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TBTs, firm organization and labor structure

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Abstract

This article investigates the effect of shocks to the occupational structure of exporting firms induced by the introduction of technical barriers to trade (TBTs) in importing countries. We rely on specific trade concerns data to identify trade-restrictive TBT measures, combined with matched employer-employee data for French exporters over the period 1995–2010, and information on the product-destinations served by each exporter. Controlling for time-invariant firm/occupation fixed effects and for time-varying sector/occupation shocks, the 2SLS estimates show that exporting firms adapt to the imposition of TBTs at destination by increasing the share of managers at the expense of blue collars, white collars and other professionals.

KEYWORDS
labor demand, non-tariff measures, skill composition, trade barriers

JEL CLASSIFICATION
F13, F14, J23, J24

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1 | INTRODUCTION

Trade policies that impose stringent technological standards in destination markets can affect the occupational structure of exporting firms. Adapting to these standards frequently requires investments to upgrade production process, as well as additional coordination and marketing needs and consequently a skill upgrading of the workforce.[1] Similarly, trade shocks in export markets have been found to affect the relative demand for skills (Biscourp & Kramarz, 2007; Burstein & Vogel, 2017; Harrigan & Reshef, 2015; Yeaple, 2005). This article investigates the effects of shocks induced by the introduction of a specific category of non-tariff measures (NTMs) in destination countries, namely restrictive technical barriers to trade (TBTs), on the composition of the workforce and organization of exporting firms.

Trade policy has recently undergone profound changes. While multilateral agreements, preferential trade agreements and unilateral episodes of trade liberalization have limited the use of custom tariffs, policymakers are increasingly resorting to NTMs that impede trade and protect domestic producers (see Crivelli & Groeschl, 2016; Fontagné et al., 2015; Fontagné & Orefice, 2018; Grundke & Moser, 2019; World Trade Report, 2012).[2] TBTs are measures that impose technical requirements on exporting firms and the specific characteristics of a product, such as quality, production methods, labeling, and packaging.[3] Although these measures are not *de jure* aimed at restricting trade, and are often designed to protect the environment, consumer safety or national security, in many cases they are *de facto* effective trade barriers (see WTO, 2012 for a survey), which may partly counterbalance tariff reductions (Beverelli et al., 2019; Francois et al., 2011; Orefice, 2017).

Of course, not all TBTs are trade-restrictive, as, for example, they could simply impose standards of transparency on product characteristics and reduce uncertainty for consumers. However, several TBTs are sufficiently restrictive, and possibly unjustified on safety or other grounds, to be challenged by exporting countries through the specific trade concerns (STCs) procedure at the WTO.[4] We therefore focus our analysis on the TBTs challenged by at least one exporting country within the TBT committee at the WTO, as an indirect way to gauge their potential for restricting trade. To our knowledge this is the first paper to study the impact of *restrictive* TBTs on the labor force and organization of exporting firms. Our presumption is that these TBTs mostly affect the fixed costs of exports.[5]

We exploit the variability of restrictive TBTs over time and their different occurrence in different markets—for a given product category—as a trade shock for exporters. Our identification strategy relies on the variation in exporters' exposure to restrictive TBTs (i.e., TBTs for which a concern has been raised) in their different markets. We observe the year in which the concern is raised at the WTO committee, as well as the duration of the case, at the HS4 product category and destination level. Detailed French customs data allow us to observe the portfolio of products-destinations of exporting firms, from which we construct a firm level, time varying measure of exposure to TBTs.

To properly identify the effects of these trade barriers, we isolate the impact of TBTs from the impact that other determinants of export behavior may have on the firm's occupational composition. Other trade barriers, such as tariffs at destination, are explicitly controlled for in the empirical exercise.[6] Beyond trade, we also need to control for technological shocks that may affect the composition of occupations. Our empirical approach is based on the assumption that such shocks are sector × occupation × year-specific and fully absorbed by a set of time-varying sector-occupation fixed effects. Finally, other unobserved firm-specific (time-invariant) characteristics, such as average productivity, management structure, and managerial quality are absorbed by firm × occupation-specific fixed effects.

Despite this rich set of controls, an endogeneity concern may arise if corporate lobbying activity determines which TBT measure is challenged in the WTO committee. This concern is substantially mitigated in our study for two reasons. First, it is unlikely that the STCs raised by the EU will be affected by any specific French firm. Second, firm fixed effects fully control for the average (time-invariant) lobbying power of each firm. Another concern is that the number of TBTs each firm faces may depend on the choice of the markets it serves. But insofar as self-selection towards high- or low-TBTs intensive destinations depends on time-invariant factors, such as managerial capacity, it is absorbed by firms fixed effects. To address any further reverse causality problem and the possibility of endogenous firm selection in destination markets induced by time-varying firm-specific shocks, we propose an Instrumental Variable approach in which the presence of a EU-raised TBT STC is instrumented by the presence of a non EU-raised STC. Such an instrument is unlikely to be correlated with firm-level shocks that trigger entry in destination markets or with the lobbying power of French firms.[7] While this is reassuring about the validity of the instrumental variable, any assertion of causality must be taken with a grain of salt, as it based on the (untestable) assumption that the exclusion restriction holds.[8]

We collect firm-specific information from a number of French individual- and firm-level data sources. We measure the composition of the workforce in French firms in terms of occupational categories using DADS (*Déclarations Annuelles des Données Sociales*), a matched employer-employee large-scale administrative database.[9] Occupational categories include managers (subdivided into several subcategories), professionals, white-collar workers, skilled blue-collar workers and unskilled blue-collar workers.[10] We also use information on the list of product-destinations served by each French exporter over the period 1995–2010 from customs data provided by the *Direction Générale des Douanes et Droits Indirects* (DGDDI). Finally, as mentioned above, we rely on *restrictive* TBTs as revealed by STC, at 4-digit HS and by destination, so that for each firm we are able to observe the number of exported varieties (i.e., product-destination combinations) in the presence of technical standards (TBT) that actually imply an additional export cost due to increased complexity of the firm's process (i.e., cost of complying with the technical standard).

