CESifo
CONFERENCES 2020

CESifo and AUEB-LINER Conference on
The Role of Institutions and Policies in Firm Exporting
Munich, 5–6 November 2020

Technical Barriers to Trade and Firms' Export Decisions

Shuyao Yang

CESifo

Technical Barriers to Trade and Firms' Export Decisions

Shuyao Yang *

Draft
This version: October 26, 2020

Abstract

This paper investigates the impact of restrictive TBTs on firms' extensive margins (export participation and exit probability), intensive margins (export value) and pricing strategy (export price). To this end, product-level restrictive TBTs and firm-level export are combined and an instrumental-variable approach is utilized. The results show that the imposition of restrictive TBTs adversely affect firms' intensive and extensive margins, but not significantly affect firms' price on average. More importantly, firms of different types, in the sense of firm sizes, number of destination markets and ownership types, are affected differently. Given the same restrictive TBTs, firms with higher productivity suffer less, while firms with lower productivity are more vulnerable to the trade barriers.

Keywords: TBTs, Firm heterogeneity, Extensive margins, Intensive margins, Pricing strategy.

JEL classification: F13, F14

*ifo Institute - Leibniz Institute for Economic Research at the University of Munich, Poschinger Str. 5, 81679 Munich, Germany; LMU Munich; E-mail: yang@ifo.de

I would like to thank my supervisor Gabriel Felbermayr for his support throughout this project. I am also grateful to Oliver Falck, Lionel Fontagné, Moritz Goldbeck, Anna Kerkhof, Alexander-Nikolai Sandkamp and Sebastian Wichert for valuable comments and suggestions.

1 Introduction

Over the last decades, modern trade policies such as non-tariff measures (NTMs) are gaining prevalence. One of the key players among NTMs are Technical Barriers to Trade (TBTs). TBTs require exporters' quality, labelling, testing and certification procedures to fulfill the standards in the importing country. TBTs are by far the most commonly used NTMs, with countries imposing them on average on about 30% of trade (UNCTAD, 2013).

Despite the widespread use of TBTs, their impact on trade remains ambiguous, especially at the firm-level. Most studies use aggregate data to analyse the impact of TBTs on trade. They find that TBTs are trade restrictive in general and trade promoting in certain sectors or products.[1] However, studies using firm-level data are relatively scarce. Theoretically, firm heterogeneity models predict that the effect of TBTs on firms' export is both positive and negative; nonetheless, the net effect is unclear. Empirically, exporters in the U.S., France and Egypt have been examined.[2] Yet, little work has been done for the case of China, one of the world's largest exporters and targets of NTMs (Lu et al., 2013). To the best of my knowledge, there are two papers exploring the impact of TBTs on Chinese exporters, but they are limited in either the type of firms (Hu et al., 2019) or the range of firm characteristics (Gulotty et al., 2017).

To quantify TBTs with trade-restrictive nature (henceforth restrictive TBTs) is another challenge. TBT is one of the most difficult NTMs to quantify (Bao and Qiu, 2012). Researchers use different approaches to measure TBTs based on TBT notifications and still face limitations.[3] Even if data on TBT notifications can be estimated, it is often impossible to distinguish between discriminatory and non-discriminatory measures. In the spirit of WTO's TBT Agreement, TBTs should be non-discriminatory and "do not create unnecessary obstacles to trade" (WTO, 2012). However, TBTs might be over utilized by the governments and become trade protectionism (Kang and Ramizo, 2017). Moreover, such restrictive TBTs might be systematically, though unintentionally, biased against developing countries (UNCTAD, 2013). It is thus important to scrutinize TBTs that are applied in a discriminatory or trade-restrictive way.

This paper aims to fill the aforementioned gaps by analyzing the impact of restrictive TBTs on Chinese firms' export decisions. Specifically, I investigate the impact of restrictive TBTs on firms' extensive margins (firms' decisions to export or to exit a product-destination market), intensive margins (firms' export values on a product-destination combination) and pricing

[1] For example Fontagné et al. (2005); Disdier et al. (2008); Jiang (2009); Bao and Qiu (2010); Uprasen (2014).

[2] See Reyes (2011); Fontagné and Orefice (2018); Kamal and Zaki (2018) respectively.

[3] Though WTO members are required to report the new or changed TBTs through the WTO, they normally have no incentive to do so. And some TBT notifications fail to provide specific product codes and descriptions (Bao and Qiu, 2012; Crivelli and Groeschl, 2016).

strategy, with a focus on the heterogeneous impact across firms.

To this end, two major databases are used: the first is firm-level data on the universe of Chinese exporters from the China customs data. The second is product-level data on restrictive TBTs from a novel WTO database on TBT specific trade concerns. This database records all the TBT-related concerns raised by exporting countries to the TBT Committee. Considering the time and cost involved in the procedure, a TBT concern will only be raised if exporters regard it as a "sizeable" barrier for their export activities (Fontagné et al., 2015).[4] In other words, a concern will only be raised if exporters perceive it as more trade restrictive than necessary. Therefore, the TBT concerns are suitable measures for restrictive TBTs. In this paper, the two terms, restrictive TBT and TBT concerns will be used interchangeably. Exporter data and restrictive TBTs are combined at HS4 product level over the 2002-2009 period. China offers an ideal setting here, as Chinese firms are frequently and widely targeted by TBTs and have substantial inter- and intra-industry differentiation (Hu et al., 2019).

The identification strategy is an instrumental-variable (IV) approach. I regress firms' outcome variables (firms' extensive margins, intensive margin and pricing strategy) on TBT concerns and a group of interaction terms between TBT concerns and firms characteristics (firm size, multi-destination status and ownership types). By linking product-level TBTs and firm-level exports, the interaction terms are able to shed light on the heterogeneous effects of TBTs across firms. Crucially, in the first stage of the IV strategy, I instrument for the TBT concerns raised by China using the TBT concerns raised by any third country, and the interaction terms between China-raised TBT concerns and firm characteristics using the interaction terms between third-country-raised TBT concerns and firm characteristics. The rational is that TBT concerns raised by third country rather than China are likely to be exogeneous to Chinese firms' exporting behavior. In the second stage of the IV strategy, I predict firms' export decisions on instrumented TBT concerns and instrumented interaction terms.

This paper finds that restrictive TBTs have negative effects on firms' extensive and intensive margins and a null average effect on price, with the effect varying across heterogeneous firms. First, the imposition of restrictive TBTs prevents firms from export participation and inducing higher exit rates. However, the negative effect is attenuated for firms that are large, have multiple destinations (henceforth multi-destination firms) or domestic ownership type (henceforth domestic-owned firms).[5] Interestingly, I find that multi-destination firms in China and France

[4] A WTO member wishing to raise a TBT-specific trade concern (raising country) has to inform both the TBT Committee and the country imposing the corresponding TBT (maintaining country) at least two weeks before the next TBT Committee meeting. The TBT-specific trade concern will be listed in the agenda and discussed in the forum (Holzer, 2019).

[5] In this paper, domestic-owned firms are not firms serving the domestic market, but rather exporters with domestic ownership type.

react oppositely to the restrictive TBTs. Fontagné and Orefice (2018) find that it is more likely for multi-destination firms in France to exit the market with restrictive TBTs. However, I find that multi-destination firms in China are willing to overcome the higher trade costs and stay in the market. Second, incumbent firms face a loss of export values in general. But large, multi-destination or domestic-owned firms enjoy reduced competition and larger market share. Third, a null average effect on firms' pricing strategy is discovered. But firms of different types set their export price differently. Given the same restrictive TBTs, large and multi-destination firms tend to pass-through part of the increased cost to the final consumers by charging a higher price, whereas domestic-owned firms tend to reduce price by less than cost. By dividing domestic-owned firms into state-owned and private-owned ones, I find that the price-decreasing effect is mainly driven by state-owned rather than private-owned firms.

The contribution of this paper is threefold: First, I exploit a rich set of firm characteristics to uncover interesting firm-level heterogeneity. I find that multi-destination firms in a developing country react differently to the ones in developed countries,[6] and firms' pricing strategies vary not only across different firm characteristics but also within the same ownership type. Second, two types of measurements are used to estimate restrictive TBTs. Beyond the traditional dummy variable, TBTs are also measured by the number of years that a TBT concern remains unresolved (TBT duration). The empirical results are consistent in both measures. Third, by applying an IV approach, I show that simple OLS approach suffers from endogeneity bias.

The remainder of the paper is organized as follows: Section 2 reviews the literature on TBTs. Section 3 introduces the data sets. Section 4 summarizes the theoretical predictions and presents the empirical strategies. Section 5 reports and discusses the main results. Section 6 extends the main results and provides a series of robustness checks. Section 7 concludes the paper.

2 Literature Review

This paper relates to several strands of literature. First, the "New New" trade theory initiated by Melitz (2003) assumes that firms within an industry are heterogeneous in productivity. Incorporating variable and fixed costs of trade into the model, he shows that large and more productive firms enter the export market and simultaneously force less productive firms to exit. Based on the Melitz framework, researchers (Chaney, 2008; Helpman et al., 2008; Melitz and Ottaviano, 2008; Lawless, 2009) develop theoretical models to investigate the effect of trade cost as well as firm-level trade on both intensive and extensive margins. For example, Chaney (2008)

[6] Fontagné and Orefice (2018) find that the driving-out effect of TBTs is stronger for multi-destination firms in France. However, this paper finds that multi-destination firms in China expand export under restrictive TBTs.

extends the Melitz model with the influence of trade barriers on the two trade margins. He shows that a drop of trade barriers increases export volume of incumbent exporters (intensive margin) as well as the set of exporters (extensive margin). Mayer and Ottaviano (2008) reveal that exporters outperform non-exporters in several aspects: they are bigger, more productive and generate higher added value.

Second, a rich set of literature uses aggregate data to analyse the trade effect of NTMs in general. Kee et al. (2009) provide three indicators of trade restrictiveness for 78 developing and developed countries. They find that the restrictiveness of NTMs takes a large share across countries, especially in developed ones, and sometimes even outweigh the restrictiveness of tariffs. Building on Kee et al. (2009)'s work, Hoekman and Nicita (2011) find that tariff and non-tariff measures continue to be trade impediments for developing countries; Niu et al. (2018) estimate the ad valorem equivalents of NTMs for 97 countries over 1997-2015 and conclude that NTMs are rising as dominant components of trade protection over the years. Similar trade dampening impact of NTMs are revealed by Bratt (2017) and Kinzius et al. (2019).

Some scholars narrow down the types of NTMs and explore the trade effect of TBTs in particular. Most of the work find that TBTs are trade restrictive in most cases and trade promoting in a few sectors or products. For instance, Fontagné et al. (2005) estimate the impact of SPS and TBT measures for 161 product groups and find that the impacts of NTMs vary across products. In particular, it is trade promoting for very few manufacturing products and trade hindering for the majority of products. Disdier et al. (2008) estimate the impact of SPS and TBT measures in agricultural trade. The results show that these measures dampen OECD imports on the whole, whereas foster trade in some sectors. Bao and Qiu (2010) investigate the effect of TBTs on China's import during 1998 to 2006. They find that China's TBTs are overall trade restrictive while trade promoting for some manufacturing goods.

More specifically, a branch of literature focuses on one large, emerging and export-oriented country - China - and investigates the impact of TBTs on China's export at aggregate level. Examining all industries, Uprasen (2014) discovers that TBTs in the EU market play dual roles in Chinese exports: encouraging exports when TBTs are regarding product quality or performance requirements (B700) and conformity assessments (B800); whereas hindering exports when TBTs are about the restrictions of products (B100). Exploring one industry, Jiang (2009) look at TBTs raised by the U.S., the European Union, and Japan aiming at China's textile products. He finds both positive influence in the long run (quality upgrading) and negative influence in the short run (export reduction).

