoid this issue we impose the parallel trend assumption conditional on being an HS4 products sold to the same country of destination within the same HS2 sector. In order to inspect the validity of this assumption, we run a specification analogous to 6 but introducing additional dummies to select a larger window:

$$y_{i,p,d,t} = \sum_{l=-B}^{-1} \left(\alpha_l 1[L_{p,d,t}^{AnnouncedTBT} = l] + \beta_l 1[L_{p,d,t}^{SurpTBT} = l]\right) + \\ \sum_{k=0}^{A+1} \left(\alpha_k 1[K_{p,d,t}^{AnnouncedTBT} = k] + \beta_k 1[K_{p,d,t}^{SurpTBT} = k]\right) + \\ \delta asinh(\text{tariff}_{p,d,t}) + \mu_{HS2,t,d} + \mu_i + \epsilon_{i,p,d,t}, \quad (6)$$

where $L_{p,d,t}$ represents the number of periods before the introduction of the TBT while $K_{p,d,t}$ the one after, while the superscripts $AnnouncedTBT$ and $SurpriseTBT$ are used to distinguish windows around Announced versus Surprise TBTs. Therefore these two variables represent the relative time around the introduction of a TBT. More specifically $L_{p,d,t} = t - min\{I_{p,d}\}$ is the number of periods before the first semester of introduction of the TBT, while $K_{p,d,t} = t - max\{I_{p,d}\}$ is the number of periods after the last semester of introduction. For example, $L_{p,d} = -1$ identifies the period before the introduction of the TBT. Then, $B \geq 0$ are the number of time lags from the treatment included in the model, while $A \geq 0$ are the specific short run effects. If the introduction of a TBT is randomly assigned and unpredictable conditionally on the tariff level and on the market and firm fixed effects, there are no pre-trends, i.e. $\beta_l = 0$ for $l < 0$.

The standard errors of the coefficients for all estimations are clustered at the (p, d, t), i.e. at the level of assignment of the treatment in our research design.[46] Our standard errors, therefore, account for the possibility that firms' trade margins may be correlated in the same period between units that are shocked by the same regulation.

4 Estimating Firms' Reaction to Surprise TBTs

In this Section we discuss the estimates of the effects of changes in TBT regulations on firms' trade margins. The second part of this Section is devoted to test their quality. In particular, we verify the validity of the parallel trend assumption and investigate the heterogeneity of the estimates across different episodes of changes in TBTs.

4.1 Baseline Results

Table 6 reports the estimates of the baseline specifications in 4, for both case when we aggregate TBTs and when we distinguish between Announced and Surprise TBTs. The table has 6 columns: in columns 1-2, the dependent variable is the export value in log, followed by the probability of exit in columns 3-4, and the lagged probability of exit in 5-6.

Estimates in columns 1,3,5 show that the introduction of a restrictive TBT increases the probability of exiting the market in the period before the introduction (around 4.5%), while does not affect significantly the intensive margin. These results are similar to the ones found in Fontagné and Orefice (2018).[47] The null effect on the intensive margin of the average firms, coupled with the evidence of a strong negative effect of TBTs on aggregate export, has motivated the authors to argue that restrictive TBTs mostly increase the fixed (rather than variable) trade costs which push some firms out of the market.[48]

[46] In Abadie et al. (2017), the authors discuss this experimental design reason for clustering, which is when clusters of units, rather than individual units, are assigned to a treatment.

[47] Note that the estimate of β_0 on exit is higher both because we use higher frequency data, as well as because we use a more precise definition of a TBT which considers the actual dates of the TBT rather than the ones of the STC.

[48] In Chaney (2008) the aggregate trade elasticity to fixed trade costs is predicted to be driven by the extensive margin, with a negligible role of the intensive margin.

However, when we disentangle Announced from Surprise measures, a very different picture emerges. Announced measures are associated to a in the average export value of firms (around 23%) and a positive effect (almost 6%) on the probability of exit in the period before the introduction. Surprise measures determines instead a substantial fall, of around 30%, in the average export value of exporters, while they do not significantly impact the probability of exit. This set of results unveils two different regimes within restrictive TBTs. When Announced, a TBT produces a positive effect on the intensive margin, which is then offset on the average restrictive TBT by the negative effect of Surprise measures.

What we find for Announced measures is in line with Bao and Qiu (2012). The authors have indeed estimated the effects of TBTs by using a sample of notified measures. The authors interpret these results in terms of the evolution of competition as well as of exporters' demand in the market. In particular, they suggest that, in addition to the reallocation of market shares due to selection, the increase in the aggregate export is coherent with the idea that, when TBTs pursue legitimate objectives, they work as an information revelation or quality assurance feature. This raises consumers confidence over foreign goods and hence boosts demand for imports. In our case, instead, we do not observe an aggregate increase in French exports following the introduction of a TBT (Figure 3). Thus the average increase in firms' intensive margin is here more coherent with an hypothesis of reallocation of market shares across French exporters, following an increase in the cost to serve the market, rather than an information-revealing aspect of these TBT.

On the other hand, results on Surprise measures are new to the literature. In this case we observe a fall in the intensive margin, while not a significant exit of firms. The next Sections will be devoted to the interpretation of this peculiar pattern. Before that, we discuss the validity of our research design.

4.2 Dynamic Model

Figures 7 and 8 plot the regression estimates of Equation 6 for a time window around the introduction period of a TBT, for the export and the exit probability.[49] Each Figure

[49] We choose three lags, i.e. one year and an half, since at the earliest a Notification occurred 21 months before the introduction, while at the latest, a late Notification is provided 19 months later.

Table 4: Announced vs Surprise measures - Baseline Model

DEPENDENT VARIABLE	Export_t		Exit_t		Exit_{t-1}	
	(1)	(2)	(3)	(4)	(5)	(6)
TBT	0.11		0.01		0.045^c	
	(0.09)		(0.017)		(0.01)	
SurpriseTBT		-0.27^b		0.04		0.00
		(0.13)		(0.03)		(0.02)
AnnouncedTBT		0.23^b		0.00		0.055^a
		(0.11)		(0.01)		(0.02)
asinh(tariff)	-0.05^a	-0.05^a	0.00^a	0.00^a	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	4,214,856	4,214,856	2,522,245	2,522,245	2,418,685	2,418,685
Adj. R2	0.26	0.26	0.11	0.11	0.11	0.11
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
HS2-Country-Time FE	Yes	Yes	Yes	Yes	Yes	Yes

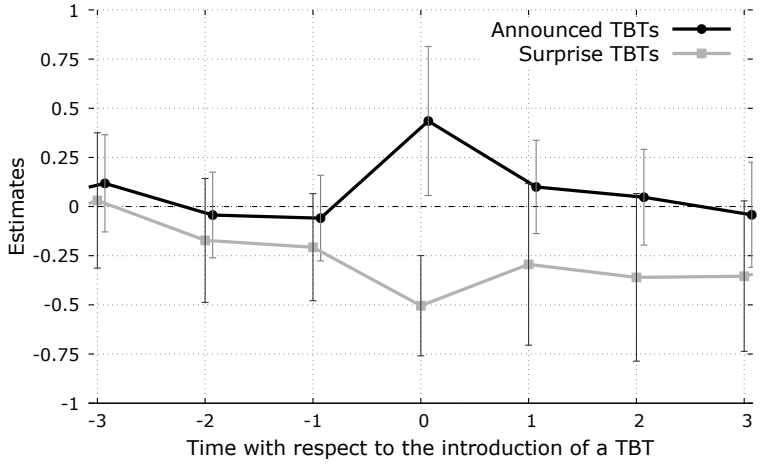
Notes: Export is in log, so the marginal effect of a dummy reads $100(e^{\beta}-1)\%$, with β being the coefficient on the dummy. Standard errors in parenthesis are clustered at (product,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 since who exits does not export in the period. Significance levels: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$.

displays 2 panels, representing the coefficients $\hat{\alpha}$ and $\hat{\beta}$, over leads and lags around the introduction of a TBT.