Controlling for firm × occupation-specific time-invariant unobserved heterogeneity, time-varying sector × occupation shocks, and tariffs at destination, we find that one additional STC on TBT implies a 0.3 percentage point increase in the share of managers in the exporting firm (i.e., the top hierarchical layer). When instrumenting the EU-raised TBTs faced by French firms in a given destination-sector with the TBTs raised by non-EU countries in the same destination-sector to account for residual endogeneity concerns, we find that one additional TBT concern increases the share of managers by 1 percentage point, that is, a non-negligible 5% (7%) increase in the share of managers in firms initially facing at least one TBT (no TBT). The average increase in the share of managers in the firm facing a restrictive TBT goes hand in hand with a decrease in the share of all other occupational groups (in particular skilled and unskilled blue-collar workers).

Interestingly, when we break down managers into finer occupational categories, we find that exporters affected by TBTs at destination employ higher proportions of salaried company managers (CEOs and company directors) and engineers. This result indicates that firms respond to the increased complexity caused by stricter TBTs (i.e., the cost of adaptation) by increasing the proportion of workers in managerial and technical positions at the highest hierarchical level, hence increasing the share of skill intensive occupations. Interestingly, this result holds for firms with more than 50 employees, probably large enough to face the fixed cost of adjustment. Our findings

are in line with previous literature highlighting the skill-intensive nature of fixed costs due to export (Brambilla et al., 2012; Matsuyama, 2007). Here, we are also able to characterize the specific occupational groups (among skilled workers) that firms use to overcome the increases in export costs induced by TBTs.

This article links two strands of literature. The first concerns the impact of trade on the labor market. While early empirical studies downplayed such effects, the increasing wage inequality being attributed to skill-biased technological change, recent evidence has challenged this view. There is a growing consensus that in the US manufacturing sector, over the period 1991–2011, local labor markets highly exposed to competition from Chinese imports experienced greater job losses than less exposed areas (Acemoglu et al., 2016; Autor et al., 2013). More generally, the polarization of the labor market has been explained by the combination of trade and technological progress (exposure to trade and the share of hours worked in technology-related occupations have increased in parallel).[11] On the other hand, Feenstra et al. (2019) use US data between 1991 and 2011 and show that export expansion creates new jobs that, at the industry level, largely offset the job loss due to Chinese import competition. The net effects is instead found to be negative at the community zone level. None of these papers looks at the relative demand for skills within the firm.

Due to scant data available on firms' employment, the effect of trade shocks on the *within firm* composition of the workforce and organization of activities got limited coverage in the literature.[12] One (first) notable exception is Friedrich (2021). Based on a trade shock that hit Denmark in 2006, the Cartoon Crisis, he shows that the drop in firms' exports to Muslim countries caused a compression of wages and a reduction in the number of hierarchical layers within the firm. A (second) notable exception is Sforza (2020) who studies how firms adjust their organizational structure in response to negative shocks: while a credit supply shock affects high-skilled workers more than low-skilled workers, an import shock (China) reduces employment at all levels. We contribute to this literature, first, by analyzing the effect on the workforce of a different type of shock, namely NTMs, which potentially require skill intensive investments and activities; second, by investigating the effects of a shock in the *export* market (rather than from import competition), which is a relatively understudied aspect.[13]

The second strand of literature to which this article refers asserts that firms organize production according to knowledge-based hierarchies (Caliendo & Rossi-Hansberg, 2012; Garicano, 2000) and predicts that firms react to shocks by managing the number of layers in the organization.[14] We add to this literature by examining whether firms respond to TBTs by increasing the complexity of their management, and find that exporting firms faced with a more technical standards at destination increase the share of managers in total employment, that is, they reshape the organizational pyramid, with the top layer growing at the expense of lower layers. However, we find that the number of layers is unaffected.[15]

The remainder of the article is organized as follows. Section 2 describes the data and presents basic descriptive statistics. Section 3 discusses the empirical strategy. Section 4 presents our results on the occupational composition of firms and on the number of hierarchical layers. Section 5 concludes.

2 | DATA DESCRIPTION AND SAMPLE SELECTION

In this section, we present the data used in our empirical exercise. WTO STCs and French customs data are presented in Section 2.1. In Section 2.2, we turn to the matched employer-employee

data and the classification of workers' occupation adopted to define employment shares by occupational category. In Section 2.3, we present some descriptive statistics concerning the presence of TBT barriers.

2.1 | Specific trade concerns on TBT

We use STC data released by the WTO to identify trade *restrictive* TBTs.[16] All WTO member states have the possibility to file a complaint (more precisely a "concern") with the TBT WTO Committee concerning a technical standard imposed by another member state.[17] The TBT WTO Committee usually holds three formal meetings per year. The meetings are open to all WTO members, governmental observers and intergovernmental organization. They analyze each concern raised by member states (i.e., a technical standard affecting the exports of the complaining country), and deliberate on whether the contested technical standard is legitimately imposed.[18] If the technical standard is deemed not to be legitimately imposed, the imposing country must remove it.[19]

When one or several WTO members raise a concern over a NTM with the TBT WTO Committee, they specify the country imposing the measure, the product of concern and the purpose of the measure. All this information is recorded and made available by WTO.[20]

The collection of all STCs provides a systematic set of all TBT measures perceived as significant trade barriers by exporters. Indeed, the measures must be significant enough for exporting countries to raise a "concern." For this reason, we can be relatively confident that our data does identify actual *barriers* to trade. This is a significant advantage over other sources of TBTs that are based on an exhaustive list of measures in place. Indeed other datasets (as TRAINS or Perinorm), by listing all the measures imposed by a country, mix measures that restrict trade with those that might even increase it.[21] An example of STC on a TBT measure is the concern raised by Peru in 2001 against the EU. The Peruvian government complained against the EEC regulation 2136/89, which prevented Peruvian exporters for using the trade description "sardines" for their products (i.e., "sardinops sagax sagax" according to the *Codex Alimentarius standards*). This measure was solved with a mutually recognition.[22] Another example of STC TBT measure is the concern raised by EU in October 2010 over China's new General Safety Technical Code for Textile Products.[23] This measure set a mandatory limit PH value for textile products and banned the use of aromatic Amines 2.4 and 2.6 Xylidine in textile products. The complainant country felt this measure was more trade restrictive than necessary and requested scientific evidence to support the measure.