Third, while most of the NTMs-related research relies on aggregate trade data, firm-level analyses are relatively scarce. Analysing different NTMs and their relationship with firms' export

performance, defined as export propensity and market diversification (Chen et al., 2006) or as the number of export markets and products (Chen et al., 2008), researchers find that NTMs adversely affect firms' export (Chen et al., 2006), or the effects vary across standards, which can be either positive (quality standards, labelling requirements) or negative (certification procedure) (Chen et al., 2008).

Some scholars investigate the impact of one specific type of NTMs on the export performance of firms in developed countries: Reyes (2011) find that U.S. manufacturing firms with higher productivity increase entry to the EU market following a reduction of one NTM.[7] For firms located in France, Fontagné et al. (2015) find a negative effect of SPS concerns on both extensive and intensive margins, but such negative effects are attenuated in larger firms. Similar negative effects of TBT concerns on export are revealed by Fontagné and Orefice (2018). Moreover, those negative effects are stronger for multi-destination firms, which tend to divert to destinations without TBTs.

Looking at developing countries, Kamal and Zaki (2018) analyse the impact of TBT concerns on Egyptian firms. The results indicate a negative effect of TBT concerns on the intensive margin but no clear cut-off effect on the extensive margin unless taking firm size into consideration. Combining data on pesticide standards and firms' export in 42 developing countries, Fernandes et al. (2019) find that restrictive standards adversely affect firms' export, but firm size and network can partially compensate such negative effects.

Though China is one of the world's largest exporters and targets of NTMs (Lu et al., 2013), limited work has been done to investigate the impact of NTMs, particularly TBTs, on Chinese firms. To my best knowledge, there are two papers in this field. Hu et al. (2019) investigate the impact of TBT notifications on firm-level export using the Children-Resistance Act as a quasi-natural experiment. They explore cigarette lighter firms from 2004 to 2008. Compared to Hu et al. (2019), this paper has a broader range of firm types (the universe of Chinese firms) and a longer time span (from 2002 to 2009). Gulotty et al. (2017) exploit the influence of TBT concerns on Chinese firms from 2000 to 2007. Their specification considers firm size. Compared to Gulotty et al. (2017), this paper enriches the analysis of firm characteristics by including firms' multi-destination status and ownership types as well.

3 Data on Restrictive TBTs and Exporters

The data consists of two important databases: a recently available database on TBT specific trade concerns (STCs) from WTO and a database of Chinese firm exports.

[7] the harmonization of European product standards to international norms in the electronics sector

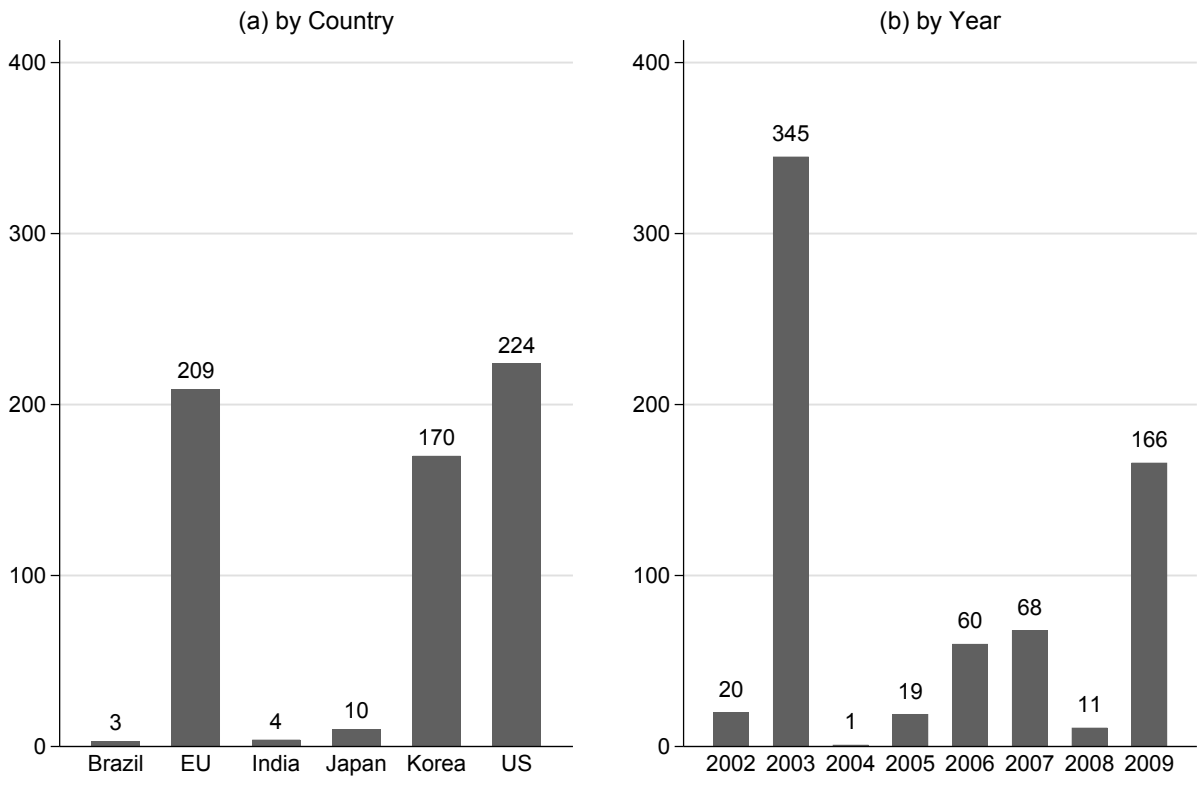
TBTs are measures widely adopted to regulate markets, protect human health and safety, preserve natural resources and protect consumers. It is required that exporters' product quality, labelling and technical standards fulfill the TBTs imposed by the importing countries. Ideally, TBTs should be transparent and unbiased. However, they can also be used to discriminate against imported products and protect domestic ones. If a WTO member thinks that another member's TBTs may unfavorably impact their particular goods, they are entitled to raise their specific trade concerns (STCs) on that TBT measure to the WTO Committee. For example, the United States notified a new TBT measure on the standards for the flammability of clothing textiles from China in 2007. Considering the requirement to be more trade restrictive than necessary, the representative of China raised an STC to the WTO Committee (Ngobi, 2016).

By compiling all the TBT concerns issued by WTO members, WTO builds up a comprehensive database on TBT STCs over the period of 1995-2011.[8] This new database has in total 318 STCs and each STC entry contains information on: (1) product code, at the Harmonized System (HS), Revision 2, four-digit level, (2) years that STCs are raised at the first time and subsequently, (3) WTO members that raise the STC on a specific TBT measure (raising country), (4) WTO members that impose the TBT measure (maintaining country).

As this paper intends to investigate the impact of restrictive TBTs on Chinese exporters, my analysis focuses on STCs raised by China against certain importing countries over the period of 2002-2009. An overview of the products under TBT concerns raised by China is provided in Figure 1. Panel (a) shows the total number of products under TBT concerns by the maintaining country. China raised most TBT concerns targeting the United States, the European Union and South Korea, followed by Japan, India and Brazil. The number of products under TBT concerns by year is reported in Panel (b). 2003 and 2009 have the highest number of products under TBT concerns, whereas 2004 has only one case. Figure 1 reveals a substantial variation of product numbers under TBT concerns across maintaining countries and time.

[8]The database on TBT STCs is retrieved 9 October 2019, from `https://www.wto.org/english/res_e/publications_e/wtr12_dataset_e.htm`.

Figure 1: The Number of Products under TBT Concerns by Country and Year



Note: Panel (a) shows the total number of products under TBT concerns from 2002-2009 by country. Panel (b) shows the total number of products under TBT concerns against all maintaining countries by year.

Traditional TBT notifications provide no information on whether the TBTs are restrictive or not. However, this newly available database on TBT STCs solves this issue as it only focuses on restrictive TBTs. Considering the time and effort needed to raise a concern, a WTO member will only raise an STC on a certain TBT measure if they think that the TBT is over restrictive and will potentially become a trade barrier for them (Fontagné et al., 2015). Based on this data set, I am able to proxy the restrictive TBTs, in other words, TBT concerns, using two different measurements.

TBT Dummy: The first measurement is broadly used in the literature. It equals one if China raises a TBT concern against country c on product p in year t, and zero otherwise.

TBT Duration: The second measurement is the number of years that a TBT concern remains unresolved. The data set provides information on the first year of raising a STC but no information on the year of resolution. I circumvent this problem by using the information on the date of TBT concerns that have been subsequently raised. Research shows that the average duration of a TBT concern is two years (WTO, 2012; Fontagné and Orefice, 2018). I

therefore set TBT concern to be resolved after two years if the concern is not raised again in WTO committee. For instance, if a STC was raised by China against South Korea in 2002, subsequently raised in 2004, and not re-raised in any following year, the STC is assumed to be "resolved" in 2006. After estimating the resolution year, I am able to construct the second measure, TBT duration. 50% of the TBT concerns last for two years, which is also the shortest duration of a TBT concern, while the longest duration is ten years.

The second data set used in this paper is annual China export data at firm-product(HS8)-destination-year level for the period 2000-2009. This analysis focuses on the period 2002-2009 during which the data on TBT STCs is also available. The china export data contains information on unique firm identification, product code at the 8-digit HS level, the trading year and destination country. The free-on-board value in U.S. dollars and export quantities are reported directly, from which unit values can be approximated using producer price. It also provides information on firm characteristics, such as firm size proxied by total export value, the number of firms' destination countries in each product-year combination, and firms' ownership types.

This data set directly provides the key outcome variables capturing firms' intensive margins and pricing strategy; however, firms' extensive margins (firms' decisions to participate or exit a market) cannot be directly obtained. In order to generate variables on firms' export participation and exit probability, I need to expand the data set so that each firm-product-destination combination has an observation in all years. Export value is set to zero when exports do not happen in that year by that firm-product-destination combination. The expanded data set allows me to define the following firm outcome variables $Y_{c,p,f,t}$:[9]

Firm's export participation: a dummy equals one if firm f exports a positive value of product p to country c at time t, and zero otherwise.

Firm's exit probability: a dummy equals one if firm f does not export product p to country c at time t but did so at time $t-1$, and zero if firm f does export product p to country c in both years.

Apart from the aforementioned two main data sets, the tariff data at product(HS4)-year-country level are included as control variables.[10] Theoretically, the tariff and non-tariff measures can be used as substitutes or complements (Fontagné et al., 2015). In order to isolate the trade effect of restrictive TBTs from traditional tariffs, the focus of this paper, I control for bilateral tariffs

[9]Note that considering firms' exit decision in year 2000 is problematic, as no information is given regarding to firms' export status in year 1999. It is arbitrary to assume that a firm does or does not export in year 1999. Thus I have to exclude the starting year of the data set and look at the extensive margin from 2001 onwards.

[10]The tariff data come from Teti (2020). The author cordially thank Teti (2020) for collecting and sharing the data set.

between China and destination countries at HS4 product level. Note that tariffs are provided in percentage points, for example 12% tariff will be listed as 12 in the data set, I first divide tariffs by 100 (denoted as Tariff) and then calculate the logarithmic form $ln(Tariff + 1)_{c,p,t}$. The summary statistics of $ln(Tariff + 1)_{c,p,t}$ are given in Table 1.

Before combining the product-level TBT concerns and firm-level export data, several steps of data preparation are needed. First, data cleaning. As I want to obtain a consistent measure on firm's participation and exit, I drop occasional exporters, who export the same product to the same destination less than 4 times within the sample period. Second, product code harmonization. The China export data reports the HS1996 classification for the year 2000-2001, HS2002 classification for the year 2002-2006 and HS2007 classification for the year 2007-2009. The TBT STCs data set reports the HS2002 classification. The tariff data uses HS1992 classification. All the product codes are converted to the HS1992 classification using the concordance tables provided by UN Trade Statistics.[11] Third, exclusion of trade intermediaries. This paper aims to investigate firms' direct decisions on export, so trade intermediaries are excluded as they might behave differently when facing restrictive TBTs (Beestermöller et al., 2018). Lastly, I aggregate all exports by firm-year-destination to the HS4 level, and merge trade data with TBT concerns at this level using year, product code and destination country.