Figure 7 shows that, for both Surprise and Announced measures the effect on the value of export is significant only during the period of introduction of the TBT. In both cases, no substantial pre-trend is detected. This means that before the introduction of a TBT, the firms product lines touched by the new regulation are not substantially different from the others within the same HS2 produce category, that we use as counterfactual group. This is mostly important for the Surprise measures, for which we have observed a positive trend that precedes the introduction of the TBT relative to the average performance of French exports. In contrast, during the introduction of a new requirement we detect an idiosyncratic behavior in the export of targeted products. However, this appears to vanish quickly, even if the estimates are quite imprecise, mostly in the case of Surprise measures.

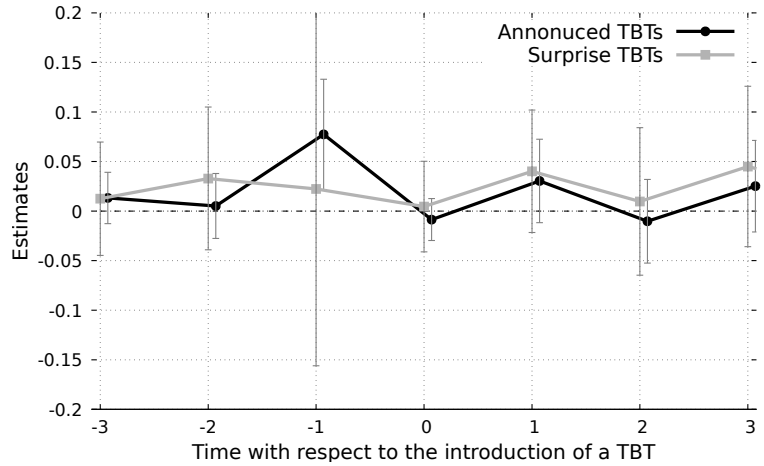
Figure 8 shows that the effect of Announced measures on the probability of exit is significant just in the period before the regulation is enforced. This is coherent with the timing of the announcement: almost the entirety of the Announced measures are notified between 3 and 6 months before the introduction period. This suggest that in

Figure 7: Dynamic model for Export, regression coefficients and 95% CI



Notes: The image plot the estimated coefficients of equation 5 with lags and leads around the treatment, for two type of treatments, Surprise and Announced TBTs. The dependent variable is here the (log) value of export.

Figure 8: Dynamic model for Exit, regression coefficients and 95% CI



Notes: The image plot the estimated coefficients of equation 5 with lags and leads around the treatment, for two type of treatments, Surprise and Announced TBTs. The dependent variable is here the probability of exit.

case of Announced measures firms expect the change in the next period and will there exit before incurring the per period cost. On the other hand, there is no significant exit on the average firm following a Surprise TBT. Yet in this case too estimates of Surprise TBTs are more imprecise.

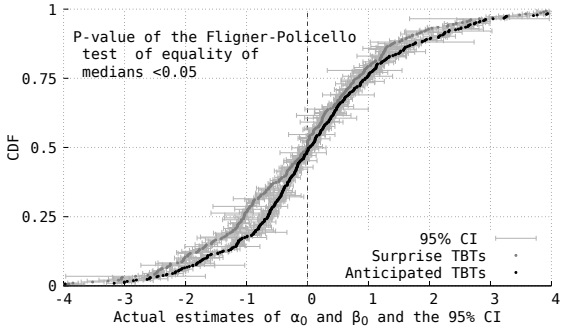
4.3 Heterogeneity of the effects

To run out the possibility that our estimates are driven by singles extreme values, we follow a similar strategy to Cengiz et al. (2019) and perform an event-by-event analysis, where an event is here a TBT. For this purpose, we create individual dataset, one for each TBT event. The data sets include the TBT and all clean control groups. Clean control groups are those markets (product, destination country, time) that are not interested by the introduction of a TBT. We calculate the event-specific $\hat{\alpha}$ and $\hat{\beta}$ by estimating model 5 for each dataset. Figure 9 reports the distribution of the estimates by type of TBTs. We detect large heterogeneity. However, the results from the Fligner and Policello (1981) test of stochastic dominance confirms the differences - and their directions - inspected on the averages $\hat{\alpha}_0$ and $\hat{\beta}_0$. In particular, the distribution of the event-by-event $\hat{\beta}_0$ and $\hat{\beta}_{-1}$ stochastic dominate the $\hat{\alpha}_0$ and $\hat{\alpha}_{-1}$ on the intensive and extensive margin, respectively; while $\hat{\alpha}_0$ does not stochastic dominate $\hat{\beta}_0$ on the extensive margin.

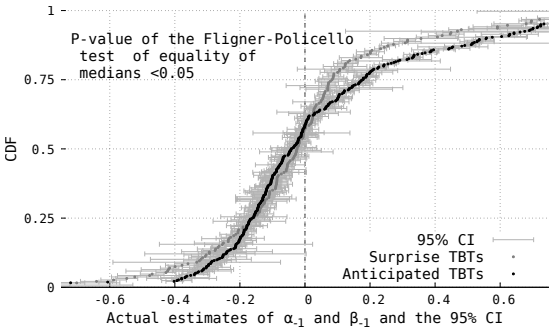
4.4 Robustness Checks

Alternative counterfactual groups We include $(HS2, d, t)$ set of fixed effects to compare products that are, except for being subject to the new regulation, otherwise similar in their characteristics. If countries target through a Surprise TBT those imports that are performing relatively well in the country, we expect their effects to be particularly negative with respect to otherwise similar goods than relative to the average product sold in the destination. Indeed, Table 12 shows that the estimates of a model where we include just (destination,time) pair fixed effect is lower, around 17%. Interestingly, when we instead exclude the firm fixed effect, estimates do not change dramatically. This suggests that firms are hit by Surprise TBTs despite their destination, product, characteristics, such as the time invariant component of differences in firms overall ability and exporting performance. In the last column of Table 12 we add firm-country FE to test whether firm-destination time invariant characteristics, such as market specific reputation, shape the response of firms to TBTs. The effect does not change qualitatively,

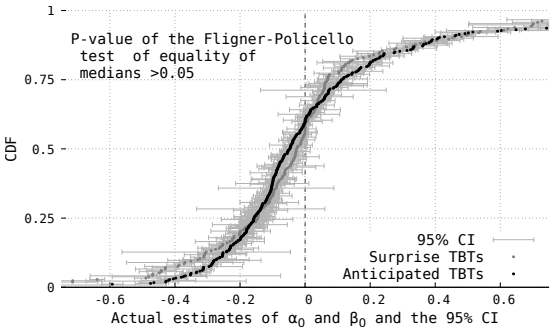
Figure 9: TBT Event-specific Estimates for the intensive and extensive margins



(a) INTENSIVE, the introduction of a TBT



(b) EXTENSIVE, one lag before the introduction of a TBT



(c) EXTENSIVE, at the introduction of a TBT

with the coefficient being slightly smaller for Surprise TBTs while larger for Announced ones.