Overall, the TBT-STCs database contains information respectively on 318 STCs raised over the period 1995–2010. For each concern, we have information on: (i) the country raising the concern,[24] (ii) the country imposing the measure, (iii) the product codes (HS 4-digit) involved in the concern,[25] (iv) the year in which the concern has been raised to the WTO and (iv) whether it has been resolved and how. We therefore build a panel dataset that tracks the presence of an ongoing STC on TBT for a specific country pair (imposing-complaining country) and product combination over time.[26] Then we disentangle the STCs raised by EU (which are the relevant ones for French firms exports) from those raised by non-EU countries (used to build our instrumental variable in what follows). Finally, we collapse this dataset by HS 4-digit, destination and year, keeping the information on whether a given product-destination combination has at least one ongoing STC on TBT raised by EU and/or extra-EU member (in a given year). It is important to note that concerns are raised, discussed within the committee, and withdrawn after a period of time, usually

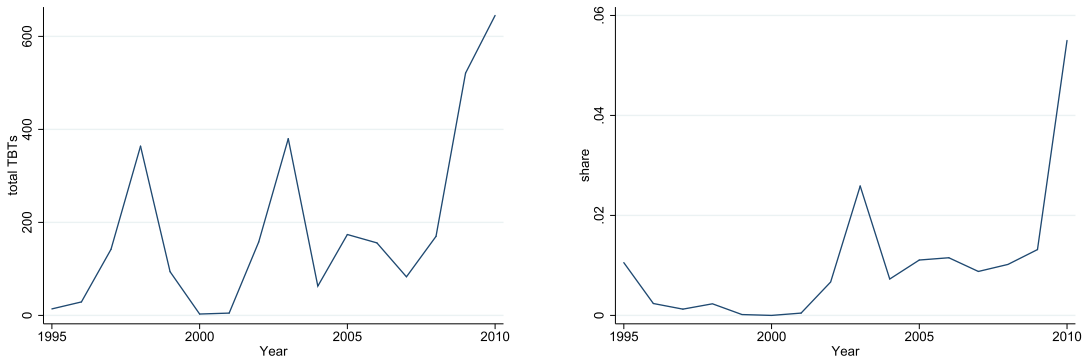
on the basis of a gentleman agreement amending the regulation. Although some concerns did not reach such agreement, they may disappear from the data if the exporting country considers that the concern cannot be solved and that its exporters will adjust and comply. It should be also noted that a concern is considered resolved by the WTO if it is not re-examined in the TBT committee for two years or more. Then, the date of the last raising at the TBT committee is assumed to be the date of the resolution of the STCs.[27]

The STC TBT dataset is then used to calculate the number of restrictive TBTs faced by each French exporter. To this end we have matched the STC data with French customs data providing information on the list of product-destination served by a given French exporter over the period 1995–2010.[28] For each firm we have information on the export value into a given product-destination. The dataset classifies product categories using Combined Nomenclature at 8 digits (CN8) but it has been aggregated here at HS 4-digit level to be consistent with the STCs dataset. We finally merged individual exports data with STCs data by HS 4-digit and destination, so that for each firm we obtained the number of exported varieties (i.e., product-destination combinations) affected by a TBT-STC. Each firm has a unique identification code ("SIREN"), which enables us to match customs/STC data with the DADS data discussed in the next subsection.

2.2 | Matched employer-employee data

We measure the composition of the workforce in French exporting firms using the DADS (*Déclarations Annuelles des Données Sociales*), a matched employer-employee large-scale administrative database. These data are based upon mandatory employer reporting of the earnings of each employee subject to social security charges (which essentially apply to all employed persons in the economy including self-employed). Each observation in the DADS corresponds to a unique individual-plant combination in a given year, with detailed information about the plant-individual relationship, including the number of days during the calendar year that the individual worked in that plant, the salary (gross and net), the type of occupation (classified according to socio-professional categories), the full time/part time status of the employee. Moreover, it provides the tax identifier of the firm that owns the plant, the geographical location of both the employing plant and firm, as well as the industry classification of the activity undertaken by the plant/firm. The data span the 1995–2010 period. Since we are interested in the occupational composition of firms, we restrict the analysis to companies having at least five employees (after removing workers with missing and zero gross wages).

Before moving to the descriptive and econometric evidence, we need to clearly define the occupation groups considered here. Based on the French occupation classification (*Catégories Socioprofessionelles*, CS 2-digit), we follow Caliendo et al. (2015) and categorize workers on the basis of their hierarchical level in the organization, which mimics (although imperfectly) the skill content of occupations within a firm. To this purpose, as shown in Table A1, we define five occupational categories: (*i*) *managers* (PCS codes from 21 to 38, including CEO, sales executives, engineers and other managers), (*ii*); *professionals* (PCS codes from 42 to 48, including technicians and administrative and sales intermediate professionals), (*iii*) *white-collar workers* (PCS codes from 53 to 56, including administrative and sales employees), (*iv*) *skilled blue-collar workers* (PCS codes from 62 to 65, including qualified production workers), (*v*) *unskilled blue-collar workers* (PCS codes from 67 to 69, including non-qualified production workers).[29]



(a) Total Number of TBTs (b) Share of exports with TBTs

FIGURE 1 TBTs: Total and share of exports. (a) Total number of TBTs. Number of sector-destination pairs under ongoing EU-raised STCs on TBT. (b) Share of exports with TBTs. Share of total exports towards sector-destination with ongoing STC on TBT (coverage ratio). [Colour figure can be viewed at wileyonlinelibrary.com]

2.3 | Descriptive statistics

This section aims to quantify the extent of restrictive TBTs for French firms, and to illustrate the correlation between the imposition of TBTs at destination and the occupational composition of French exporters.