Table 1: Summary Statistics

	N	Mean	SD	Min	p50	Max
$ln(value)$	5,401,899	10.72	2.34	0.69	10.80	22.64
$ln(price)$	5,393,194	1.50	2.01	-9.71	1.27	18.61
$ln(size)$	17,648,240	0.16	8.42	-15.02	0.00	22.76
$ln(visibility)$	17,624,677	0.00	0.02	-0.69	0.00	0.69
$ln(Tariff + 1)$	15,599,358	0.05	0.08	0.00	0.03	3.16
# Firms			198,957			
# Products			1,210			
# Products under TBT concerns			356			
# Destination countries			69			
# Product-firm pairs			848,393			
# Product-firm-destination pairs			2,238,156			

Note: Summary statistics for the final data set.

[11] The concordance tables are retrieved 1 November 2019, from `https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp`

Table 1 reports the descriptive statistics of the sample.[12] The final data set covers the period of 2002 to 2009, with the unit observation of firm-product-destination-year. There are around 199,000 Chinese firms in total, who export 1,200 products (HS4) to 69 countries. Over the sample period, China raised TBT concerns on 356 products, taking a 30% share of total exported products.

4 Estimation Strategy

The main objective of this paper is to explore how restrictive TBTs affect firms' extensive margins (export participation and exit probability), intensive margins (export value) and pricing strategy. To this end, I first present theoretical predictions based on the Melitz (2003) model, then test those predictions empirically using product-level TBT data and firm-level export data.

4.1 Theoretical Predictions

The key feature of the Melitz (2003) model is that firms are heterogeneous in productivity and face both variable (iceberg) cost and fixed entry cost in order to export. Based on the Melitz (2003) model, the impacts of restrictive TBTs on firms' export performance involve two steps.

First, the imposition of restrictive TBTs in importing country increases both fixed and variable costs of firms exporting to that country. An increased fixed cost can be initial investments in production process, packaging and labeling requirements in compliance with importing countries' standards. An increased variable cost can be due to the fact that exporters have to adapt their production, use better inputs or upgrade their products' quality to fulfill the standards of the importing country (Reyes, 2011; Bao and Qiu, 2012; Kamal and Zaki, 2018; Hu et al., 2019; Fontagné and Orefice, 2018). Maskus et al. (2005) find that TBTs raise the variable production cost by 0.06 and 0.13 percent, and raise the fixed cost by 4.7 percent, which are statistically significant increase.

Second, the increased trade costs induced by restrictive TBTs will impact firms' trade margins and pricing strategy. Specifically, firms' extensive margins are adversely affected by the rise of variable and fixed costs induced by restrictive TBTs. However, the effect on firms' intensive margin is ambiguous. A higher variable cost can reduce firms' export value to the TBT imposing

[12] $ln(value)$ denotes export value of firm f exporting product p to country c at time t. $ln(price)$ denotes export price of firm f exporting product p to country c at time t. $ln(size)$ denotes firm size proxied by export value. $ln(visibility)$ denotes firm visibility proxied by sector-county-year specific export value. $ln(Tariff + 1)$ denotes tariffs in logarithmic form between China and trading countries at product level. The five variables will be described in details in the following section.

country. But a higher fixed cost can drive less productive firms out of the market and reduce competition, thereby raising export value of more productive firms remaining in the market (Bernard et al., 2012). The effect on firms' export price is similarly ambiguous. The Melitz (2003) model demonstrates that a higher variable cost increases firms' export price. But more productive firms may charge a lower price, as they can comply to higher standards at lower cost (Bloom et al., 2010; Fontagné et al., 2015). But a higher fixed entry cost can drive less productive firms out of the market and reduce competition in foreign market. More productive firms remaining in the market can therefore charge a higher price.

In addition, the Melitz (2003) model emphasizes firm heterogeneity in productivity even within narrowly defined industries, and the heterogeneity is closely associated with firms' trade patterns. A more productive firm will have larger output and revenues, charge a lower price and earn higher profits than a less productive firm. Trade liberalization will induce more productive firms to enter the export market and simultaneously force the least productive firms to exit, leading to resources reallocations across firms within an industry.

Overall, the Melitz (2003) model predicts that restrictive TBTs have: (1) negative impact on firms' extensive margin, (2) both negative and positive impacts on firms' intensive margin and pricing strategy, (3) heterogeneous impacts across firms. The net effect of restrictive TBTs on firms' intensive margin and pricing strategy is theoretically ambiguous, it is therefore necessary to exploit this issue empirically.

4.2 Empirical Estimation

Against the aforementioned theoretical background, the aim of this section is to empirically estimate the impacts of restrictive TBTs on all firms' extensive margins as well as on incumbent firms' intensive margin and pricing strategy. There are two steps to set up the empirical specification: First, an ordinary least squares (OLS) approach is presented to illustrate the key variables and coefficients of interest. Second, an instrumental-variable (IV) strategy is employed to solve potential endogeneity issues.

Following Fontagné et al. (2015) and Fontagné and Orefice (2018), the point of departure is a simple OLS model,[13] regressing firm outcome variables on restrictive TBTs and firm characteristics:

[13] OLS model with high-dimensional fixed effect is estimated using the STATA command "reghdfe" provided by Correia (2016).

$$
\begin{aligned}
Y_{c,p,f,t} =& \beta_1 TBT_{c,p,t-1} + \beta_2 ln(size)_{f,t-1} + \beta_3 (TBT_{c,p,t-1} * ln(size)_{f,t-1}) \\
&+ \beta_4 ln(visi)_{f,HS2,p,t-1} + \beta_5 (TBT_{c,p,t-1} * ln(visi)_{f,HS2,p,t-1}) \\
&+ \beta_6 ln(Tariff + 1)_{c,p,t-1} + \nu_f + \nu_p + \nu_{k,c,t} + \epsilon_{c,p,f,t}.
\end{aligned} \tag{1}
$$

The firm outcome variables $Y_{c,p,f,t}$ are: (1) firm's export participation: a dummy equals 1 if firm f exports a positive value of product p to country c at time t, and 0 otherwise. (2) firm's exit probability: a dummy equals 1 if firm f does not export product p to country c at time t but did so at time $t-1$, and 0 if firm f does export product p to country c in both years. (3) export value (in logs) for firm f exporting product p to country c at time t. (4) firm's export price proxied by unit value.

The explanatory variables are restrictive TBTs, a group of firm characteristics and interaction terms between the two. Specifically, $TBT_{c,p,t-1}$ is TBT concerns raised by China against county c for product p at time $t-1$. It is measured by a TBT dummy or TBT duration. $ln(size)_{f,t-1}$ is firm size proxied by export value of firm f at $t-1$. The interaction term between firm size and TBTs is included in the regression. By doing so, I am able to link product-level TBTs and firm-level export to investigate the possible heterogeneous effect of TBTs across firm size. Based on trade theory, I expect that bigger firms, most likely more productive, should react differently to the restrictive TBTs. The coefficient of the interaction term will be the main focus of this specification. In addition, Fontagné et al. (2015) point out that large and more visible firms, in terms of export value in a certain sector and destination, may be targeted by partner countries by means of raising specific TBTs. If it were the case, highly visible firms should suffer more from the restrictive TBTs. To address this possible reverse causality, firm visibility ($ln(visi)_{f,HS2,p,t-1}$) proxied by sector(HS2)-county-year specific export value at $t-1$ and its interaction with TBTs are included.

As tariff and non-tariff measures can be either substitutes or complements, it is necessary to separate the tariff effect from the specification. Therefore the tariffs between China and country c of product p at time $t-1$ is included. Recall that the tariffs are provided in percentage points in the data set. I divide tariffs by 100 (denoted as Tariff in the equations) and calculate the logarithmic form $ln(Tariff+1)_{c,p,t-1}$, so that β_6 gives a direct estimates of the trade elasticity of tariffs.

All the explanatory variables are lagged by one year to address endogeneity bias. Indeed, the presence of a TBT concern and additional variables at $t-1$ are likely to be exogenous to firm's export decisions at t (Fontagné et al., 2015; Fontagné and Orefice, 2018; Fernandes et al., 2019; Kamal and Zaki, 2018; Kinzius et al., 2019).

A set of fixed effects are applied to absorb unobserved variations. Firm fixed effects (ν_f) are used to control for time-invariant firm-specific unobserved characteristics that might affect exporters' performance. Product fixed effects (ν_p) are used to control for time-invariant product-specific unobservable features. Sector(HS2)-destination-time fixed effects (ν_{kct}) are used to control for sector-destination-time level unobserved characteristics, such as exchange rate fluctuation, business cycle and shocks in the foreign markets. Given that both the dependent variables and main variables of interest (the interaction terms between TBTs and firm characteristics) vary at the firm-product-destination-time level, the standard errors are clustered at the product-destination-time level. ϵ_{cpft} is the error term.

Trade theory predicts that the impacts of TBTs are likely to be heterogeneous across firms. To test this prediction empirically, firm size and its interaction with TBTs are included. Moreover, the comprehensive data set enables me to further enrich the analysis by considering another two characteristics: firms' multi-destination status and ownership types.

First, the inclusion of firms' multi-destination status is inspired by Fontagné and Orefice (2018), who find that multi-destination exporters in France tend to exit the market under TBTs and look for new markets that have no TBTs (TBT-free markets) as a result of restrictive TBTs. To investigate whether such an effect holds for multi-destination exporters in China, I include a multi-destination dummy ($multi_{f,p,t-2}$), which equals 1 if the number of TBT-free destinations for each firm-product-year combination is above the 90^{th} percentile, and 0 otherwise. The threshold corresponds to 13 TBT-free destinations in the data set. The dummy is lagged by 2 years to circumvent potential reverse causality and ensure that its interaction with TBTs has clear indication.

Second, existing literature reveals that Chinese firms' productivity, financial access and export performance vary dramatically across ownership types (Manova et al., 2009; Song et al., 2011; Khandelwal et al., 2013; Tao et al., 2012; Brandt et al., 2012; Girma et al., 2009). It is therefore worthwhile to consider heterogeneity within ownership structure as a result of restrictive TBTs. Firms' ownership types are grouped into two categories: domestic-owned firms and foreign-owned firms. Domestic-owned firms include State-owned Enterprises (SOEs), collective and private enterprises. Foreign-owned firms contain 100% foreign-owned enterprises and joint ventures. I include a domestic dummy ($domestic_{f,t-1}$), which equals 1 if firm f is domestic at $t-1$, and 0 otherwise. Similar to previous exercise, the interaction term between domestic dummy and TBTs is also introduced.

Therefore, the OLS regressions with various firm characteristics (firm size, multi-destination status and ownership types) are given as following:

$$
\begin{aligned}
Y_{c,p,f,t} =& \beta_1 TBT_{c,p,t-1} + \beta_2 ln(size)_{f,t-1} + \beta_3 (TBT_{c,p,t-1} * ln(size)_{f,t-1}) \\
&+ \beta_4 ln(visi)_{f,HS2,p,t-1} + \beta_5 (TBT_{c,p,t-1} * ln(visi)_{f,HS2,p,t-1}) \\
&+ \beta_6 multi_{f,p,t-2} + \beta_7 (TBT_{c,p,t-1} * multi_{f,p,t-2}) \\
&+ \beta_8 ln(Tariff + 1)_{c,p,t-1} + \nu_f + \nu_p + \nu_{k,c,t} + \epsilon_{c,p,f,t},
\end{aligned} \tag{2}
$$

$$
\begin{aligned}
Y_{c,p,f,t} =& \beta_1 TBT_{c,p,t-1} + \beta_2 ln(size)_{f,t-1} + \beta_3 (TBT_{c,p,t-1} * ln(size)_{f,t-1}) \\
&+ \beta_4 ln(visi)_{f,HS2,p,t-1} + \beta_5 (TBT_{c,p,t-1} * ln(visi)_{f,HS2,p,t-1}) \\
&+ \beta_6 domestic_{f,t-1} + \beta_7 (TBT_{c,p,t-1} * domestic_{f,t-1}) \\
&+ \beta_8 ln(Tariff + 1)_{c,p,t-1} + \nu_f + \nu_p + \nu_{k,c,t} + \epsilon_{c,p,f,t}.
\end{aligned} \tag{3}
$$

Though the aforementioned OLS approach can largely control the reverse causality (by adding firm visibility and using lagged explanatory variables) and unobserved variables (by adding a rich set of fixed effects), one might still worry about potential endogeneity. For instance, unobservables might determine TBTs and firms' export decisions, or past changes in exporters' performance might determine TBTs.