Underidentification in the structure of the FE A potential issue associated with 4 regards the underidentification associated to the structure of the fixed effects. In our estimation, this happens if a restrictive TBT touches all HS4 products within an HS2 category. Then, within a treatment unit one can not disentangle the market characteristics from the effects of the the new TBT. As shown in Table 2, there are some TBTs that touches several HS4 products, making underidentification plausible in these cases.[50] To check that our results do not suffer of this underidentification we test whether our estimates are robust to drop those TBTs that cover a large share of HS4 products within the same HS2 sector. Point estimates of α_0 and β_0 do not almost change when we exclude those TBTs which cover more than 90%, 80%, 70% and 60% of units within an $HS2, d, t$ group (see Tables 14 and 15 in the Appendix).

Differences in the length of the treatment period Introduction period that extends over multiple semesters might occur only for Announced TBTs, since Surprise ones, by construction, are introduced in the semester in which they are enforced. Interestingly, when we sub-sample those TBTs whose introduction period last no more than 3 (cols 1 and 2 of Table 17), 2 (cols 3 and 4), and 1 (cols 5 and 6) semesters, the average effect does not change dramatically and, if anything, decrease on both the intensive and (coherently) the extensive margin. In other words, the shorter the period of introduction of the measure, the lower the exit of firms from the market, the lower the gain in market shares from surviving firms. This can be explained by the fact that longer introduction are usually granted in case of more complicated requirements, for which longer adaptation is needed and plausibly a larger investment.

Full sample of French exporters As discussed in Section 2.4, the estimating sample includes those firms that are under the BRN regimes, which is those that earn annual revenues larger than 763€. This might potentially introduces a selection bias towards larger firms. We show in Appendix 11 that while observations almost double in size, results remains qualitatively similar. Differences in magnitudes of the coefficients are in the direction that one would expect. In case of Announced Measures, the estimated coefficient on exit is slightly larger in the full sample, while the estimate on the the intensive margin becames non significant. The coefficients associated to Surprise Measures

[50] For the median $HS2, d, t$ 8% of the HS4 products are interested by a change in the regulation, while 24% are the average.

do not change substantially, they are smaller but in a not significant way, suggesting that at the time of the Surprise TBTs all exporters are hit independently, for example, of their ability.

5 Interpreting the effects of Surprise measures

By distinguishing the effects on firms' trade activity, our estimates uncover differences between Announced and Surprise TBTs. While Announced measures cause exit of firms before the introduction of the new measure, Surprise measures determines a simultaneous drop in their export value.

We interpret this evidence within a framework of investment under uncertainty using the intuitions of the real options literature developed in Dixit et al. (1994). This framework builds on two main elements: (i) the irreversibility of investments and (ii) the possibility to wait to invest. Most of the investment are partly irreversible, they generate assets that can not be fully appropriated to an alternative use of a firm. In other words, these investments, once taken, become sunk costs. The choice of exporting in a market is modelled as an irreversible investment in Limão and Maggi (2015) and Hanson et al. (2016). Also the choice of staying in a market can include the evaluation of some irreversible costs. These are associated for example to updating the distributional networks, tailoring production to changing regulation and filling in periodic declarations and other forms. The role of future conditions is particularly important when firms must decide on costly irreversible investments such as adopting a new product requirement, producing a new good or selling in a market. The reason is that a firm with an opportunity to invest is holding an option similar to a financial call option, which gives the right but not the obligation to buy an asset at some future time. When a firm makes an irreversible investment expenditure, it looses this option to invest. For example, it gives up the possibility of waiting for new information to arrive that might impact on the profitability or timing of the investment. This lost option value is an opportunity cost that must be considered as part of the cost of the investment.

We can think of a change in technical regulation as a change in the sunk cost to serve that market. In case of Announced measures, this change affects firms' expected payoff before entering the market, when the per period sunk cost of exporting there has not yet been incurred. This allows the firm to take into consideration the additional cost of adapting to the new regulation in the decision to serve the market in that period. On the

other hand, Surprise measures affect the instantaneous payoff once the firm has entered and already paid the per period sunk cost. The different timing in which firms consider whether to implement the new requirement explain why we observe a significant exit of firms in the case the change in regulation is anticipated by firms, while we do not in the case the measure is unexpected.

In case of Surprise TBTs, we can explain the fall in the export value, along with no significant exit, as to be due to a temporary halt in the exporting activity of firms within the semester. We interpret this halt to be caused by a in the uncertainty of serving the market. We think of this as to be due to the fact that when countries avoid to codify the regulation through a notification they the uncertainty on the profitability of the market. This interpretation finds support in the words of the US representative bringing the case of the Mexican ban to the TBT Committee. The lack of information on the list of licence providers, he argued, raised the uncertainty on the cost of proving conformity of its own products. The increase in uncertainty in turn the value of the real option of waiting to collect new information before implementing the investment to adapt to the new standard. In other words, by rising the uncertainty, Surprise measure incentives firms to delay their investment decision about remaining in the market. We therefore think of this temporary halt as the output of firms decision to wait for new information to come.

5.1 A temporary halt of export

While we interpret the drop in the export value as due to a temporary halt of the activity of exporters, another possibility is that firms continue to export but at a reduced intensity. If firms halt their exporting activity, we should observe a reduction in the frequency with which a firm operate in a market. On the other hand, if firms keep the same shipment rate but reduce their size we expect to see a fall in the average export value per shipment. As shipment unit we use data on monthly export activity. We decompose the semestral export value into (i) the number of months in which a firm exports and (ii) the average export value per shipment. We then use these two margins as the new dependent variables in our baseline model in equation (4). The estimates in table 5 shows that the average number of months in which a firm serve a market with a product falls substantially when an unexpected TBT is introduced on it. The average shipment instead does not. This evidence support our interpretation that when firms are caught by Surprise TBTs they stop, at least for a while, to serve the market. The

Table 5: Announced vs Surprise measures - Shipment margin

DEPENDENT VARIABLE	#(Shipments)	Export per Shipment
	(1)	(2)
SurpTBT	-0.201^{b}	-0.195
	(0.083)	(0.145)
AnnouncedTBT	-0.044	0.253^{b}
	(0.035)	(0.113)
asinh(tariff)	-0.007^{a}	-0.051^{a}
	(0.001)	(0.002)
Obs.	4,214,856	4,214,856
Adj. R2	0.26	0.26
Firm FE	Yes	Yes
HS2-Country-Time FE	Yes	Yes

Notes: The number of shipments is the number of months in which a firm is active. The export per shipment is the average export value per active month. Export is in log, so the marginal effect of a dummy reads $100(e^{\beta}-1)\%$, with β being the coefficient on the dummy. Standard errors in parenthesis are clustered at (product,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 since who exits does not export in the period. Significance levels: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$.

fact that simultaneously we do not record a significant exit suggests this to be only a temporary halt.