Figure 1 shows two graphs: the left panel reports the evolution of the total number of destination-HS4 combinations with ongoing STCs on TBTs raised by the EU between 1995 and 2010,[30] while the right panel shows the evolution of the share of French exports towards destination-product combinations under active STCs on TBTs (share over the total value of French exports). To closely follow our next econometric exercise, both measures are computed on the sample of HS4 sectors and firms used in the estimates. The number of TBT concerns varies a lot over time: it rose to almost 400 concerns before the year 2000, fell to almost zero between 2000 and 2001, before peaking again in 2003 and in 2009.[31] The 2003 and 2009 peaks in the number of varieties under TBT STCs (left panel in Figure 1) mirror the relatively high proportion of French exports under TBT STCs observed in 2003 and 2009 (right panel of Figure 1). The large variation over time (and across products) of STC TBT measures is key for our identification strategy based on the within variation of TBT-induced change in fixed export cost (see the next section).

Figure 2 provides a visual representation of what we are seeking to test in our econometric exercise. It plots the difference between 2010 and 1995 in the average number of TBTs faced by a French firm belonging to a given HS 4-digit sector (horizontal axis),[32] against the same long-term change in the average share of employees by occupational group in each HS 4-digit manufacturing sector (vertical axis). The figure shows that, in the HS 4-digit sectors with larger increases in the number of restrictive TBT measures, we observe larger changes in the share of managers (panel 1), and smaller changes in the share of white-collar workers (panel 3), skilled and unskilled blue-collar workers (panel 4 and 5). Changes in the share of professionals reported in panel 2 seem to be uncorrelated with the change in the number of TBT faced by French firms. The correlations in Figure 2 (albeit weak) are consistent with the idea that firms change the composition of their workforce, when affected by the imposition of technical standards at destination, by shifting in favor of managerial occupations.

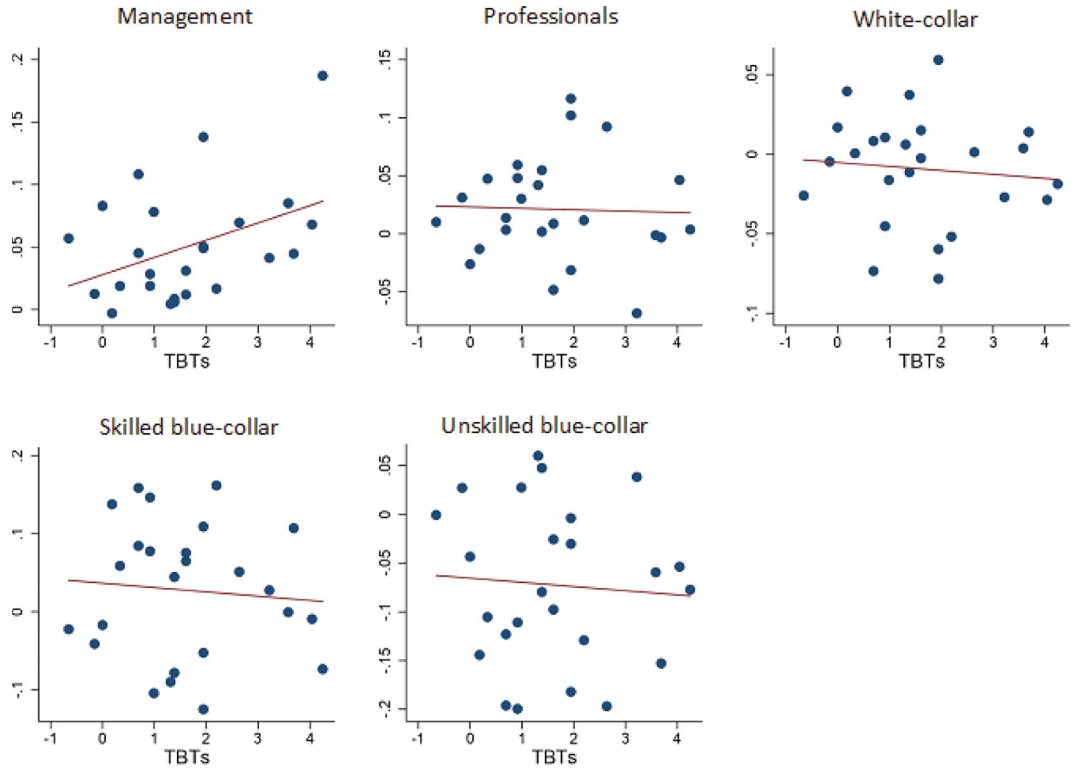


FIGURE 2 TBTs and changes in the within firm employment composition. In the vertical axis we report the change in the average share of employment (by type of occupation) across firms within a HS 4-digit sector. In the horizontal axis we report the change in the average number of TBTs faced by French firms over the period 1995–2010. Each point represents a 4-digit sector. Sectors without TBT or having zero change in TBT are not reported to the sake of readability (given the presence of firm fixed effects subsuming sector fixed effects, these sectors do not contribute the identification of our econometric results). *Source*: Authors' calculations on DADS, WTO STCs and French custom data. [Colour figure can be viewed at wileyonlinelibrary.com]

Interestingly, Table 1 shows the absence of pre-trend in the shares of each employment category over the pre-treatment period (i.e., before the presence of TBT in at least one variety exported by the firm). The share of managers and unskilled blue-collar workers respectively increase and decrease just after the firm faces a new TBT measure among the exported varieties.

In Table 2, we report in-sample descriptive statistics. We split the sample into firms that serve sectors-destinations that have never been affected by a STC (last column of the table) between 1995 and 2010, and other firms (with at least one TBT). Firms experiencing at least one TBT concern over the period face one average 1.67 TBT concerns. The second and third row of Table 2 show the number and the percentage of firms in each column. As expected, firms facing STCs on TBT are the minority (8.9% of the sample). The rest of the table shows for both affected and non-affected firms samples: (i) the sectoral distribution, (ii) the average employment share by macro-occupation, and (iii) the average trade friction (tariff and distance) and export margins.

We observe a total of 32,897 firms: among them, we have 2927 firms affected at least once by a restrictive TBT between 1995 and 2010.[33] When looking at the sectoral distribution of firms with concerns, as expected, the manufacturing of food, beverages, and tobacco is over-represented in the sample with TBTs. Looking at macro-occupations, the share of managers and professionals

TABLE 1 Occupational shares before and after the TBT.