To address these endogeneity concerns, an IV strategy is employed. I instrument for the TBT concerns raised by China ($TBT_{c,p,t-1}$) using the TBT concerns raised by any third country ($TBT_{j,p,t-1}$). Similarly, I instrument for the interaction terms between China-raised TBT concerns and firm characteristics ($TBT_{c,p,t-1} * Character_{f,t-1}$) using the interaction terms between third-country-raised TBT concerns and firm characteristics ($TBT_{j,p,t-1} * Character_{f,t-1}$). Note that firm characteristics includes firm size ($ln(size)_{f,t-1}$), multi-destination status ($multi_{f,p,t-2}$) and domestic ownership ($domestic_{f,t-1}$).

I argue that the third-country-raised TBT concerns and their interactions with firm characteristics constitute a valid set of instruments. First, instead of using TBT concerns raised by China over product p at time $t-1$, I use TBT concerns raised by any third country (neither China nor China's allies) over the same product p at the same time $t-1$. The rationale is that a TBT concern raised by a third country over product p at time $t-1$ is likely to be exogenous to Chinese firms' exporting behavior regarding to that product p at time t. Second, the third country should not be China's allies. If it were the case, China might collude with its ally to pursue protectionist policies by allowing its ally to raise TBT concerns that are actually in favor of Chinese firms. Therefore China's allies are excluded from the third country cohort to ensure the exogeneity of the instrument.

Similar to the previous exercise, the third-country-raised TBT concerns are measured by TBT dummy or TBT duration, and are further interacted with firm characteristics (firm size, multi-destination dummy and domestic dummy).

In the first stage, TBT concerns raised by third countries rather than China ($TBT_{j,p,t-1}$) and the interaction terms with firm characteristics ($TBT_{j,p,t-1} * Character_{f,t-1}$) are used to predict the instrumented TBT concerns ($\widehat{TBT}_{c,p,t-1}$) and instrumented interaction terms ($TBT_{c,p,t-1} \widehat{* Character}_{f,t-1}$) In the next section, first-stage coefficients and F-statistic are reported to check the relevance of the instruments.

In the second stage, I use the instrumented TBT concerns ($\widehat{TBT}_{c,p,t-1}$) and instrumented interaction terms ($TBT_{c,p,t-1} \widehat{* Character}_{f,t-1}$) predicted in the first stage to estimate the same set of firms' outcome variables. Note that firms' ownership types are rather stable over time, which implies that the domestic dummy varies largely at firm level. Thus, firm fixed effects are excluded from the IV regression when TBT concerns are interacted with domestic dummy, as illustrated in equation 6.

The second stage of the IV strategy consists of the following equations:

$$\begin{aligned} Y_{c,p,f,t} =& \beta_1 \widehat{TBT}_{c,p,t-1} + \beta_2 ln(size)_{f,t-1} + \beta_3 (TBT_{c,p,t-1} \widehat{* ln(size)}_{f,t-1}) \\ &+ \beta_4 ln(Tariff+1)_{c,p,t-1} + \nu_f + \nu_p + \nu_{k,c,t} + \epsilon_{c,p,f,t}, \end{aligned} \tag{4}$$

$$\begin{aligned} Y_{c,p,f,t} =& \beta_1 \widehat{TBT}_{c,p,t-1} + \beta_2 ln(size)_{f,t-1} + \beta_3 (TBT_{c,p,t-1} \widehat{* ln(size)}_{f,t-1}) \\ &+ \beta_4 multi_{f,p,t-2} + \beta_5 (TBT_{c,p,t-1} \widehat{* multi}_{f,p,t-2}) \\ &+ \beta_6 ln(Tariff+1)_{c,p,t-1} + \nu_f + \nu_p + \nu_{k,c,t} + \epsilon_{c,p,f,t}, \end{aligned} \tag{5}$$

$$\begin{aligned} Y_{c,p,f,t} =& \beta_1 \widehat{TBT}_{c,p,t-1} + \beta_2 ln(size)_{f,t-1} + \beta_3 (TBT_{c,p,t-1} \widehat{* ln(size)}_{f,t-1}) \\ &+ \beta_4 domestic_{f,t-1} + \beta_5 (TBT_{c,p,t-1} \widehat{* domestic}_{f,t-1}) \\ &+ \beta_6 ln(Tariff+1)_{c,p,t-1} + \nu_p + \nu_{k,c,t} + \epsilon_{c,p,f,t}. \end{aligned} \tag{6}$$

5 IV Estimation Results

This section presents the main findings regarding the impact of restrictive TBTs on firms' margins of trade: all firms' extensive margins (export participation and exit probability), in-

cumbent firms' intensive margins (export values) and pricing strategy. The results obtained from the IV strategy (equations 4, 5 and 6) are the main results of interest. While the results from the OLS strategy (equations 1, 2 and 3) are used as comparisons.

5.1 Extensive Margin of Trade

Table 2 reports the impact of restrictive TBTs on firms' export participation, estimated using equations 4, 5 and 6. First-stage coefficients and F statistics are presented to show the relevance of the instrument. Specifically, the coefficient of $IVTBT$ is estimated using TBT as a dependent variable in the first stage. Similarly, the coefficient of $IVTBT \times Size$ is estimated using $TBT \times Size$ as a dependent variable in the first stage.

Table 2: The Impact of Restrictive TBTs on Firms' Export Participation

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Second-stage Results						
IV TBT	-0.0054**	-0.0073***	-0.0184***	-0.0003	-0.0004**	-0.0013***
	(0.0021)	(0.0022)	(0.0029)	(0.0002)	(0.0002)	(0.0002)
IV TBT × Size	0.0011***	0.0011***	0.0021***	0.0001***	0.0001***	0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
IV TBT × Multi		0.0143***			0.0010***	
		(0.0021)			(0.0002)	
IV TBT × Domestic			0.0178***			0.0014***
			(0.0032)			(0.0002)
ln(tariff+1)	0.0013	0.0014	0.0028	0.0015	0.0015	0.0034
	(0.0102)	(0.0102)	(0.0099)	(0.0101)	(0.0101)	(0.0098)
First-stage Coefficients						
IV TBT	0.968***	0.968***	0.972***	0.983***	0.982***	0.985***
IV TBT × Size	0.990***	0.990***	0.991***	0.992***	0.993***	0.993***
IV TBT × Multi		0.988***			0.992***	
IV TBT × Domestic			0.979***			0.989***
First-stage F-stat	183217	183217	183217	183217	183217	183217
Observations	5,314,977	5,314,457	4,785,877	5,314,977	5,314,457	4,785,877
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	71375	71375	71375	71375	71375	71375

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Looking at the second stage of Table 2, the negative and significant coefficient of $IVTBT$ confirms the first theoretical prediction: restrictive TBTs have negative impact on firms' extensive margin. They reduce the probability of firms' export participation by approximately 0.5% (col-

umn(1)). The third theoretical prediction is also verified when the interaction terms between TBTs and firm characteristics are considered. In particular, the positive and significant coefficient of $IVTBT \times Size$ suggests that the probability of export participation increases with firm size. As firm size is measured as the deviation from the median, the effect can be decomposed to small firms (below median size) and large firms (above median size). Namely, the negative effect of TBTs on export participation is lower for large firms. Similarly, the probability of export participation increases by 1.4% (column (2)) when the firms are multi-destination exporters and by 1.8% (column (3)) when the firms are domestic-owned exporters. Similar results are obtained when TBTs are measured by TBT duration in column (4)-(6). In short, TBTs have on average a negative effect on firms' export participation, but this negative effect is dampened for large, multi-destination and domestic-owned firms.

Table 3 reports the impact of restrictive TBTs on firms' exit probability. The second-stage results show that, in general, restrictive TBTs increase the probability of exit of Chinese exporters (by 1.9%, an average coefficients in column (1)-(3)). The coefficient of the interaction term between firm size and TBTs is negative, implying that big firms are less likely to exit than small firms. This finding is in line with the large literature on heterogeneous firms. Further, negative coefficients are found on the interaction terms between TBTs and multi-destination dummy as well as domestic dummy. The probability of exit decreases by 0.99% (column (2)) when the firms are multi-destination exporters and by 2.2% (column (3)) when the firms are domestic-owned exporters. Similar results are obtained when TBTs are measured by TBT duration in column (4)-(6). In short, restrictive TBTs trigger a higher exit probability but this negative effect is mitigated for large, multi-destination and domestic-owned firms.

Table 3: The Impact of Restrictive TBTs on Firms' Exit Probability

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Second-stage Results						
IV TBT	0.0148***	0.0160***	0.0266***	0.0010***	0.0011***	0.0019***
	(0.0026)	(0.0026)	(0.0030)	(0.0002)	(0.0002)	(0.0002)
IV TBT × Size	-0.0025***	-0.0024***	-0.0020***	-0.0002***	-0.0002***	-0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
IV TBT × Multi		-0.0099***			-0.0006***	
		(0.0025)			(0.0002)	
IV TBT × Domestic			-0.0222***			-0.0017***
			(0.0027)			(0.0002)
ln(tariff+1)	0.0013	0.0012	-0.0032	0.0006	0.0006	-0.0040
	(0.0117)	(0.0117)	(0.0101)	(0.0117)	(0.0117)	(0.0101)
First-stage Coefficients						
IV TBT	0.949***	0.949***	0.957***	0.973***	0.973***	0.978***
IV TBT × Size	0.998***	0.998***	0.996***	0.997***	0.997***	0.997***
IV TBT × Multi		0.982***			0.990***	
IV TBT × Domestic			0.967***			0.983***
First-stage F-stat	99550	99550	99550	99550	99550	99550
Observations	2,144,810	2,144,701	2,063,220	2,144,810	2,144,701	2,063,220
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	60650	60650	60650	60650	60650	60650

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Both Table 2 and Table 3 show a null effect of tariffs. It is not surprising, as tariff means a rise of variable cost and affect trade mainly through the intensive margins rather than extensive margins (Fontagné and Orefice, 2018). Similar findings are confirmed by Reyes (2011), who finds that tariffs do not significantly affect firms' extensive margin.

One interesting feature is found on multi-destination firms. The behavior of multi-destination exporters in China is in sharp contrast to the ones in France. Fontagné and Orefice (2018) find that the driving-out effect of TBTs on firms' extensive margins is stronger for multi-destination firms in France, who exit the TBT-imposed markets and divert trade to TBT-free markets. They state that this is due to low diversion cost of multi-destination firms, i.e. the cost of

diverting to existing (fixed entry cost already paid) or new (need to pay fixed entry cost) TBT-free markets is lower than the cost of complying with restrictive TBTs. So the strategy for multi-destination firms in France is simply to exit the TBT-imposed markets and relocate towards TBT-free markets.

On the contrary, Chinese multi-destination firms stick to the TBT-imposed markets and continue exporting. This may due to two reasons. One reason can be that the "high productivity" feature dominates the "low diversion cost" feature of multi-destination firms in China.[14] Multi-destination exporters, being more productive, are able to overcome the higher variable and fixed costs induced by restrictive TBTs, thereby staying in the export markets, enjoying reduced competition and gaining larger market share. Another reason can be due to the feature of TBT-imposed markets. Most of the TBT concerns raised by China are targeting the US, the EU and South Korea. Those destinations, though impose restrictive TBTs, are all important trading partners of China. The benefits (large sale, high demand, stable institutions, etc.) of staying in the TBT-imposed markets can compensate or even outweigh the cost of fulfilling the restrictive TBTs. Either way can explain the different behavior between French and Chinese multi-destination firms. This empirical evidence contributes to the literature showing that developing and developed country could be affected by the same TBTs differently (Bao and Qiu, 2012).