6 Firm heterogeneity and the ability to wait

With firm heterogeneity not all firms are equally likely to survive the same negative shock. Those firms that were close to the surviving cutoff before the shock will be forced to exit. This is the case for both Announced and Surprise measures, if the new regulation impose additional costs to serve the market whatever the source of the cost is. In both cases, we expect the least productive firms to struggle the most in surviving the change in the regulation. In this section we look at the differential effects of Announced and Surprise measures for different classes of firms' size.[51]

[51] In the standard framework a' la Melitz, differences in terms of productivity maps into the differences in performances of firms, such as their size.

6.1 Estimating the role of size

We proxy the size of a firm with its total sales in the domestic market. This choice is made to reduce potential concerns of simultaneity in case we were to use the export value. We classify the size of the firms in three groups. We do this by using the 40th and 80th percentile of the size distribution in each period t. We define three dummy variables for each group $Size_{c,i,t}$ with c indexing $\{S, M, L\}$, which takes value one when the total sales of a firm is respectively below or equal the 40th, above the 40th but below the 80th, above or equal the 80th percentile. We augment our specification in 4 with size classes and their interaction with Announced and Surprise TBTs:

$$y_{i,p,d,t} = \sum_{c\in\{L,M\}} \gamma_{0,c}\ \text{Size}_{c,i,s} + \sum_{c\in\{L,M,S\}} \alpha_{0,c}\text{Size}_{c,i,t} \times \text{AnnouncedTBT}_{p,d,t} \\ \sum_{c\in\{L,M,S\}} \beta_{0,c}\ \text{Size}_{c,i,t} \times \text{SurpriseTBT}_{p,d,t} + \\ + \delta_1 asinh(\text{tariff}_{p,d,t}) + \mu_{HS2,d,t} + \mu_i + \epsilon_{i,p,d,t} \quad (7)$$

We drop $\text{Size}_{S,i,s}$ in order to have our estimates as deviation from small firms in markets where the regulation does not change. We are interested in decomposing the effect of a regulation into the marginal contribution of each size class. We will therefore be looking at the estimates of $\beta_{0,c} + \gamma_{0,c}$ for Surprise TBTs and $\alpha_{0,c} + \gamma_{0,c}$ for Announced TBTs. For the marginal effect of being treated by a regulation, given a certain size, we will be looking at $\beta_{0,c}$ and $\alpha_{0,c}$ across size classes c.

6.2 Results and discussion

Table 6 reports the estimates of the specifications described in model 5 and 7. The table has 6 columns: in columns 1-2, the dependent variable is the export value in log, followed by the probability of exit in columns 3-4, and the lagged probability of exit in 5-6.

In markets with no change of regulation, the medium (large) size firm exports on average 22% (46%) more of a small firm counterpart and she is around 7% (12%) less likely to exit the market.

Conversely, in markets touched by a Surprise TBT, the medium size firm exports even less than the small firm counterpart in a market with no regulation, on average 21%

less, and is around 6% more likely to exit the market. Large firms touched by a Surprise TBT export instead only 21% more than a small firm counterpart in a market with no regulation and are always 12% less likely to exit the market. Small firms export instead 34% less then their counterpart in markets with no TBT and their probability to exit the market is 13% larger. By comparing each class size with its own counterpart in a market not touched by a regulation, we see that the expected export value is substantially lower for all the three size classes. The drop in export value is more substantial for small and medium size firms, who loose 29% and 34%, respectively, against the 17% loss for large firms. On the other hand, the probability of exit increase significantly only for small and medium firms, by 12% and 13% respectively. On the contrary, in the period before the introduction of a Surprise TBT we do not record any significant change in the probability of exit for any size class.

In markets touched by an Announced measures, the medium size firm exports again on average 22% more of the small firm counterpart in a market with no TBT. Large firms export around 91% more, while small firms get larger - they export 27% more than the small firm counterpart in a market with no TBT. In the period before the introduction of the Announced TBT small firms exit with a probability that is 10% bigger, medium firms with no substantial difference, while large firms are only 4% less likely, then the small counterpart in a market with no TBT. Then, by comparing each class size with its own counterpart in a market not touched by a regulation, we see that the expected export value is substantially larger for small and large firms. In the period before the introduction of a announced TBT, the probability of exit increase for all class sizes, but in particular for small firms.

This set of results reinforces our interpretation of the estimates of the baseline model. In case of Announced measures, mostly small firms exit before the TBT is implemented to avoid to pay the sunk cost to serve the market and adopt the new regulation. In case of Surprise TBTs, firms did not expect the change and exit within the same period in which the measure is enforced. Only large firms do not exit substantially, while the record a significant reduction in the export value pointing to the fact that this firms undergo a temporary stop. We interpret this evidence as suggesting that large firms wait and delay their investment decision on serving the market. One possible reason of why large firms are more prone to wait is that they find it easier to divert their sales somewhere else. This channel has been investigated in Fontagné et al. (2015), who finds that multi-destination firms, are able to switch destination countries more easily than other firm when they are hit by a new TBT. They explain this by benefiting from a

Table 6: Effects of Announced vs Surprise measures for different size classes

DEPENDENT VARIABLE	Export_t		Exit_t		Exit_{t-1}	
	(1)	(2)	(3)	(4)	(5)	(6)
$Size_{MED,t}$	0.195^a	0.196^a	-0.072^a	-0.072^a	-0.077^a	-0.077^a
	(0.006)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)
$Size_{BIG,t}$	0.378^a	0.378^a	-0.122^a	-0.122^a	-0.130^a	-0.130^a
	(0.008)	(0.008)	(0.003)	(0.003)	(0.003)	(0.003)
SurpTBT×$Size_{SMALL}$		-0.339^a		0.125^b		-0.019
		(0.151)		(0.072)		(0.121)
SurpTBT×$Size_{MED}$		-0.429^a		0.132^a		-0.006
		(0.094)		(0.036)		(0.092)
SurpTBT×$Size_{BIG}$		-0.192^b		0.004		0.020
		(0.106)		(0.021)		(0.084)
AnnouncedTBT×$Size_{SMALL}$		0.246^b		-0.0003		0.103^a
		(0.140)		(0.037)		(0.046)
AnnouncedTBT×$Size_{MED}$		0.078		0.003		0.073^a
		(0.117)		(0.023)		(0.035)
AnnouncedTBT×$Size_{BIG}$		0.273^a		-0.013		0.095^a
		(0.137)		(0.013)		(0.036)
asinh(tariff)	-0.05^a	-0.053^a	0.001^a	0.001^a	0.001^a	0.001^a
	(0.002)	(0.002)	(0.0005)	(0.001)	(0.0005)	(0.001)
Obs.	4,214,856	4,214,856	2,522,245	2,522,245	2,418,685	2,418,685
Adj. R2	0.26	0.26	0.11	0.11	0.11	0.11
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
HS2-Country-Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Export is in log, so the marginal effect of a dummy reads $100(e^{\beta}-1)\%$, with β being the coefficient on the dummy. Standard errors in parenthesis are clustered at (product,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 since who exits does not export in the period. Significance levels: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$.

wide portfolio of alternatives, multi-destination firms are more able than other firms in diverting trade towards TBT-free destinations for which fixed-costs of market access have already been paid.