	Managers	Professionals	White-collar	Skilled blue-collar	Unskilled blue-collar
$t-2$	0.120	0.208	0.171	0.319	0.083
	(0.098)	(0.112)	(0.173)	(0.170)	(0.069)
$t-1$	0.121	0.215	0.172	0.321	0.078
	(0.097)	(0.108)	(0.168)	(0.166)	(0.066)
$t0$	0.131	0.215	0.163	0.326	0.075
	(0.101)	(0.105)	(0.164)	(0.166)	(0.064)
$t+1$	0.132	0.216	0.151	0.329	0.074
	(0.104)	(0.105)	(0.162)	(0.167)	(0.064)
$t+2$	0.134	0.218	0.147	0.328	0.076
	(0.106)	(0.108)	(0.159)	(0.166)	(0.063)

Source: DADS, WTO STCs and French custom data for 1995 to 2010. We report the average occupational share in each period before and after the introduction of the TBT (t0) and the standard error of employment share in parenthesis in each entry of the table.

is higher among firms subject to TBTs, while both the share of skilled and unskilled blue-collar workers is lower. In general, firms in the TBT sample serve relatively more distant destinations, face higher average tariffs, and export a wider range of varieties than other exporters. This suggests that TBT-affected and TBT-free firms are substantially different in terms of observables, requiring accurate econometric modeling to account for potential unobserved heterogeneity. The following section presents our empirical strategy.

3 | EMPIRICAL STRATEGY

Our basic empirical specification is borrowed from Fontagné et al. (2015), except that the impossibility to attribute workers to the production of a specific good for a specific export destination forces us to work at the firm-year level (i.e., total number of firm's product-market combinations under TBT concern). Our preferred specification addresses endogeneity issues by adopting an instrumental variable (IV) approach. We now present the set up and the IV strategy sequentially.

3.1 | Basic set up

We estimate the following equation:

$$y_{i,t,k} = \alpha_{i,k} + \gamma_{s,t,k} + \beta_{1,k} TBT_{i,t-1} + \beta_{2,k} \text{Tariffs}_{i,t-1} + \varepsilon_{i,t,k}, \quad (1)$$

where $y_{i,t,k}$ is the share of the occupational category k in the employment (total number of workers) of firm i at time t.[34] The term $\alpha_{i,k}$ is a firm × occupation fixed effect, and $\gamma_{s,t,k}$ is a set of (1-digit) sector × year dummies specific to occupation k. $\text{Tariffs}_{i,t-1}$ measures the average level of tariff duties faced by each French firm for its exported products and destinations, and aims to isolate the effect of TBTs from these tariffs.[35] More precisely, we observe the tariff level that firm i faces

TABLE 2 In-sample descriptive statistics.

	At least one TBT	TBT-free
Average number of TBTs per affected firm	1.67	0
# firms	2927	29,970
% of firms	8.9	91.1
Sectoral distribution (%)		
Manufacturing of food, beverages, and tobacco	14.4	6.93
Manufacturing of of textiles and leather	28.79	12.68
Manufacture of wood, paper, publ./print	1.03	11.14
Chemical products, rubber, metals	19.16	36.75
Machinery and equipment	9.17	10.52
Manufacture of electrical and optical equipment	18.3	11.21
Transport equipment/furniture	9.15	10.76
Occupations (%)		
Share of managers	17.7	13.0
Share of professionals	23.1	19.9
Share of white collars	18.0	21.8
Share of qualified blue collars	29.2	34.5
Share of non qualified blue collars	11.7	10.3
Tariff	0.12	0.08
Market distance (km)	14,336	8855
Number of Markets served	21.71	7.00
Number of Varieties	71.98	14.94
Observations	4383	185,598

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

for each of its product-destination combinations, and then take firm-specific simple average tariff for all products and destinations served by the firm.[36]

The variable $\text{TBT}_{i,t-1}$ measures the number of STCs on TBTs faced by the firm i at time $t-1$,[37] measured as the sum of the EU-raised TBT STCs faced in all the products-markets combinations in which the firm exports:[38]

$$\text{TBT}_{i,t-1} = \sum_{sj} I^{\text{TBT}}_{sj,t-1} \times I^{EXP}_{isj,t-1}, \tag{2}$$

where $I^{\text{TBT}}_{sj,t-1}$ is a dummy variable equal to one if a EU-raised TBT STC is active in a product-market combination sj and $I^{EXP}_{isj,t-1}$ is equal to one if firm i exports into such a product-market combination.[39] Consequently, our coefficient of interest, $\beta_{1,k}$, measures the average impact of the number of TBTs a firm faces on the proportion of workers it employs in occupation k. Notice that the variable $\text{TBT}_{i,t-1}$ varies both when a concern is raised (or solved)[40] on a market in which the firm is already present, and when the firm enters or exits a market in which a concern exists. This

raises an endogeneity concerns which is addressed (and discussed) in Section 3.2. We run the above specification, separately for each occupation k, on the full sample of manufacturing *exporting* firms with more than five employees resulting from the merge between Custom and matched employer-employee data (see Section 2 for more details on the estimation sample). As already mentioned, we do not take into account firms with fewer than five employees, as micro firms do not have a full spectrum of occupations, and this would inflate the dataset with zeros for many occupational categories. Also, in order to have a proper counterfactual, we do not consider firms that export uniquely towards TBT-free destinations, that is, $\text{TBT}_{i,t-1} = 0$. Results from estimates on these samples are presented in Section 4.

The occupation-specific firm fixed effect $\alpha_{i,k}$ absorbs any time-invariant firm-specific factor—including average productivity, average firm size and managerial structure (and quality)—affecting the share of workers employed in occupation k. Controlling for average firm size is particularly important in our empirical strategy, as large firms export (on average) to a greater number of destinations and therefore be confronted with a greater number of TBT measures. Moreover, firms with good managerial structure and capabilities may opt for a larger set of destination markets, and therefore face a larger number of TBTs among destinations. Firm fixed effects, by controlling for the average managerial capability of the firm, purge our results from any managerial-related time-invariant confounding factor. The use of a within estimator also reduces reverse causality concerns, as any reverse causality argument must be valid in deviations from the occupation-specific firm average (rather than in levels), as further discussed in Section 3.2.