Overall, the effects of restrictive TBTs on firms' extensive margins (Tables 2 and 3) are in line with the Melitz (2003) model. The rise of variable and fixed costs of trade induced by restrictive TBTs adversely affect firms' extensive margins. Restrictive TBTs increase the productivity cut-off below which firms exit. Least productive firms are prevented from export participation and forced to exit. Whereas big players, with respect to productivity, size, the number of export destinations and ownership types, are less affected by restrictive TBTs. Resources are reallocated from low-productive firms towards high-productive ones.

5.2 Intensive Margin of Trade

Table 4 reports the impact of restrictive TBTs on the value exported by incumbent firms (firms present in years $t-1$ and t). The first-stage coefficients and F statistics confirm the relevance of the instrument.

A negative effect of tariffs is revealed in the second stage, which supports the findings in Tables 2 and 3. Tariffs, as a type of extra variable cost, affect mainly the intensive margins instead

[14] Heterogeneous-firm models predict a positive relationship between a firm's productivity and the number of its export destinations (Melitz, 2003; Bernard et al., 2011). This prediction is empirically verified by Bernard et al. (2011) and Wagner (2012) using data on exporting firms in the U.S. and Germany respectively.

of extensive margins. A ten percentage points increase in tariffs reduces export values by an average of 1.3% (column(1)-(3)). The findings are in line with Fontagné et al. (2015), who find that a ten percentage points increase in tariffs reduces export values by 1.4%, and with Fontagné and Orefice (2018) by 1.5%. Note that tariff is included as a control variable and its coefficients have to be interpreted with caution. As tariffs are normally defined at 8-, 10- or even 12-digit product level, the analysis on the 4-digit level may suffer from aggregation bias, leading to an underestimation of the tariff effect (Felbermayr et al., 2019; Fontagné et al., 2015; Fontagné and Orefice, 2018).

The negative and significant coefficients of $IVTBT$ imply that restrictive TBTs have a negative impact on the intensive margins of incumbent firms in general. Firms staying in the market lose export values by an average of 4% (column(2)-(3)). The positive and significant coefficients of interaction terms between TBTs and firm characteristics indicate heterogeneous impacts of TBTs across firms. Large, multi-destination or domestic-owned firms are less affected by restrictive TBTs. Large firms staying in the market benefit from reduced competition and gain export values by an average of 1.26% (column(1)-(3)). Multi-destination and domestic-owned firms gain export values by 11.77% (column(2)) and 7.94% (column(3)) respectively. Similar conclusion can be drawn from the results of TBT duration in column(4)-(6).

Firm heterogeneity theory predicts that restrictive TBTs have both negative and positive impact on firms' intensive margin. The empirical results show that on average the negative impact dominates the positive one, the net effect of TBTs is negative for incumbent firms. Moreover, empirical evidence is in support of the prediction of heterogeneous impacts across firms. Exporters with higher productivity suffer less from the restrictive TBTs. Specifically, large, multi-destination and domestic-owned firms are able to overcome the variable and fixed costs induced by restrictive TBTs, continue staying in the foreign market, benefit from reduced competition and gain a larger export value.

Table 4: The Impact of Restrictive TBTs on Firms' Export Value

	TBT Dummy			TBT Duration		
	(1)	(2)	(3)	(4)	(5)	(6)
Second-stage Results						
IV TBT	-0.0144	-0.0293**	-0.0538***	-0.0020*	-0.0032***	-0.0042***
	(0.0141)	(0.0144)	(0.0169)	(0.0012)	(0.0012)	(0.0014)
IV TBT × Size	0.0114***	0.0101***	0.0164***	0.0009***	0.0008***	0.0012***
	(0.0016)	(0.0016)	(0.0018)	(0.0001)	(0.0001)	(0.0001)
IV TBT × Multi		0.1177***			0.0092***	
		(0.0178)			(0.0014)	
IV TBT × Domestic			0.0794***			0.0058***
			(0.0146)			(0.0011)
ln(tariff+1)	-0.1271*	-0.1259*	-0.1476*	-0.1267*	-0.1256*	-0.1470*
	(0.0753)	(0.0753)	(0.0768)	(0.0753)	(0.0753)	(0.0768)
First-stage Coefficients						
IV TBT	0.949***	0.949***	0.957***	0.974***	0.974***	0.978***
IV TBT × Size	0.998***	0.998***	0.996***	0.997***	0.997***	0.997***
IV TBT × Multi		0.982***			0.990***	
IV TBT × Domestic			0.967***			0.984***
First-stage F-stat	99312	99312	99312	99312	99312	99312
Observations	1,732,342	1,732,280	1,666,994	1,732,342	1,732,280	1,666,994
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	57362	57362	57362	57362	57362	57362

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

5.3 Pricing Strategy

Table 5 reports the impact of restrictive TBTs on the pricing strategy of incumbent firms (firms present in years $t-1$ and t). The price is approximated by the unit value. The coefficient of $IVTBT$ is small, suggesting an average null effect of restrictive TBTs on the export price of incumbent firms. This is not surprising, as trade theory predicts both negative and positive impacts of TBTs on firms' pricing strategy. It turns out that neither side dominates empirically. The coefficient of interaction term between TBTs and firm size is positive and significant, meaning that large firms increase the export price by an average of 0.7% (column(1)-(3))

when facing restrictive TBTs. Similarly, multi-destination firms increase their export price by 6.7% (column(2)). The price increase of large or multi-destination firms indicates that more productive firms tend to pass-through part of the cost to their export price when facing higher cost induced by TBTs. The coefficient on the interaction term between TBTs and domestic dummy is, however, negative and significant, meaning that domestic-owned firms reduce their export price by 3.8% (column(3)) due to restrictive TBTs. Comparable results are presented using TBT duration in column(4)-(6).

Contrary pricing strategies are found among large or multi-destination firms and domestic-owned firms. It can be due to the different features of those firms. On the one hand, large or multi-destination firms belong to the highly productive group (Melitz, 2003; Mayer and Ottaviano, 2008; Bernard et al., 2011; Wagner, 2012). In the model of heterogeneous firms, more productive firms are able to cope with higher variable and fixed costs of restrictive TBTs. They enter the international markets and simultaneously drive the least productive firms out, thereby enjoying a reduced competition and larger market share. Besides, those firms have a lower demand elasticity, it is possible for them to pass-through part of the increased cost to the customers by charging a higher export price. On the other hand, domestic-owned firms are less productive than the other two. Their demand elasticity is higher than for more efficient firms. It is more likely for them to reduce the price by less then the cost, in order to survive in the international competition and capture some market share (Manova and Zhang, 2012).

Firm heterogeneity theory predicts both positive and negative impact of TBTs on firms' pricing strategy. In fact, neither side dominates the final effect, as an average null effect is obtained from the empirical results. In addition, empirical evidence is in line with the prediction of heterogeneous impacts across firms. Given the same TBTs, the most productive firms (large and multi-destination firms) charge a higher price, whereas the less productive ones (domestic-owned firms) charge a lower price.

Table 5: The Impact of Restrictive TBTs on Firms' Pricing Strategy

	TBT Dummy			TBT Duration		
	(1)	(2)	(3)	(4)	(5)	(6)
Second-stage Results						
IV TBT	0.0113	0.0027	0.0123	-0.0001	-0.0007	0.0004
	(0.0104)	(0.0106)	(0.0139)	(0.0008)	(0.0008)	(0.0011)
IV TBT × Size	0.0060***	0.0053***	0.0099***	0.0005***	0.0004***	0.0007***
	(0.0009)	(0.0009)	(0.0012)	(0.0001)	(0.0001)	(0.0001)
IV TBT × Multi		0.0675***			0.0049***	
		(0.0080)			(0.0006)	
IV TBT × Domestic			-0.0375***			-0.0032***
			(0.0103)			(0.0008)
ln(tariff+1)	0.0171	0.0178	0.0411	0.0166	0.0171	0.0407
	(0.0410)	(0.0410)	(0.0502)	(0.0411)	(0.0411)	(0.0503)
First-stage Coefficients						
IV TBT	0.949***	0.949***	0.957***	0.974***	0.974***	0.978***
IV TBT × Size	0.998***	0.998***	0.996***	0.997***	0.997***	0.997***
IV TBT × Multi		0.982***			0.990***	
IV TBT × Domestic			0.967***			0.984***
First-stage F-stat	99569	99569	99569	99569	99569	99569
Observations	1,729,202	1,729,140	1,664,038	1,729,202	1,729,140	1,664,038
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	57331	57331	57331	57331	57331	57331

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

To wrap up, the IV results support the theoretical predictions and reveal the heterogeneous impacts of restrictive TBTs across firms. Restrictive TBTs have a negative average impact on firms' extensive and intensive margins: firms are deterred from export participation and suffer higher exit rates; incumbent firms face a loss of export values. However, more "able" firms, that are larger, have more export destinations or domestic ownership, can dampen the negative impact of restrictive TBTs on firms' export decisions. They are able to overcome the higher variable and fixed costs induced by restrictive TBTs, survive in the international markets, enjoy reduced competition and gain higher export values. Lastly, a null average effect of TBTs on firms' pricing strategy is discovered. More specifically, given the same restrictive TBTs, large

and multi-destination firms (most productive ones) tend to pass-through part of the increased cost to their consumers by charging a higher price, while domestic-owned firms (less productive ones) tend to decrease their export price by less than cost.

6 Extensions and Robustness Checks

6.1 Alternative Estimation: OLS

The previous section discusses the main results using IV estimation. This section presents a number of robustness checks using OLS estimation based on equations 1, 2 and 3. The key results are summarized in Table 6 and details are reported in Tables 9 - 12 in the Appendix.

First, panel A and panel B show that the impact of restrictive TBTs on firms' extensive margins remain negative and significant, with the effect being attenuated for large, multi-destination and domestic-owned firms. Interestingly, the coefficients on the TBTs and interaction terms using OLS estimation are somewhat smaller than the main results, suggesting that the negative effect on firms' extensive margins are underestimated in OLS.

Interesting results are found for firms' visibility. Recall that firms' visibility and its interaction with TBTs are added to control for reverse causality. If a firm were highly visible, in the sense that its export value is large in a sector-destination-year combination, it could be targeted by the importing country via purposed TBTs. If it were the case, a reverse causality should arise and a significant (positive or negative depending on the firm outcome variables) coefficient on the interaction term between visibility and TBTs is expected. Luckily, the estimation on export participation (panel A) does not suffer from reverse causality. The coefficient on the interaction term between visibility and TBTs is insignificant using TBT dummy (column (1)-(3)) and positive using TBT duration (column (4)-(6)), which means that highly visible firms are not purposely targeted. Otherwise those firms should be prevented from export participation - negative and significant coefficient. However, estimation on exit probability (panel B) suffers from an endogeneity problem, as the coefficient between visibility and TBT dummy is positive and significant (column (1)-(3)), implying that highly visible firms are strongly affected by TBTs and tend to exit the foreign market. In this case, it is especially necessary to utilize IV strategy as the main method to settle a clean causal relationship.

Second, panel C of Table 6 shows the impact of restrictive TBTs on incumbent firms' export values. The OLS estimation fails to capture the negative average impact of TBTs, as the coefficient on TBT is insignificant (except for column(5)-(6)). However, it indeed captures the heterogeneous impacts of restrictive TBTs across firms. Same as the IV results, firms with

larger size, more export destinations or domestic ownership have higher export value when facing restrictive TBTs. These findings are in line with the theoretical predictions. Moreover, the positive and significant coefficient between visibility and TBTs is favorable, as it indicates that highly-visible firms are not targeted more by restrictive TBTs, thereby suggesting that the OLS estimation does not suffer from endogeneity bias.