7 Persistence of Uncertainty and the role of formal Information

Our argument builds on the assumption that Surprise measures determine uncertainty on the cost to serve the market. Our theoretical framework predicts that when this happens, firms will postpone their investment decision on whether to stay. This is because the uncertainty over the profitability of the investment creates a value to wait for new information. In this section we investigate whether the arrival of new information, through late notification, erodes the value of the option to wait. To do so we distinguish

the dynamic effects between those Surprise Measures for which a notification is provided with delay from those that are left unnotified. For this purpose, we modify our baseline specification to include the distinction between late notified and never notified Measures.

7.1 Estimating the role of late notifications

We define a k-periods far from a Surprise measure to be Late Notified in semester t, if in s it is k-period apart from the introduction and a notification has been provided by the start of the semester:

$$SurpTBT^{UN}_{p,d,t,k} = 1[\text{if } K^{SurpTBT}_{p,d,t} = k] \times 1[\text{if semester}(N_{p,d}) < t].$$

We then distinguish unnotified measures as those that after k-periods from the introduction have no yet been notified. This might occur either because the Notification will be provided afterwards or because it will never been notified:

$$SurpriseTBT^{LN}_{p,d,t,k} = 1[\text{if } K^{SurpriseTBT}_{p,d,t} = k] \times 1[\text{if semester}(N_{p,d}) \geq t \text{ or } N_{p,d} = NA].$$

We estimate a semi-dynamic model with short run effects after the introduction of the Surprise TBTs, which distinguishes the two groups:

$$\begin{aligned} y_{i,p,d,t} = \beta_0 SurpTBT_{p,d,t} + \sum_{k=1}^{A-1} \beta^{LN}_k SurpTBT^{LN}_{p,d,t,k} + \\ \sum_{k=1}^{A-1} \beta^{UN}_k SurpTBT^{UN}_{p,d,t,k} + \sum_{k=0}^{A-1} \alpha_k 1[\text{if } K^{AnnouncedTBT}_{p,d,t} = k] + \\ + \delta asinh(\text{tariff}_{p,d,t}) + \mu_{HS2,t,d} + \mu_i + \epsilon_{i,p,d,t} \end{aligned} \quad (8)$$

We are here interested in comparing β^{UN}_k and β^{LN}_k, to see whether the average effect of Unnoitifed TBT is more persistent – significant for a longer k – than the case of Late Notified TBTs.

7.2 Results and discussion

Columns 1 to 3 of Table 7 reports the estimates of the coefficients of model 8 when we increase at each stage by one the number of forward periods (A). For those measures that are notified, the drop in the export value lasts just one semester, the one in which the Surprise TBT occurs. On the other hand, the effects of unnotified measures last longer, also during the subsequent period. This suggests that indeed notifications play a role in reducing the value of the wait option. An alternative explanation could be that the group of Unnotified and Late Notified measures have different effects already at the moment of their enforcement. Table 17 in Appendix shows this not to be the case: the estimate of the lagged variables is almost the same (-0.28 versus -0.26) and indeed the p-vuale of a null hypothesis of equality of the coefficients is very large. In other words, while Surprise Measures hit firms in an equivalent way, independently of whether they will or not be notified in the following months, once disclosed the effects to not persist to the successive one.

8 Conclusion

The findings of this paper support the view that, depending on how changes in technical regulations are promoted internationally, trade effects on exporters may be different. When TBTs are introduced in a less transparent way, they became *de facto* more trade restrictive than necessary. Using a panel of French exporters we found that newly introduced regulations, that are not properly disclosed internationally, halt the exporting activity of firms. Only large firms are able to wait. Small and medium firms tend instead to exit permanently the market. The provision of a formal documentation from the introducing country, allows large firms to restore their exports. We interpret these results as evidence that through the lack of transparency, countries can effectively hinder trade by raising the uncertainty to invest in the adoption of the new technical standard.

Table 7: Export, semi-dynamic for Unnotified and Late Notified

	(1) Export	(2) Export	(3) Export
$SurpriseTBT_{p,d,t,k=0}$	-0.269^{c}	-0.268^{c}	-0.267^{c}
	(0.14)	(0.14)	(0.14)
$SurpriseTBT^{UN}_{p,d,t,k=1}$	-0.310^{a}	-0.320^{a}	-0.321^{a}
	(0.119)	(0.135)	(0.135)
$SurpriseTBT^{LN}_{p,d,t,k=1}$	0.0936	0.0951	0.0924
	(0.193)	(0.194)	(0.194)
$SurpriseTBT^{UN}_{p,d,t,k=2}$		-0.186	-0.294
		(0.173)	(0.255)
$SurpriseTBT^{LN}_{p,d,t,k=2}$		0.0192	0.0152
		(0.177)	(0.177)
asinh(tariff)	-0.0520^{a}	-0.0514^{a}	-0.0508^{a}
	(0.00204)	(0.00206)	(0.00210)
N	3965137	3819196	3666606
adj. R^2	0.261	0.262	0.262
Firm FE	Yes	Yes	Yes
HS2-Country-Time FE	Yes	Yes	Yes

Notes: K are the number of semesters after the introduction of a TBT. The superscript UN and LN are used to distinguish the two types of Surprise TBT, Unnotified and Late Notified ones. Estimates for AnnouncedTBT and the relative forward window are not shown. The definition of the sample is described in Appendix. Export is in log. Standard errors in parenthesis are clustered at (product,country,Time). Significance levels: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$.

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A Construction of the Database

A.1 Procedure to search timestamps in the content of the concern.

The content of the Minutes that we use is a text variable provided in the STC database.[52] The algorithm that parse them look at all possible timestamps contained in the text. We then had to go over them manually to decide whether those dates where indeed the one of interests. In case no relevant dates are provided we label the measures based on the content of the Minutes in 3 ways: (i) 'Y' if the measure is already in force (ii) 'NY' not yet in force and (iii) 'NA' not available. The first case labels those measure that are declared to be in force in the text of the Minutes, even if no specific dates are provided. The second case, labels those measure that are declared to still be under a process of drafting. The third case labels those measure that do not provide sufficient information to distinguish between the above cases. For those measures that are declared in force yet, we assume that the enforcement has occurred in the semester in which the concern has been raised for the first time, since it is plausible that, as no draft is provided, the country is complaining about the entry into force of a new measure.

A.2 Estimation sample for the (semi)dynamic models

Due to the leads of lags of the treatment indicator in an event study framework, information on the treatment needs to be observed for a longer observation window than for the dependent variable. To identify the window of estimation we follow the guidelines on Data Requirement in Schmidheiny and Siegloch (2019) "For a given balanced panel of the dependent variable from $[\underline{s}, \overline{s}]$ and an effect window $[\underline{l}, \overline{l}]$, we need to observe events from $\underline{s} - \overline{l} + 1$ to $\overline{s} + |l| - 1$. If events are derived from changes in policy variables, i.e. treatment status, we need to observe treatment status from $\underline{s} - \overline{l}$ to $\overline{s} + |l| - 1$". The intuition behind this requirement is the following. Imagine that a technical regulation is introduced in October 1994. When we estimate a (semi)-dynamic model with, for example, three leads after the event ($l = 3$), we are assuming that there are short term effects up to three semesters from the introduction. This means that we follow those market up to the first semester of 1996, including them in the treated group. If we do not have information on regulation before 1995, then, we can not distinguish, at the beginning of our sample, those market that are still experiencing short term effects from those that are not. To avoid this, we will estimate our model on the window starting from $s = 3$, after all unobservable post effects have faded away."