For each occupation k we include in all specifications (1-digit) sector-time dummies that control for any factor likely to affect the composition of the workforce of French firms. This captures any technological shock to occupation k common to all firms in a given sector. Indeed, unobserved sector-specific demand shocks may require an adjustment to the workforce composition of firms operating in the sector, and will be absorbed for by the fixed effect $\gamma_{s,t,k}$. Finally, any firm-specific shock that affects *homogeneously* all categories of workers in the firm—that is, that affects the level of employment—is mechanically controlled for by having as a dependent variable the *share* of a given worker category relative to total employment.

While our specification includes a rich set of fixed effects $\alpha_{i,k}$ and $\gamma_{s,t,k}$ that allow us to deal with many potential sources of omitted variable bias, there may be other sources that we examine in the next subsection.

3.2 | Additional sources of bias and instrumental variable strategy

First of all, one may be concerned about reverse causality. In view of the political economy of trade barriers, it can be argued that the STCs raised by the EU may result from the lobbying activity of large skill-intensive French firms with the EU commission. As discussed above, the rich set of fixed effects $\alpha_{i,k}$ and $\gamma_{s,t,k}$ included in Equation (1) considerably reduces this concern, as any reverse causality argument must be valid in *deviation* from the firm time-invariant average (i.e., deviations from the average firm's occupational composition affecting the change in the set of product-destination combinations under restrictive TBT). Yet, it cannot be ruled out that firms whose skill intensity increases with respect to the time-invariant average are in a better position to lobby the EU Commission to raise a STC.

A second concern is the risk of not disentangling the effect that comes from an *exogenous* change in the number of TBTs a given firm faces, and the firm's *endogenous* entry decision. Following a positive productivity shock at the firm level (or a change in managerial structure), firms

may at the same time become more skill-intensive and enter product-destination markets with TBTs, which confronts them with additional TBT measures endogenously. This could lead to the fallacious conclusion that firms facing restrictive TBTs upgrade the skill mix of their workforce. Insofar as the source of unobserved heterogeneity at the firm-level is time-invariant, this problem is fully resolved by the use of firm × occupation fixed-effects. However, it is always possible that time-varying, firm-specific shocks may prompt firms to self-select endogenously into specific destination markets.[41]

For these reasons, we complement the specification laid out in Equation (1) with an IV strategy aimed at addressing the remaining concerns. The construction of the IV for TBTs is based on the wealth of information contained in STC data. As a source of exogenous variation in the number of STCs on TBTs faced by French firms, we use the STCs raised by *non-EU* countries, which are plausibly orthogonal to any time-varying non observable shock hitting French firms. Specifically, we instrument our main dependent variable, that is, the number of product-market combinations under EU-raised STCs on TBT to which the specific firm i exports at time $t-1$, with the number of STCs raised by the rest of the world (extra-EU) on the sample of product-destination combinations served by firm i at time $t-1$.

$$\mathrm{TBT}^{IV}_{i,t-1} = \mathrm{TBT}^{\text{non-EU}}_{i,t-1}. \tag{3}$$

Our IV, therefore, varies at the firm level, very much as the endogenous explanatory variable $\mathrm{TBT}_{i,t-1}$. The rationale for this IV is that STC raised by non-EU countries are unlikely to be affected by the time-varying characteristics of French firms. Formally, the identification assumption is that STC raised by non-EU countries are orthogonal to any shocks at the firm level, and in particular to the composition of the workforce of a specific French firm (conditioning on firms and sector-by-year effects specific to occupation k). Under this assumption, we capture the exogenous variation in the EU-TBTs that is uncorrelated with firm-level shocks that may induce firms to self-select into specific destinations. It should be noted that we do not claim that the use of an IV based on TBTs raised by countries other than the EU makes the decision to enter the market exogenous. Rather, our IV estimates rely on the untestable assumption that the instrument is uncorrelated with the (endogenous) entry decision (i.e., that the exclusion restriction holds). In short, as usual, the validity of our IV strategy relies on the untestable assumptions that the conditional variation of the instrument is as good as random and that the exclusion restriction holds.

In order to corroborate the plausibility of these identifying assumptions and thus establish the robustness of our results, we propose two sample stratification checks. First, we check whether our results are confirmed on a sub-sample of firms whose productivity levels can be considered homogeneous. To this end, we focus on a sub-sample of firms that serve more than 6 markets (the 95th percentile of the distribution of markets served by firms on average over the period); as only high-productivity firms serve a large number of markets (Bernard et al., 2007; Bernard et al., 2011), this allows us to zoom in on a subset of relatively homogeneous, high-productivity firms for which endogenous selection into specific destinations is less problematic. As these firms are potentially able to serve any destination, they are less likely to selectively enter markets affected by TBTs.

Second, we rely on a sub-sample of firms with a stable portfolio of destinations over time.[42] We propose two definitions of "stable" portfolios: (*i*) firms having at least 3 or 4 or 5 years of presence into the average destination,[43] and (*ii*) firms whose shortest export-spell is on average of 3, 4, or 5 years.[44] The latter strategy captures firms whose average shortest spell (i.e., number of years

of continuous presence in a destination market) is not too short. The idea is that firms having a stable portfolio of destinations do not base their entry/exit decision on the presence of TBT at destination, and that, consequently, the within-firm TBT variation can plausibly be considered exogenous.

Combining the IV strategy with firms fixed effects and the sample-stratification exercises described above reduces concerns about various potential sources of bias (reverse causality and endogenous selection of firms into markets), but obviously, cannot eliminate them completely, given the impossibility of properly testing the exclusion restriction assumption. With this *caveat* in mind, we interpret the evidence below as suggesting the existence of a causal relationship between TBTs and the workforce composition of French firms.