Third, panel D of Table 6 shows the impact of restrictive TBTs on incumbent firms' pricing strategy. Crucially, the OLS estimation fails to capture the key feature of the domestic-owned firms. The main results using the IV strategy (Table 5) find that domestic-owned firms tend to reduce the export price when facing restrictive TBTs. Thus a negative and significant coefficient on the interaction term between domestic dummy and TBTs is expected. However, the OLS results in Table 6 show that the coefficient is insignificant using TBT dummy and positive using TBT duration, indicating an estimation bias of OLS. In addition, the OLS estimation suffers from endogeneity as a significant coefficient on the interaction term between visibility and TBT duration (column (4)-(6)) is discovered.

Table 6: Alternative Estimation: OLS

	TBT Dummy			TBT Duration		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Export Participation						
TBT	-0.0044**	-0.0058***	-0.0123***	-0.0003*	-0.0005***	-0.0010***
	(0.0020)	(0.0020)	(0.0027)	(0.0002)	(0.0002)	(0.0002)
TBT × Size	0.0006**	0.0005*	0.0013***	0.0001***	0.0001***	0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
TBT × Visibility	0.0605	0.0488	0.0165	0.0220***	0.0206***	0.0184***
	(0.0580)	(0.0577)	(0.0582)	(0.0058)	(0.0058)	(0.0058)
TBT × Multi		0.0116***			0.0009***	
		(0.0020)			(0.0002)	
TBT × Domestic			0.0133***			0.0010***
			(0.0031)			(0.0002)
Panel B: Exit Probability						
TBT	0.0113***	0.0123***	0.0187***	0.0010***	0.0010***	0.0015***
	(0.0022)	(0.0023)	(0.0027)	(0.0002)	(0.0002)	(0.0002)
TBT × Size	-0.0025***	-0.0024***	-0.0027***	-0.0002***	-0.0002***	-0.0002***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
TBT × Visibility	0.0706*	0.0771*	0.0810*	0.0029	0.0035	0.0039
	(0.0427)	(0.0426)	(0.0428)	(0.0040)	(0.0040)	(0.0040)
TBT × Multi		-0.0087***			-0.0005***	
		(0.0024)			(0.0002)	
TBT × Domestic			-0.0123***			-0.0009***
			(0.0024)			(0.0002)
Panel C: Export Value						
TBT	-0.0051	-0.0161	-0.0242	-0.0018	-0.0027**	-0.0045***
	(0.0134)	(0.0135)	(0.0154)	(0.0012)	(0.0012)	(0.0013)
TBT × Size	0.0087***	0.0076***	0.0084***	0.0006***	0.0005***	0.0006***
	(0.0015)	(0.0015)	(0.0015)	(0.0001)	(0.0001)	(0.0001)
TBT × Visibility	2.2363***	2.1525***	2.0894***	0.3398***	0.3306***	0.3261***
	(0.5002)	(0.4993)	(0.4993)	(0.0515)	(0.0514)	(0.0514)
TBT × Multi		0.0987***			0.0074***	
		(0.0168)			(0.0014)	
TBT × Domestic			0.0416***			0.0062***
			(0.0159)			(0.0013)
Panel D: Pricing Strategy						
TBT	-0.0005	-0.0074	0.0017	-0.0003	-0.0009	-0.0010
	(0.0090)	(0.0091)	(0.0093)	(0.0008)	(0.0008)	(0.0008)
TBT × Size	0.0062***	0.0055***	0.0054***	0.0005***	0.0004***	0.0004***
	(0.0009)	(0.0009)	(0.0009)	(0.0001)	(0.0001)	(0.0001)
TBT × Visibility	0.2395	0.1873	0.2363	0.0355**	0.0295*	0.0345**
	(0.1546)	(0.1552)	(0.1546)	(0.0172)	(0.0173)	(0.0172)
TBT × Multi		0.0621***			0.0048***	
		(0.0077)			(0.0006)	
TBT × Domestic			-0.0053			0.0015**
			(0.0091)			(0.0008)

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. For details see Tables 9 - 12 in the Appendix.

6.2 Decomposition of Firm Characteristics

Table 7 reports a number of heterogeneity when firm characteristics are decomposed. Each panel shows the coefficients on the interaction terms between restrictive TBTs and one type of firm characteristics that is decomposed. Restrictive TBTs are measured by TBT dummy (column(1)-(4)) or TBT duration (column(5)-(8)). In each case, four outcome variables are considered: firms' export participation, exit probability, export value and pricing strategy.

Small vs. Large Firms First, Panel A of Table 7 decomposes firm size into small (below the median) and large (above the median) firms. IV regression is implemented for each of the size category based on equation 4. Columns (1) and (2) of Panel A estimate firms' extensive margins. I find that compared to small firms, large firms can strongly mitigate the negative impact of restrictive TBTs on firms' extensive margins. Column (3) shows that the effects of restrictive TBTs on export value differ across firm size: small firms have lower, whereas large firms have higher export values. Price effects reported in Column(4) are insignificant for small firms while positive and significant for large firms, indicating that large firms charge a higher price. Similar patterns are found using TBT duration to measure restrictive TBTs in Columns (5)-(8). The results in Panel A are in line with the main IV results: the negative impacts of restrictive TBTs decline with firm size. Contrary to small firms, large firms are able to stay in the market, increase export value and charge a higher price.

Based on the literature observing the correlation between firm size and productivity, the results in Panel A imply that given the same restrictive TBTs, more productive firms (larger firms) increase export participation and expand export value relative to less productive ones (smaller ones), they also pass-through part of the cost to consumers by charging a higher price.

The 95^{th} vs. 85^{th} Percentile of Multi-destination Dummy Second, Panel B changes the measure of the multi-destination dummy. In the main specification, the multi-destination dummy equals 1 if the number of TBT-free destinations served by a firm-product combination at $t-2$ is above the 90^{th} percentile. As a robustness check, I change the thresholds to both above and below the main setting: the 95^{th} and 85^{th} percentiles are used as alternative thresholds to define the multi-destination dummy. The 95^{th} percentile is stricter than the other one, implying that the defined multi-destination firms export to "exceptionally many" countries, they can be seen as *super* multi-destination firms. An IV regression is implemented for each of the measure based on equation 5. The results reported in Panel B suggest that the main IV results remain robust to different measures of multi-destination dummy. If anything, the magnitude of the coefficient is larger for *super* multi-destination firms (above 95^{th} percentile). Similar patterns

are found using TBT duration in Column (5)-(8).

According to the literature observing the correlation between firms' productivity and the number of destinations, the results in Panel B imply that given the same restrictive TBTs, *super* multi-destination firms, being more productive, have a higher probability to participate in the export market, a lower probability to exit, and a larger increase in export value and price.

State- vs. Private-owned Firms Third, Panel C decomposes domestic-owned firms into two categories: State-owned enterprises (SOEs) and private-owned enterprises (private).[15] An IV regression is implemented for each of the category based on equation 6. In line with the main results, Columns (1)-(3) show that domestic-owned firms, both SOEs and private ones, suffer less from the negative impact of restrictive TBTs on firms' extensive and intensive margins. Both types of firms participate in the export market and increase their export value. Interestingly, however, price effects reported in Column(4) is significant and *negative* for SOEs whereas *positive* for private firms, indicating that the main results (Table 5) of a negative price effect on domestic-owned firms is mainly driven by SOEs rather than private firms. Similar patterns are found using TBT duration in Column (5)-(8).

A growing body of literature reveals that SOEs in China are often inefficient and unproductive, while at the same time, they receive more support from the government and have better financial access (Khandelwal et al., 2013; Tao et al., 2012; Song et al., 2011). Against this background, the results in Panel C indicate that given the same TBTs, more productive firms (private firms) pass-through part of the increased cost to their export price, whereas less productive firms (SOEs) reduce their export price by less than cost to remain competitive in the international market. This indication in turn confirms my explanation on the different pricing strategies in section 5.

[15] private-owned firms consist of collective-owned and private-owned ones. Collective-owned firms, owned by a certain number of individuals, are also a type of private ownership.

Table 7: Decomposition of Firm Characteristics (Second-stage IV)

	TBT Dummy				TBT Duration			
	(1) Export Participation	(2) Exit Probability	(3) Export Value	(4) Pricing Strategy	(5) Export Participation	(6) Exit Probability	(7) Export Value	(8) Pricing Strategy
Panel A: Firm Size								
IV TBT × Small firms	-0.0005	-0.0011	-0.0193**	-0.0040	-0.0000	-0.0000	-0.0016***	-0.0003
	(0.0004)	(0.0013)	(0.0080)	(0.0042)	(0.0000)	(0.0001)	(0.0006)	(0.0003)
IV TBT × Large firms	0.0036***	-0.0018***	0.0120***	0.0051***	0.0003***	-0.0001***	0.0009***	0.0004***
	(0.0003)	(0.0003)	(0.0018)	(0.0010)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Panel B: Multi-destination Dummy								
IV TBT × Multi (95th percentile)	0.0224***	-0.0165***	0.1082***	0.0681***	0.0016***	-0.0011***	0.0083***	0.0048***
	(0.0027)	(0.0028)	(0.0216)	(0.0100)	(0.0002)	(0.0002)	(0.0017)	(0.0008)
IV TBT × Multi (85th percentile)	0.0116***	-0.0068***	0.0681***	0.0534***	0.0009***	-0.0004**	0.0050***	0.0039***
	(0.0019)	(0.0022)	(0.0156)	(0.0071)	(0.0001)	(0.0002)	(0.0012)	(0.0005)
Panel C: Domestic Dummy								
IV TBT × SOEs	0.0053**	-0.0148***	0.0611***	-0.1611***	0.0006***	-0.0012***	0.0043***	-0.0128***
	(0.0026)	(0.0025)	(0.0149)	(0.0113)	(0.0002)	(0.0002)	(0.0012)	(0.0009)
IV TBT × Private	0.0148***	-0.0143***	0.0425***	0.0818***	0.0010***	-0.0011***	0.0032***	0.0060***
	(0.0025)	(0.0030)	(0.0151)	(0.0107)	(0.0002)	(0.0002)	(0.0012)	(0.0008)

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects in panel A and B, product and sector(HS2)-destination-time fixed effects in panel C. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (4) and by TBT duration in column (5) to (8). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

6.3 Exclusion of Big Firms

Endogeneity bias may arise if big firms are powerful enough to push government to raise TBT concerns in favor of their needs. I therefore exclude big firms to address the potential endogeneity. Big firms are defined as those whose export value of product-destination combination is above the 99^{th} percentile. They account for 16% of the total firms. Main results are reported in Table 8. Panel A and panel B show that the impact of restrictive TBTs on firms' extensive margins remain negative and significant, with the effect being compensated for large, multi-destination and domestic-owned firms. Panel C reveals that excluding big firms fails to capture the negative average impact of restrictive TBTs on export value, but it is able to capture the heterogeneous impacts of TBTs across firms. Panel D reports the impact of restrictive TBTs on incumbent firms' pricing strategy. The results show a null average effect on price and heterogeneous impacts across firms, which is in line with the main findings.