[52] In Figure 10 you can find an example of the extracted text associated to a concern.

Figure 10: Example of the format of the Notification

WORLD TRADE ORGANIZATION

G/TBT/N/ARG/101
23 May 2003
(03-2765)

Committee on Technical Barriers to Trade Original: Spanish

NOTIFICATION

The following notification is being circulated in accordance with Article 10.6.

1.	**Member to Agreement notifying:** ARGENTINA **If applicable, name of local government involved (Articles 3.2 and 7.2):**
2.	**Agency responsible:** National Institute of Vitiviniculture **Name and address (including telephone and fax numbers and E-mail and Web site addresses, if available) of agency or authority designated to handle comments regarding the notification shall be indicated if different from above:** *Idem* National Enquiry Point
3.	**Notified under Article 2.9.2 [** X **], 2.10.1 [ ], 5.6.2 [ ], 5.7.1 [ ], other:**
4.	**Products covered (HS or CCCN where applicable, otherwise national tariff heading. ICS numbers may be provided in addition, where applicable):** Wine
5.	**Title, number of pages and language(s) of the notified document:** Wine – Sulphate Content (2 pages, in Spanish)
6.	**Description of content:** Establishes the maximum limits for sulphate content, expressed as potassium sulphate, both in wine that is in circulation and in wineries.
7.	**Objective and rationale, including the nature of urgent problems where applicable:** The need to establish, as an exporting country, the appropriate limits for these products through essential production and conservation techniques, as laid down by the International Organization of Vine and Wine (OIV).
8.	**Relevant documents:** INV Resolution No. 14/2003
9.	**Proposed date of adoption:** 30 April 2003 (Official Journal) **Proposed date of entry into force:** 8 May 2003
10.	**Final date for comments:** -
11.	**Texts available from: National enquiry point [**X**], or address, telephone and fax numbers and E-mail and Web site addresses, if available, of other body:** Punto Focal de la República Argentina Dirección Nacional de Comercio Interior (DNCI) Avda. J. A. Roca 651, Piso 4°, Sector 22 (1322) Buenos Aires Fax: 54 11 4349 4072 Tel.: 54 11 4349 4067 E-mail: focalotc@mecon.gov.ar Web site: http://www.puntofocal.gov.ar

B Baseline Table

Table 8: Dynamic and semi-dynamic model estimates

	(1) Export	(2) Export	(3) Export	(4) Exit	(5) Exit	(6) Exit
$L^{AnnouncedTBT}_{HS4,d,t} = 3$	0.104		0.118	0.0156		0.0132
	(0.126)		(0.126)	(0.0159)		(0.0158)
$L^{AnnouncedTBT}_{HS4,d,t} = 2$	-0.0463		-0.0430	0.00950		0.00950
	(0.112)		(0.111)	(0.0210)		(0.0209)
$L^{AnnouncedTBT}_{HS4,d,t} = 1$	-0.0616		-0.0589	0.0876^{a}		0.0883^{a}
	(0.111)		(0.111)	(0.0310)		(0.0308)
$L^{AnnouncedTBT}_{HS4,d,t} = 0$	0.431^{b}	0.232^{b}	0.435^{b}	-0.0163	-0.00933	-0.0158
	(0.193)	(0.111)	(0.193)	(0.0145)	(0.0123)	(0.0145)
$L^{SurpriseTBT}_{HS4,d,t} = 3$	0.0300		0.0308	0.000337		0.0131
	(0.161)		(0.176)	(0.0271)		(0.0296)
$L^{SurpriseTBT}_{HS4,d,t} = 2$	-0.173		-0.172	0.0493		0.0756
	(0.146)		(0.161)	(0.0423)		(0.0490)
$L^{SurpriseTBT}_{HS4,d,t} = 1$	-0.204		-0.207	0.0201		0.0171
	(0.133)		(0.139)	(0.0986)		(0.106)
$L^{SurpriseTBT}_{HS4,d,t} = 0$	-0.366^{b}	-0.271^{c}	-0.504^{a}	0.00388	0.0393	-0.00491
	(0.150)	(0.147)	(0.130)	(0.0323)	(0.0315)	(0.0334)
$K^{AnnouncedTBT}_{HS4,d,t} = 3$		-0.0374	-0.0421		0.0386	0.0530
		(0.124)	(0.136)		(0.0291)	(0.0303)
$K^{AnnouncedTBT}_{HS4,d,t} = 2$		-0.0222	0.0475		-0.0112	-0.0176
		(0.115)	(0.124)		(0.0178)	(0.0283)
$K^{AnnouncedTBT}_{HS4,d,t} = 1$		0.111	0.100		0.0227	0.0402
		(0.127)	(0.121)		(0.0153)	(0.0267)
$K^{SurpriseTBT}_{HS4,d,t} = 3$		-0.218	-0.354		0.0399^{b}	0.0634
		(0.117)	(0.195)		(0.0190)	(0.0525)
$K^{SurpriseTBT}_{HS4,d,t} = 2$		-0.0576	-0.360		-0.0793^{b}	0.00273
		(0.151)	(0.217)		(0.0333)	(0.0568)
$K^{SurpriseTBT}_{HS4,d,t} = 1$		-0.175	-0.294		0.0181	0.0260
		(0.120)	(0.210)		(0.0167)	(0.0288)
asinh(tariff)	-0.0554^{a}	-0.0502^{a}	-0.0528^{a}	0.00148^{a}	0.000767	0.00120^{b}
	(0.00220)	(0.00214)	(0.00237)	(0.000508)	(0.000493)	(0.000542)
Obs.	3617360	3666606	3069085	2231765	2262662	1972190
adj. R^2	0.260	0.262	0.261	0.116	0.116	0.116
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
HS2-Country-Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: L represents the lags, while K the leads, before and after the introduction of a TBT, respectively. The superscript $Antic$ and $Surp$ are used to distinguish the two types of TBT. Model (1) and (4) are semi dynamic backward models, (2) and (5) are semi dynamic forward model while (3) and (6) are dynamic models. Cols (3) and (6) are the estimates of Fig. 7 and 8. Export is in log. Standard errors in parenthesis are clustered at (HS4,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 since exit is defined for firms that have exported at least two subsequent periods. levels: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$.

C Motivation Table

Data is aggregated at the $HS4, d, t$ level, which is summing exports value across firms. We then run the following specification:

$$y_{HS4,d,t} = \sum_{l=-B}^{-1} \left(\alpha_l 1[L^{AnnouncedTBT}_{p,d,t} = l] + \beta_l 1[L^{SurpriseTBT}_{p,d,t} = l]\right) + \sum_{k=0}^{A+1} \left(\alpha_k 1[K^{AnnouncedTBT}_{p,d,t} = k] + \beta_k 1[K^{SurpriseTBT}_{p,d,t} = k]\right) + \delta asinh(\text{tariff}_{p,d,t}) + \mu_{p,t} + \epsilon_{p,d,t}, \tag{9}$$

where the variables are as defined for the full dynamic specification of 8. Note that here the model includes $(HS4, d)$ fixed effects and therefore exploits time variability within markets.