As widely recognized in the literature, even tariffs cannot be considered purely exogenous in a firm-specific regression if the firm has sufficient power to influence the trade policy of the destination country, or if that country reacts to a firm specific import shock by raising tariffs.[45] For this reason, we instrument also the average tariffs faced by the specific French firm to further reduce any endogeneity concern. The IV for tariffs is based on the tariff level faced by extra-EU countries in exporting toward a given destination-sector market. For each destination j and sector s we calculate the average import tariff imposed on non-EU exporting countries ($\text{Tariffs}^{\text{non-EU}}_{s,j}$). We instrument the firm's average tariff using the average tariff imposed by firm's destinations on non-EU exporters:

$$\text{Tariffs}^{IV}_{i,t-1} = \frac{1}{S}\frac{1}{J}\sum_{sj} \text{Tariffs}^{\text{non-EU}}_{s,j,t-1}, \tag{4}$$

where S and J respectively stand for the total number of sectors s and destination j served by firm i at time $t-1$. The tariff level imposed by destination j on sector s on a non-EU exporter can be plausibly considered exogenous and affecting the occupation composition of firm i only through its effect on $Tariff_{i,t-1}$ (exclusion restriction). Notice that also for tariffs, the instrument varies at the firm level as the endogenous variable. We run the IV specification, separately for each occupation k, on the full sample of exporting manufacturing firms as described in Section 2; results from IV estimates are presented in Section 4. Sample stratification IV estimates are presented in Section 4.1.

4 | RESULTS: TBTS AND THE OCCUPATIONAL COMPOSITION OF FIRMS

We estimate Equation (1) on all manufacturing companies that have exported at least once between 1995 and 2010, using a sample of over 30,000 manufacturing companies. Table 3 reports results from separate regressions of Equation (1) for each occupational category. In particular, we look at the effect of TBT on the share of managers, professionals, white collar workers, skilled and unskilled blue collar workers in the firm's total workforce. The first column shows the fixed effect OLS estimation, while the second column shows the results from the fixed effects IV estimation, where both TBTs and tariffs are instrumented as explained in the previous section. The dependent variable is the share of full-time equivalent employees in occupation k over the total workforce of the exporting firm. The measure of TBTs is the (1-year lagged) total number of concerns (HS4-destination pairs) faced by each firm, while tariffs are measured by the average level of tariffs faced by the firm on the product-destination served (also 1-year lagged). As indicated in

TABLE 3 TBTs and the occupational composition of firms; full sample.

	TBT	
	FE	**IV + FE**
Share of managers		
TBTs	0.003***	0.010***
	(0.000)	(0.001)
Tariffs	−0.006**	−0.009**
	(0.003)	(0.005)
Share of professionals		
TBTs	−0.001	−0.003***
	(0.000)	(0.001)
Tariffs	0.002	0.002
	(0.004)	(0.007)
Share of white-collar workers		
TBTs	0.001*	−0.000
	(0.000)	(0.000)
Tariffs	0.009***	0.010*
	(0.003)	(0.006)
Share of skilled blue-collar workers		
TBTs	−0.000	−0.003*
	(0.000)	(0.001)
Tariffs	−0.001	0.000
	(0.006)	(0.010)
Share of unskilled blue-collar workers		
TBTs	−0.002***	−0.003**
	(0.000)	(0.001)
Tariffs	−0.003	−0.009
	(0.006)	(0.009)
IV: TBT		0.455***
IV: Tariffs		0.527***
Observations	189,981	189,795
First stage Kleibergen-Paap rk Wald F statistic		165.43
Number of firms	29,991	29,962
Firm FE & Sector × Year FE	YES	YES

Note: Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage Tariff equation.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

Equation (1), all regressions include firm fixed effects and the interaction between (1-digit) sector dummies and year dummies.

Table 3 shows strong and significant results for the managerial layer, in both specifications: an additional TBT concern in one of the markets where the firm was present the previous year increases the managerial share by 0.3 percentage points. The fact that IV estimates are also positive and significant is reassuring, as it implies that fixed effects OLS estimates do not simply capture entry into difficult markets (i.e., markets characterized by high TBTs) accompanied by an increase in the share of managers, by firms hit by a positive (unobservable) shock. The point estimate of the TBT coefficient is three times larger (1 percentage points) when estimated using IVs. For firms almost unaffected by TBT at $t-1$ (i.e., facing zero or one TBT among destination markets) the imposition of a new TBT implies a 5% to 7% increase in the managerial share. The difference in point estimates between OLS and 2SLS can be interpreted in light of the political economy concern discussed above. If firms that are unable to comply with the new TBTs (less management-intensive firms) are more likely to lobby for raising a STC at the WTO (implying a negative correlation between the share of managers and the number of TBT), then the OLS coefficient would be biased downwards. In line with this argument, when endogeneity is addressed, the point estimate becomes larger. The table also reports the main first-stage coefficients, that is, the coefficient of the instrument for TBT of the first-stage TBT equation and the coefficient of the instrument for tariffs of the first-stage tariff equation, along with the Kleibergen-Paap Wald test. Not surprisingly, the first-stage coefficients of the instruments are highly significant and there is no evidence of instruments being weak.

The average increase in the share of managers is matched by a significant decrease in the shares of professionals, skilled and unskilled blue-collar workers, suggesting a strong impact of restrictive TBTs on the workforce composition of French exporters. In particular, an additional TBT concern in one of the product-destination combinations served by firm i at time $t-1$ decreases the share of professionals by 0.3 percentage points, and the share of skilled and unskilled blue-collar workers by 0.3 and 0.2 percentage points respectively. In other words, the increase in the share of managerial occupations is balanced by the reduction in professional and blue collar occupations. Overall, and in line with the previous literature highlighting the nature of fixed export costs related to skilled workers, an increase in the TBT-induced fixed export cost is associated with an increase in the firm's skilled intensive managerial occupations.

4.1 | Robustness checks

4.1.1 | Top exporters serving more than 6 markets

As discussed above, firms may endogenously self-select to destinations with high or low STCs on TBT. For instance, following a positive productivity shock,[46] a firm may decide to enter a promising but costly (TBT-imposing) product-destination market. Our IV approach addresses this concern under the assumption that the instrument is uncorrelated with firm-level productivity shocks. Another way to (imperfectly) address this concern, is using a sub-sample of firms with arguably homogeneous productivity levels. To this end, we include in Table 4 only firms that serve more than six markets (the 95th percentile of the distribution of markets served by firms on average over the period), and thus have almost homogeneous and high productivity levels.[47] Not surprisingly, in this sub-sample of firms the share of managers is on average higher than in the full sample (respectively 20% for firms with at least one TBT and 15% for firms without TBTs).