Table 8: Exclusion of Big Firms (Second-stage IV)

	TBT Dummy			TBT Duration		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Export Participation						
IV TBT	-0.0041**	-0.0060***	-0.0172***	-0.0002	-0.0003*	-0.0012***
	(0.0021)	(0.0021)	(0.0029)	(0.0002)	(0.0002)	(0.0002)
IV TBT × Size	0.0011***	0.0011***	0.0020***	0.0001***	0.0001***	0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
IV TBT × Multi		0.0140***			0.0010***	
		(0.0021)			(0.0002)	
IV TBT × Domestic			0.0178***			0.0015***
			(0.0033)			(0.0002)
First-stage F-stat	188005	188005	188005	188005	188005	188005
Panel B: Exit Probability						
IV TBT	0.0142***	0.0153***	0.0254***	0.0010***	0.0010***	0.0018***
	(0.0026)	(0.0026)	(0.0030)	(0.0002)	(0.0002)	(0.0002)
IV TBT × Size	-0.0026***	-0.0025***	-0.0019***	-0.0002***	-0.0002***	-0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
IV TBT × Multi		-0.0097***			-0.0006***	
		(0.0025)			(0.0002)	
IV TBT × Domestic			-0.0225***			-0.0018***
			(0.0028)			(0.0002)
First-stage F-stat	102456	102456	102456	102456	102456	102456
Panel C: Export Value						
IV TBT	0.0088	-0.0056	0.0085	0.0001	-0.0010	0.0008
	(0.0128)	(0.0131)	(0.0151)	(0.0011)	(0.0011)	(0.0012)
IV TBT × Size	0.0139***	0.0127***	0.0108***	0.0011***	0.0010***	0.0008***
	(0.0014)	(0.0014)	(0.0015)	(0.0001)	(0.0001)	(0.0001)
IV TBT × Multi		0.1127***			0.0087***	
		(0.0160)			(0.0012)	
IV TBT × Domestic			0.0785***			0.0063***
			(0.0128)			(0.0010)
First-stage F-stat	102887	102887	102887	102887	102887	102887
Panel D: Pricing Strategy						
IV TBT	0.0123	0.0036	0.0140	0.0002	-0.0004	0.0007
	(0.0104)	(0.0105)	(0.0136)	(0.0008)	(0.0008)	(0.0011)
IV TBT × Size	0.0062***	0.0055***	0.0083***	0.0005***	0.0005***	0.0006***
	(0.0009)	(0.0009)	(0.0012)	(0.0001)	(0.0001)	(0.0001)
IV TBT × Multi		0.0679***			0.0050***	
		(0.0082)			(0.0006)	
IV TBT × Domestic			-0.0237**			-0.0020**
			(0.0102)			(0.0008)
First-stage F-stat	103169	103169	103169	103169	103169	103169

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. For details see Tables 13 - 16 in the Appendix.

7 Conclusion

This paper investigates the impact of restrictive TBTs on firms' export decisions, with heterogeneous trade effects across firms. A rich set of firms' outcome variables is exploited: firms' decisions on whether participate or exit the product-destination market (extensive margins), firms' export values on a product-destination market (intensive margins) and firms' pricing strategy. Crucially, the analysis accounts for the heterogeneous effects of restrictive TBTs on a number of firm characteristics: firm size, multi-destination status and ownership types.

The empirical results are estimated using an IV approach. First, the empirical results on firms' extensive margins are in line with theoretical predictions. Restrictive TBTs deter firms from export participation and induce higher exit rate. These negative effects are mitigated for large, multi-destination and domestic-owned firms. Interestingly, the behavior of multi-destination firms in China is in sharp contrast to the ones in France. Instead of diverting trade to TBT-free markets, multi-destination firms in China stick to the TBT-imposed markets and continue exporting.

Second, for the intensive margins, trade theory predicts both negative and positive impacts of restrictive TBTs. The empirical results show that the negative impact dominates. In line with the prediction of heterogeneous impacts across firms, I find that large, multi-destination and domestic-owned firms that remain in the market can benefit from reduced competition and gain larger export values.

Lastly, for the pricing strategy, trade theory predicts both negative and positive impacts, while the empirical results show that neither side dominates, as an average null effect is discovered. In line with the prediction of heterogeneous impacts, I find that the price strategies vary across firms. For firms remaining in the market, the most productive firms (large and multi-destination ones) charge a higher price, whereas the less productive firms (domestic-owned ones) charge a lower price. By dividing domestic-owned firms into state-owned and private-owned ones, I further show that the price-decreasing effect is mainly driven by state-owned firms.

Overall, I find that the imposition of restrictive TBTs adversely affect firms' intensive and extensive margins, but not significantly affect firms' price on average. More importantly, firms of different types, in the sense of firm size, number of destination markets and ownership types, are affected differently. Given the same restrictive TBTs, firms with higher productivity suffer less, while firms with lower productivity are more vulnerable to the trade barriers.

This paper contributes to the large literature on firm heterogeneity and the role of NTMs on trade, and also provides important political implications. Policy makers should consider the heterogeneous effects of trade agreements, which shifts gains from trade across firms and poten-

tially distorting competition. By taking the performance and benefits (or costs) of individual firm into account, policy makers can better enhance social welfare in trade negotiations.

References

Bao, Xiaohua and Larry D. Qiu (2010), "Do technical barriers to trade promote or restrict trade? Evidence from China." *Asia-Pacific Journal of Accounting and Economics* 17 (3), 253–278.

Bao, Xiaohua and Larry D. Qiu (2012), "How Do Technical Barriers to Trade Influence Trade?" *Review of International Economics* 20 (4), 691–706.

Beestermöller, Matthias, Anne Célia Disdier, and Lionel Fontagné (2018), "Impact of European food safety border inspections on agri-food exports: Evidence from Chinese firms." *China Economic Review* 48, 66–82.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott (2012), "The Empirics of Firm Heterogeneity and International Trade." *Annual Review of Economics* 4 (1), 283–313.

Bernard, Andrew B., Stephen J. Redding, and Peter K. Schott (2011), "Multiproduct firms and trade liberalization." *Quarterly Journal of Economics* 126 (3), 1271–1318.

Bloom, Nicholas, Christos Genakos, Ralf Martin, and Raffaella Sadun (2010), "Modern Management: Good for the Environment or Just Hot Air?" *Economic Journal* 120 (544) (May 2010), 551–572.

Brandt, Loren, Johannes Van Biesebroeck, and Yifan Zhang (2012), "Creative accounting or creative destruction? Firm-level productivity growth in Chinese manufacturing." *Journal of Development Economics* 97 (2), 339–351.

Bratt, Michael (2017), "Estimating the bilateral impact of nontariff measures on trade." *Review of International Economics* 25 (5) (Nov. 2017), 1105–1129.

Chaney, Thomas (2008), "Distorted Gravity: The Intensive and Extensive Margins of International Trade." *American Economic Review* 98 (4), 1707–1721.

Chen, Maggie Xiaoyang, Tsunehiro Otsuki, and John S Wilson (2006), "Do standards matter for export success." *WPS3809 World Bank*, 1–26.

Chen, Maggie Xiaoyang, John S. Wilson, and Tsunehiro Otsuki (2008), "Standards and export decisions: Firm-level evidence from developing countries." *Journal of International Trade and Economic Development* 17 (4), 501–523.

Correia, Sergio (2016), *REGHDFE: Stata module to perform linear or instrumental-variable regression absorbing any number of high-dimensional fixed effects.*

Crivelli, Pramila and Jasmin Groeschl (2016), "The Impact of Sanitary and Phytosanitary Measures on Market Entry and Trade Flows." *World Economy* 39 (3), 444–473.

Disdier, Anne Célia, Lionel Fontagné, and Mondher Mimouni (2008), "The impact of regulations on agricultural trade: Evidence from the SPS and TBT agreements." *American Journal of Agricultural Economics* 90 (2), 336–350.

Felbermayr, Gabriel, Feodora Teti, and Erdal Yalcin (2019), "Rules of origin and the profitability of trade deflection." *Journal of International Economics* 121, 1–14.

Fernandes, Ana M, Esteban Ferro, and John S Wilson (2019), "Product Standards and Firms' Export Decisions." *The World Bank Economic Review* 33 (2), 353–374.

Fontagné, Lionel, Mondher Mimouni, and Jean-Michel Pasteels (2005), "Estimating the Impact of Environmental SPS and TBT on International Trade." *Integration and Trade Journal* (22), 7–37.

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

Fontagné, Lionel, Gianluca Orefice, Roberta Piermartini, and Nadia Rocha (2015), "Product standards and margins of trade: Firm-level evidence." *Journal of International Economics* 97 (1), 29–44.

Girma, Sourafel, Yundan Gong, Holger Görg, and Zhihong Yu (2009), "Can production subsidies explain China's export performance? Evidence from firm-level data." *Scandinavian Journal of Economics* 111 (4), 863–891.

Gulotty, Robert, Xiaojun Li, Wei Lin, and Lizhi Liu (2017), "Regulatory Protection and the Geography of Trade : Evidence from Chinese Customs Data." *Working Paper*, 1–38.

Helpman, Elhanan, Marc Melitz, and Yona Rubinstein (2008), "Estimating trade flows: Trading partners and trading volumes." *Quarterly Journal of Economics* 123 (2), 441–487.

Hoekman, Bernard and Alessandro Nicita (2011), "Trade policy, trade costs, and developing country trade." *World Development* 39 (12) (Dec. 2011), 2069–2079.

Holzer, Kateryna (2019), "Addressing tensions and avoiding disputes: Specific trade concerns in the TBT Committee." *Global Trade and Customs Journal* 14 (3), 102–116.

Hu, Cui, Faqin Lin, Yong Tan, and Yihong Tang (2019), "How exporting firms respond to technical barriers to trade?" *World Economy* 42 (5), 1400–1426.

Jiang, Ningchuan (2009), "Effect of Technical Barriers to Trade on Chinese Textile Product Trade." *International Business Research* 1 (3), 91–97.

Kamal, Yasmine and Chahir Zaki (2018), "How do technical barriers to trade affect exports? Evidence from egyptian firm-level data." *Journal of Economic Integration* 33 (4), 659–721.

Kang, Jong Woo and Dorothea M. Ramizo (2017), "Impact of sanitary and phytosanitary measures and technical barriers on international trade." *Journal of World Trade* 51 (4), 539–574.

Kee, Hiau Looi, Alessandro Nicita, and Marcelo Olarreaga (2009), "Estimating Trade Restrictiveness Indices." *The Economic Journal* 119 (534), 172–199.

Khandelwal, Amit K., Peter K. Schott, and Shang Jin Wei (2013), "Trade liberalization and embedded institutional reform: Evidence from Chinese exporters." *American Economic Review* 103 (6), 2169–2195.

Kinzius, Luisa, Alexander Sandkamp, and Erdal Yalcin (2019), "Trade protection and the role of non-tariff barriers." *Review of World Economics* 155 (4) (Nov. 2019), 603–643.

Lawless, Martina (2009), "Firm export dynamics and the geography of trade." *Journal of International Economics* 77 (2) (Apr. 2009), 245–254.

Lu, Yi, Zhigang Tao, and Yan Zhang (2013), "How do exporters respond to antidumping investigations?" *Journal of International Economics* 91 (2) (Nov. 2013), 290–300.

Manova, Kalina, Shang-Jin Wei, and Zhiwei Zhang (2009), "Firm Exports and Multinational Activity Under Credit Constraints." *Review of Economics and Statistics* 97 (Dec. 2009).

Manova, Kalina and Zhiwei Zhang (2012), "Export prices across firms and destinations." *Quarterly Journal of Economics* 127 (1) (Feb. 2012), 379–436.

Maskus, Keith E., Tsunehiro Otsuki, and John S. Wilson (2005), "The cost of compliance with product standards for firms in developing countries: an econometric study." *World Bank Policy Research Working Paper No. 3590*, 1–31.

Mayer, Thierry and Gianmarco I.P. Ottaviano (2008), "The happy few: The internationalisation of European firms." *Intereconomics* 43 (3) (May 2008), 135–148.

Melitz, Marc J. (2003), "The impact of trade on intra-industry reallocations and aggregate industry productivity." *Econometrica* 71 (6), 1695–1725.

Melitz, Marc J. and Giancarlo I.P. Ottaviano (2008), "Market size, trade, and productivity." *Review of Economic Studies* 75 (1) (Jan. 2008), 295–316.

Ngobi, George William (2016), "The Specific Trade Concern Mechanism of the TBT Committee and the WTO TBT Agreement Implementation," 1–13.