Table 9: Coefficients plotted in 7 Dynamic specification

$L^{AnnouncedTBT}_{HS4,d,t} = -4$	0.0877	$L^{SurpriseTBT}_{HS4,d,t} = -4$	-0.205*
	(0.0545)		(0.104)
$L^{AnnouncedTBT}_{HS4,d,t} = -3$	0.0247	$L^{SurpriseTBT}_{HS4,d,t} = -3$	-0.000434
	(0.0554)		(0.103)
$L^{AnnouncedTBT}_{HS4,d,t} = -2$	0.125*	$L^{SurpriseTBT}_{HS4,d,t} = -2$	0.0859
	(0.0575)		(0.0917)
$L^{AnnouncedTBT}_{HS4,d,t} = -1$	0.00353	$L^{SurpriseTBT}_{HS4,d,t} = 1$	0.275**
	(0.0591)		(0.0920)
$L^{AnnouncedTBT}_{HS4,d,t} = 0$	-0.0149	$L^{SurpriseTBT}_{HS4,d,t} = 0$	-0.295***
	(0.0618)		(0.0841)
$L^{AnnouncedTBT}_{HS4,d,t} = 1$	0.0918	$L^{SurpriseTBT}_{HS4,d,t} = 1$	-0.250**
	(0.0695)		(0.0819)
$L^{AnnouncedTBT}_{HS4,d,t} = 2$	0.0776	$L^{SurpriseTBT}_{HS4,d,t} = 2$	-0.112
	(0.0716)		(0.0807)
$L^{AnnouncedTBT}_{HS4,d,t} = 3$	-0.127	$L^{SurpriseTBT}_{HS4,d,t} = 3$	0.0127
	(0.0738)		(0.0820)
$L^{AnnouncedTBT}_{HS4,d,t} = 4$	-0.0232	$L^{SurpriseTBT}_{HS4,d,t} = 4$	-0.0185
	(0.0745)		(0.0818)
N			593490
adj. R^2		0.771	

Notes: Estimates are shown in two columns but all coefficients are estimated within the same specification as in eq 9. HS4-Country FE and Tariff level are included. L represents the lags, while K the leads, before and after the introduction of a TBT, respectively. The superscript $Antic$ and $Surp$ are used to distinguish the two types of TBT. Significance levels: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$.

Table 10: Effects of Announced vs Surprise measures - Population of French exporters

DEPENDENT VARIABLE	$Export_t$		$Exit_t$		$Exit_{s-1}$	
	(1)	(2)	(3)	(4)	(5)	(6)
TBT	0.08		0.02		0.05^b	
	(0.09)		(0.02)		(0.02)	
SurpriseTBT		-0.24^a		0.02		-0.01
		(0.09)		(0.01)		(0.02)
AnnouncedTBT		0.13		-0.00		0.06^b
		(0.08)		(0.01)		(0.03)
asinh(tariff)	-0.05^a	-0.05^a	0.00^a	0.00^a	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	8,167,539	8,167,539	4,560,835	4,560,835	4,378,804	4,378,804
Adj. R2	0.32	0.32	0.28	0.28	0.28	0.28
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
HS2-Country-Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Export is in log, so the marginal effect of a dummy reads $100(e^{\beta}-1)\%$, with β being the coefficient on the dummy. Standard errors in parenthesis are clustered at (HS4,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 since who exits does not export in the period. Significance levels: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$.

D Robustness checks Tables

Alternative definition of exit In our exercise, the time dimension is crucial, since we aim at capturing short term effects. Our definition of exit, instead, collapse past, present and future choices of firms into a single value. An exiting firm is one who chooses to exit today, as well as chooses to stay out of the $HS4, d$ market in the next 2 semesters. We here test alternatives definition of exit. To investigate the possibility of a short halt we define a "short exit" by looking only one period ahead: firms exit a market if they are present today but not in the next semester. We then investigate a "long exit": firms exit a market if they are not present for the next 3 semesters. Moreover, according to our definition of exit, an active exporter is one that has exported in the market consecutively in the last two semesters. In very seasonal markets, such as the air conditioning in Mexico discussed above, we have less active firms. We then define a "Seasonal Exit" if the firm had exported at least once between today and the last semester (once in the full year) while not in the full next one (short seasonal exit) or two (long seasonal exit). Across the board of Table 18 we observe that the only variable which is highly significant for all four alternative definitions of exit is the dummy that identifies one period before the introduction of an Announced TBT. The estimates become even larger when defining longer exit, up to around 9%, suggesting that once a firm decide not to comply with a certain regulation it will stay out from that market for long.

Table 11: Effects of Announced vs Surprise measures - Excluding Regulations on HS6

DEPENDENT VARIABLE	Export_t	Exit_t	Exit_{s-1}
	(1)	(2)	(3)
SurpriseTBT	-0.25^a	0.49^a	-0.01
	(0.10)	(0.02)	(0.02)
AnnouncedTBT	0.20	-0.00	0.10^a
	(0.14)	(0.01)	(0.04)
asinh(tariff)	-0.05^a	0.00	0.00
	(0.00)	(0.00)	(0.00)
Obs.	4,017,721	8,167,539	4,560,835
Adj. R2	0.29	0.30	0.18
Firm FE	Yes	Yes	Yes
HS2-Country-Time FE	Yes	Yes	Yes

Notes: Export is in log, so the marginal effect of a dummy reads $100(e^{\beta}-1)\%$, with β being the coefficient on the dummy. Standard errors in parenthesis are clustered at (HS4,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 since who exits does not export in the period. Significance levels: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$.

Table 12: Export, alternative set of fixed effects

	(1) Export	(2) Export	(3) Export	(4) Export
SurpriseTBT	-0.267^{b}	-0.299^{a}	-0.178^{a}	-0.20^{a}
	(0.137)	(0.142)	(0.0687)	(0.0944)
AnnouncedTBT	0.230^{b}	0.216	0.188^{a}	0.26^{b}
	(0.111)	(0.131)	(0.0713)	(0.1252)
asinh(tariff)	-0.0527^{a}	-0.108^{a}	-0.0179^{a}	-0.055
	(0.00201)	(0.00232)	(0.00176)	(0.0027)
N	4214856	4215092	4249924	4209901
adj. R^2	0.261	0.094	0.221	0.44
Firm FE	Yes	No	Yes	No
Firm-Country FE	No	No	No	Yes
HS2-Country-Time	Yes	Yes	No	Yes
Country-Time FE	No	No	Yes	No

Notes: Export is in log. Standard errors in parenthesis are clustered at (HS4,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 since exit is defined for firms that have exported at least two subsequent periods. levels: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$.

Table 13: Exit, alternative set of fixed effects

	(1) $Exit_{s-1}$	(2) $Exit_{s-1}$	(3) $Exit_{s-1}$	(4) $Exit_{s-1}$
SurpriseTBT	0.00356	0.00674	-0.0121	-0.01
	(0.0615)	(0.0639)	(0.0221)	(0.0876)
AnnouncedTBT	0.0542^a	0.0550^a	0.0396^a	0.083^a
	(0.0198)	(0.0191)	(0.0114)	(0.035)
asinh(tariff)	0.00143^a	0.00143^a	-0.000388	0.00
	(0.000484)	(0.000459)	(0.000333)	(0.00067)
N	2424981	2429888	2456379	2374497
adj. R^2	0.114	0.034	0.097	0.15
Firm FE	Yes	No	Yes	No
Firm-Country FE	No	No	No	Yes
HS2-Country-Time	Yes	Yes	No	Yes
Country-Time FE	No	No	Yes	No

Notes: Standard errors in parenthesis are clustered at (HS4,country,time). The observations in cols 3 and 4 are larger than in 1 and 2 because of automatic drop of singletons. levels: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$.

Table 14: Export, exclusion of TBTs by the coverage share of the fixed effect

	(1) Export	(2) Export	(3) Export	(4) Export
SurpriseTBT	-0.273^b	-0.256^c	-0.268^c	-0.256^c
	(0.137)	(0.139)	(0.140)	(0.147)
AnnouncedTBT	0.241^b	0.246^b	0.267^b	0.290^b
	(0.113)	(0.114)	(0.116)	(0.123)
asinh(tariff)	-0.053^a	-0.053^a	-0.053^a	-0.053^a
	(0.002)	(0.002)	(0.002)	(0.002)
N	4212139	4211987	4211893	4211524
adj. R^2	0.261	0.261	0.261	0.261

Notes: Cols represents estimation of the static specification over a sample of TBTs that cover no more than 90% (1), 80% (2), 70% (3) and 60% (4) observations within the $HS2, d, t$ category. Export is in log. Standard errors in parenthesis are clustered at (HS4,country,time). Significance level: $^c < 0.1$, $^b < 0.05$, $^a < 0.01$.

Table 15: Exit, exclusion of TBTs by the coverage share of the fixed effect

	(1) Exit_{s-1}	(2) Exit_{s-1}	(3) Exit_{s-1}	(4) Exit_{s-1}
SurpriseTBT	0.003	0.002	0.005	0.003
	(0.061)	(0.062)	(0.063)	(0.065)
AnnouncedTBT	0.055^{a}	0.056^{a}	0.055^{a}	0.058^{a}
	(0.0200)	(0.0202)	(0.0204)	(0.0213)
asinh(tariff)	0.00141^{a}	0.00141^{a}	0.00141^{a}	0.00141^{a}
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
N	2,423,222	2,423,120	2,423,059	2,422,039
adj. R^2	0.114	0.114	0.114	0.114

Notes: Cols represents estimation of the static specification over a sample of TBTs that cover no more than 90% (1), 80% (2), 70% (3) and 60% (4) observations within the $HS2, d, t$ category. Export is in log. Standard errors in parenthesis are clustered at (HS4,country,time). Significance level: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$.

Table 17: Testing equality of coefficient between unnotified and late notified at the enforcement time

	Export
$SurpriseTBT^{LN}_{HS4,d,t-1,k=1}$	-0.279^{a}
	(0.0617)
$SurpriseTBT^{UN}_{HS4,d,t-1,k=1}$	-0.263^{c}
	(0.127)
asinh(tariff)	-0.0527^{a}
	(0.00225)
Obs.	4,214,856
adj. R^2	0.261
Firm FE	Yes
HS2-Country-Time FE	Yes

Notes: P-value under the equality of the coefficients for $SurpriseTBT^{LN}_{s-1,k=1}$ and $SurpriseTBT^{UN}_{s-1,k=1}$ is 0.8983. K represents the leads, with $k = 1$ being one period ahead. Since the variables of interest are lagged $(s-1)$, they estimates the effect of a SurpriseTBT in the period of enforcement, distinguishing between those TBTs that will be notified by the next semester, denoted with subscript LN and those that will not, denoted with subscript UN . Significance levels: $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$.

Table 18: Alternative definitions of exit

	(1) Short	(2) Long	(3) Short Seasonal	(4) Long Seasonal
$L^{AnnouncedTBT}_{HS4,d,t} = 3$	0.0185	0.0172	0.0219	0.0218
	(0.0171)	(0.0171)	(0.0158)	(0.0165)
$L^{AnnouncedTBT}_{HS4,d,t} = 2$	-0.0249	0.0280	0.0253	0.0331^{b}
	(0.0167)	(0.0223)	(0.0172)	(0.0168)
$L^{AnnouncedTBT}_{HS4,d,t} = 1$	0.0571^{b}	0.0886^{a}	0.0691^{a}	0.0700^{a}
	(0.0222)	(0.0328)	(0.0253)	(0.0264)
$L^{AnnouncedTBT}_{HS4,d,t} = 0$	-0.0148	-0.0234	0.0314	0.0199
	(0.0168)	(0.0149)	(0.0191)	(0.0196)
$K^{AnnouncedTBT}_{HS4,d,t} = 1$	-0.00918	-0.000682	0.0118	0.00527
	(0.0243)	(0.0281)	(0.0199)	(0.0199)
$K^{AnnouncedTBT}_{HS4,d,t} = 2$	0.0255	-0.0169	0.0280	0.0325
	(0.0269)	(0.0276)	(0.0213)	(0.0180)
$K^{AnnouncedTBT}_{HS4,d,t} = 3$	0.0401	0.00903	0.0545^{b}	0.0547^{b}
	(0.0243)	(0.0267)	(0.0227)	(0.0243)
$L^{SurpriseTBT}_{HS4,d,t} = 3$	-0.0566	0.0603^{b}	-0.0463	-0.0229
	(0.0338)	(0.0265)	(0.0370)	(0.0342)
$L^{SurpriseTBT}_{HS4,d,t} = 2$	0.0153	0.0494	0.00433	0.00398
	(0.0336)	(0.0306)	(0.0297)	(0.0336)
$L^{SurpriseTBT}_{HS4,d,t} = 1$	-0.00702	0.0284	0.0179	0.0430
	(0.0707)	(0.115)	(0.0645)	(0.0479)
$L^{SurpriseTBT}_{HS4,d,t} = 0$	0.0107	0.0296	0.0491	0.0234
	(0.0225)	(0.0309)	(0.0382)	(0.0436)
$K^{SurpriseTBT}_{HS4,d,t} = 1$	-0.0242	0.0415	-0.0207	-0.0199
	(0.0378)	(0.0423)	(0.0313)	(0.0358)
$K^{SurpriseTBT}_{HS4,d,t} = 2$	-0.0327	0.0399	0.0562	0.0231
	(0.0603)	(0.0540)	(0.0386)	(0.0324)
$K^{SurpriseTBT}_{HS4,d,t} = 3$	0.0283	0.0388	0.0310	0.0364
	(0.0389)	(0.0260)	(0.0243)	(0.0230)
asinh(tariff)	0.00289^{a}	0.00111^{a}	0.00183^{a}	0.00155^{a}
	(0.0005)	(0.0005)	(0.0004)	(0.0005)
N	3370080	1523284	4673742	4673742
adj. R^2	0.101	0.121	0.090	0.091
Firm FE	Yes	Yes	Yes	Yes
HS2-Country-Time FE	Yes	Yes	Yes	Yes

Notes: L represents the lags, while K the leads, before and after the introduction of a TBT, where the subscript $Antic$ and $Surp$ are used to distinguish the two types of TBT. Short Exit is defined Standard errors in parenthesis are clustered at (HS4,country,time). The number of observations in cols change depending on the definition of exit, since . Significance level is $^{c} < 0.1$, $^{b} < 0.05$, $^{a} < 0.01$.