Niu, Zhaohui, Chang Liu, Saileshsingh Gunessee, and Chris Milner (2018), "Non-tariff and overall protection: evidence across countries and over time." *Review of World Economics* 154 (4), 675–703.

Reyes, José-Daniel (2011), "Product Standards Harmonization and Firm Heterogeneity in International Trade." *The World Bank*. Policy Research Working Papers 5677 (June 2011), 1–34.

Song, Zheng, Kjetil Storesletten, and Fabrizio Zilibotti (2011), "Growing like China." *American Economic Review* 101 (1), 196–233.

Tao, Zhigang, Chong-En Bai, Jiangyong Lu, and Zhigang Tao (2012), "The Multitask Theory of State Enterprise Reform: Empirical Evidence from China." *American Economic Review* 96 (2) (May 2012), 353–357.

Teti, Feodora A (2020), "30 Years of Trade Policy: Evidence from 5.7 Billion Tariffs." *ifo Working Paper* (334).

UNCTAD (2013), *Non-tariff measures to trade: Economic and policy issues for developing countries.*

Uprasen, Utai (2014), "The Impact of Non-Tariff Barriers in the European Union on China's Exports." *Economic Integration in Asia*. Palgrave Macmillan UK, 141–164.

Wagner, Joachim (2012), "German multiple-product, multiple-destination exporters: Bernard-Redding-Schott under test." *Economics Bulletin* 32 (2), 1708–1714.

WTO (2012), "Trade and public policies: A closer look at non-tariff measures in the 21st century."

Appendix

Table 9: OLS, the Impact of Restrictive TBTs on Firms' Export Participation

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Export Participation						
TBT	-0.0044**	-0.0058***	-0.0123***	-0.0003*	-0.0005***	-0.0010***
	(0.0020)	(0.0020)	(0.0027)	(0.0002)	(0.0002)	(0.0002)
TBT × Size	0.0006**	0.0005*	0.0013***	0.0001***	0.0001***	0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
TBT × Visibility	0.0605	0.0488	0.0165	0.0220***	0.0206***	0.0184***
	(0.0580)	(0.0577)	(0.0582)	(0.0058)	(0.0058)	(0.0058)
TBT × Multi		0.0116***			0.0009***	
		(0.0020)			(0.0002)	
TBT × Domestic			0.0133***			0.0010***
			(0.0031)			(0.0002)
ln(tariff+1)	0.0018	0.0019	0.0040	0.0013	0.0013	0.0039
	(0.0101)	(0.0101)	(0.0102)	(0.0101)	(0.0101)	(0.0101)
Observations	5,313,505	5,312,987	4,782,874	5,313,505	5,312,987	4,782,874
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R square	0.340	0.340	0.340	0.340	0.340	0.340
Clusters	70794	70794	70794	70794	70794	70794

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. OLS regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, firms' visibility, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Table 10: OLS, the Impact of Restrictive TBTs on Firms' Exit Probability

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Exit Probability						
TBT	0.0113***	0.0123***	0.0187***	0.0010***	0.0010***	0.0015***
	(0.0022)	(0.0023)	(0.0027)	(0.0002)	(0.0002)	(0.0002)
TBT × Size	-0.0025***	-0.0024***	-0.0027***	-0.0002***	-0.0002***	-0.0002***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
TBT × Visibility	0.0706*	0.0771*	0.0810*	0.0029	0.0035	0.0039
	(0.0427)	(0.0426)	(0.0428)	(0.0040)	(0.0040)	(0.0040)
TBT × Multi		-0.0087***			-0.0005***	
		(0.0024)			(0.0002)	
TBT × Domestic			-0.0123***			-0.0009***
			(0.0024)			(0.0002)
ln(tariff+1)	0.0019	0.0019	0.0007	0.0013	0.0013	-0.0001
	(0.0116)	(0.0116)	(0.0116)	(0.0116)	(0.0116)	(0.0116)
Observations	2,144,807	2,144,698	2,059,284	2,144,807	2,144,698	2,059,284
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R square	0.120	0.120	0.120	0.120	0.120	0.120
Clusters	60614	60614	60614	60614	60614	60614

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. OLS regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, firms' visibility, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Table 11: OLS, the Impact of Restrictive TBTs on Firms' Intensive Margins

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Export Value						
TBT	-0.0051	-0.0161	-0.0242	-0.0018	-0.0027**	-0.0045***
	(0.0134)	(0.0135)	(0.0154)	(0.0012)	(0.0012)	(0.0013)
TBT × Size	0.0087***	0.0076***	0.0084***	0.0006***	0.0005***	0.0006***
	(0.0015)	(0.0015)	(0.0015)	(0.0001)	(0.0001)	(0.0001)
TBT × Visibility	2.2363***	2.1525***	2.0894***	0.3398***	0.3306***	0.3261***
	(0.5002)	(0.4993)	(0.4993)	(0.0515)	(0.0514)	(0.0514)
TBT × Multi		0.0987***			0.0074***	
		(0.0168)			(0.0014)	
TBT × Domestic			0.0416***			0.0062***
			(0.0159)			(0.0013)
ln(tariff+1)	-0.1484**	-0.1475**	-0.1420*	-0.1500**	-0.1493**	-0.1399*
	(0.0737)	(0.0737)	(0.0735)	(0.0738)	(0.0737)	(0.0734)
Observations	1,732,339	1,732,277	1,659,681	1,732,339	1,732,277	1,659,681
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R square	0.295	0.295	0.295	0.295	0.295	0.295
Clusters	57304	57304	57304	57304	57304	57304

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. OLS regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, firms' visibility, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Table 12: OLS, the Impact of Restrictive TBTs on Firms' Pricing Strategy

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Pricing Strategy						
TBT	-0.0005	-0.0074	0.0017	-0.0003	-0.0009	-0.0010
	(0.0090)	(0.0091)	(0.0093)	(0.0008)	(0.0008)	(0.0008)
TBT × Size	0.0062***	0.0055***	0.0054***	0.0005***	0.0004***	0.0004***
	(0.0009)	(0.0009)	(0.0009)	(0.0001)	(0.0001)	(0.0001)
TBT × Visibility	0.2395	0.1873	0.2363	0.0355**	0.0295*	0.0345**
	(0.1546)	(0.1552)	(0.1546)	(0.0172)	(0.0173)	(0.0172)
TBT × Multi		0.0621***			0.0048***	
		(0.0077)			(0.0006)	
TBT × Domestic			-0.0053			0.0015**
			(0.0091)			(0.0008)
ln(tariff+1)	0.0169	0.0175	0.0278	0.0164	0.0169	0.0293
	(0.0411)	(0.0411)	(0.0392)	(0.0411)	(0.0411)	(0.0392)
Observations	1,729,199	1,729,137	1,656,702	1,729,199	1,729,137	1,656,702
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R square	0.754	0.754	0.754	0.754	0.754	0.754
Clusters	57273	57273	57273	57273	57273	57273

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. OLS regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, firms' visibility, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Table 13: Exclusion of Big Firms, the Impact of TBTs on Firms' Export Participation (Second-stage IV)

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Export Participation						
IV TBT	-0.0041**	-0.0060***	-0.0172***	-0.0002	-0.0003*	-0.0012***
	(0.0021)	(0.0021)	(0.0029)	(0.0002)	(0.0002)	(0.0002)
IV TBTSize	0.0011***	0.0011***	0.0020***	0.0001***	0.0001***	0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
IV TBTMulti		0.0140***			0.0010***	
		(0.0021)			(0.0002)	
IV TBTDomestic			0.0178***			0.0015***
			(0.0033)			(0.0002)
ln(tariff+1)	0.0038	0.0038	0.0036	0.0039	0.0040	0.0042
	(0.0101)	(0.0101)	(0.0098)	(0.0101)	(0.0101)	(0.0097)
Observations	5,239,770	5,239,252	4,713,593	5,239,770	5,239,252	4,713,593
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	71303	71303	71303	71303	71303	71303
First-stage F-stat	188005	188005	188005	188005	188005	188005

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Table 14: Exclusion of Big Firms, the Impact of TBTs on Firms' Exit Probability (Second-stage IV)

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Exit Probability						
IV TBT	0.0142***	0.0153***	0.0254***	0.0010***	0.0010***	0.0018***
	(0.0026)	(0.0026)	(0.0030)	(0.0002)	(0.0002)	(0.0002)
IV TBTSize	-0.0026***	-0.0025***	-0.0019***	-0.0002***	-0.0002***	-0.0001***
	(0.0003)	(0.0003)	(0.0003)	(0.0000)	(0.0000)	(0.0000)
IV TBTMulti		-0.0097***			-0.0006***	
		(0.0025)			(0.0002)	
IV TBTDomestic			-0.0225***			-0.0018***
			(0.0028)			(0.0002)
ln(tariff+1)	-0.0003	-0.0004	-0.0052	-0.0009	-0.0009	-0.0058
	(0.0120)	(0.0120)	(0.0103)	(0.0120)	(0.0120)	(0.0103)
Observations	2,076,262	2,076,153	1,997,264	2,076,262	2,076,153	1,997,264
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	60472	60472	60472	60472	60472	60472
First-stage F-stat	102456	102456	102456	102456	102456	102456

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Table 15: Exclusion of Big Firms, the Impact of TBTs on Firms' Export Value (Second-stage IV)

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Export Value						
IV TBT	0.0088	-0.0056	0.0085	0.0001	-0.0010	0.0008
	(0.0128)	(0.0131)	(0.0151)	(0.0011)	(0.0011)	(0.0012)
IV TBTSize	0.0139***	0.0127***	0.0108***	0.0011***	0.0010***	0.0008***
	(0.0014)	(0.0014)	(0.0015)	(0.0001)	(0.0001)	(0.0001)
IV TBTMulti		0.1127***			0.0087***	
		(0.0160)			(0.0012)	
IV TBTDomestic			0.0785***			0.0063***
			(0.0128)			(0.0010)
ln(tariff+1)	-0.0580	-0.0567	-0.1173*	-0.0582	-0.0571	-0.1177*
	(0.0696)	(0.0696)	(0.0686)	(0.0696)	(0.0696)	(0.0686)
Observations	1,663,691	1,663,629	1,601,035	1,663,691	1,663,629	1,601,035
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	57117	57117	57117	57117	57117	57117
First-stage F-stat	102887	102887	102887	102887	102887	102887

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.

Table 16: Exclusion of Big Firms, the Impact of TBTs on Firms' Pricing Strategy (Second-stage IV)

	TBT Dummy			**TBT Duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
Pricing Strategy						
IV TBT	0.0123	0.0036	0.0140	0.0002	-0.0004	0.0007
	(0.0104)	(0.0105)	(0.0136)	(0.0008)	(0.0008)	(0.0011)
IV TBTSize	0.0062***	0.0055***	0.0083***	0.0005***	0.0005***	0.0006***
	(0.0009)	(0.0009)	(0.0012)	(0.0001)	(0.0001)	(0.0001)
IV TBTMulti		0.0679***			0.0050***	
		(0.0082)			(0.0006)	
IV TBTDomestic			-0.0237**			-0.0020**
			(0.0102)			(0.0008)
ln(tariff+1)	0.0155	0.0163	0.0553	0.0151	0.0157	0.0551
	(0.0409)	(0.0409)	(0.0495)	(0.0410)	(0.0410)	(0.0495)
Observations	1,660,575	1,660,513	1,598,107	1,660,575	1,660,513	1,598,107
Firm FEs	Yes	Yes		Yes	Yes	
Product FEs	Yes	Yes	Yes	Yes	Yes	Yes
HS2-destination-time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	57085	57085	57085	57085	57085	57085
First-stage F-stat	103169	103169	103169	103169	103169	103169

Note: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. IV regressions with firm, product and sector(HS2)-destination-time fixed effects. Robust standard errors clustered by product(HS4)-destination-time in parenthesis. TBT is measured by TBT dummy in column (1) to (3) and by TBT duration in column (4) to (6). Firm size, multi-destination dummy and domestic dummy are included but not reported when interacted with TBT.