TABLE 4 Effect of TBTs on the occupational composition of firms.

	TBT	
	FE	IV + FE
Share of managers		
TBTs	0.002***	0.008***
	(0.0007)	(0.001)
Tariffs	−0.003	0.004
	(0.009)	(0.011)
Share of professionals		
TBTs	−0.001	−0.003**
	(0.0007)	(0.001)
Tariffs	−0.013	−0.004
	(0.011)	(0.013)
Share of white-collar workers		
TBTs	0.0007	−0.0006
	(0.0006)	(0.0009)
Tariffs	0.012	0.004
	(0.009)	(0.013)
Share of skilled blue-collar workers		
TBTs	−0.0007	−0.002
	(0.001)	(0.001)
Tariffs	−0.005	−0.006
	(0.014)	(0.018)
Share of unskilled blue-collar workers		
TBTs	−0.001*	−0.001
	(0.0008)	(0.001)
Tariffs	0.011	0.001
	(0.013)	(0.016)
IV: TBT		0.468***
IV: Tariffs		0.853***
Observations	64,045	64,045
First stage Kleibergen-Paap rk Wald F statistic		196.45
Number of firms	7420	7420
Firm FE & Sector × Year FE	YES	YES

Note: Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage Tariff equation. Top exporters serving more than six markets.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

Results reported in Table 4 comfort our baseline findings with point estimates similar to those obtained on the full sample, for both the fixed effects and the IV+fixed effects specification. Thus, also for the most productive firms exporting in at least 6 markets, the presence of stringent standards at destination is driving firms to adopt a new organizational structure based on a higher share of managers and lower share of professionals (the coefficients on skilled and unskilled blue collar workers are similar to the baseline estimation but imprecisely estimated).[48]

4.1.2 | Firms with stable portfolio of destinations

Another approach to solve the problem of endogenous selection of firms into specific destination markets is to restrict the estimation sample to firms with a stable portfolio of destinations. This considerably reduces concerns about firm self-selection as it is plausible that firms with a stable set of destinations do not base their entry/exit decision on the presence of TBT at destination. Therefore, the presence of a new TBT can be considered, even more safely, as exogenous to the firm-specific unobserved shocks in this subsample.

Table 5 shows the results of a first robustness check using the sub-sample of French firms having *at least and alternatively* 3 (column 1), 4 (column 2), or 5 (column 3) years of average presence *per* destination (i.e., firm's average presence across destinations). As expected, the sample of firms is considerably smaller, but our results hold. The plausibly exogenous imposition of a TBT in one of the destinations stably served by the firm, induces an increase in the share managers and a reduction in the share of qualified blue collar. The robustness of the results to this sample cut reinforces confidence that results obtained on the full sample identify the causal effects of TBTs.

In Table 6 we adopt an even more conservative definition of stability in destination portfolio, and use firms whose *shortest* export-spell is on average of 3 (column 1), 4 (column 2), or 5 (column 3). We calculate the shortest number of years of consecutive presence in each destination, and then take the average across destinations. Such a sample stratification reduces even further the number of firms in the sample. Nevertheless, our results are robust also to this sample definition. Again, the fact that the point estimates are similar to those obtained in the full sample is reassuring that the results are not driven by self-selection of firms into markets.

4.1.3 | Effect with weighted TBTs

In our baseline model, the measure of TBT is a count of product-destination concerns in the markets where the firm is active. However, this measure does not take into account the importance of this specific product-market combination for the firm (i.e., firm-specific export volumes) and, also, it tends to underestimate the actual effect of TBTs if the firm exits from a product-destination market as a consequence of the imposition of a TBT.[49] In order to address the potential bias caused by this issue, we construct weights using the share of exports of a given HS 4-digit product relative to the firm's total annual exports, net of the firm exports to the destination that imposed the TBT for that same HS4 product. We interact such shares with the TBT dummy in each product-destination-year combination. Finally, we collapse by summing the weighted TBTs by firm and year. Our measure of TBTs used in the regressions is now:

$$\mathrm{TBT}^{W}_{i,t-1} = \sum_{sj} I^{\mathrm{TBT}}_{sj,t-1} \times \frac{\sum_{d,d\neq j} \mathrm{export}_{\mathrm{isdt}}}{\sum_{s}\sum_{d,d\neq j} \mathrm{export}_{\mathrm{isdt}}}, \tag{5}$$

TABLE 5 Effect of TBTs on the occupational composition of firms.

	TBT		
	IV + FE	IV + FE	IV + FE
Share of managers			
TBTs	0.010***	0.010***	0.0125***
	(0.001)	(0.001)	(0.001)
Tariffs	−0.012*	−0.023***	−0.018
	(0.007)	(0.009)	(0.015)
Share of professionals			
TBTs	−0.004***	−0.004***	−0.005*
	(0.001)	(0.001)	(0.002)
Tariffs	0.004	0.008	−0.033*
	(0.009)	(0.011)	(0.017)
Share of white-collar workers			
TBTs	−0.001	−0.000	−0.0009
	(0.001)	(0.001)	(0.001)
Tariffs	0.011	0.021**	0.0234*
	(0.006)	(0.009)	(0.014)
Share of skilled blue-collar workers			
TBTs	−0.003*	−0.002	−0.003
	(0.002)	(0.002)	(0.002)
Tariffs	−0.003	−0.004	0.047*
	(0.015)	(0.020)	(0.027)
Share of unskilled blue-collar workers			
TBTs	−0.003	−0.003*	−0.004*
	(0.002)	(0.002)	(0.002)
Tariffs	−0.013	−0.019	−0.015
	(0.015)	(0.019)	(0.029)
IV: TBT	0.451***	0.450***	0.454***
IV: Tariffs	0.586***	0.585***	0.607***
Years of presence at destination (average)	3	4	5
Observations	144,215	102,618	65,128
First stage Kleibergen-Paap rk Wald F statistic	150	144	123
Number of firms	14,272	9128	5213
Firm FE & Sector × Year FE	YES	YES	YES

Note: This table includes French firms with an average export presence into a given destination of at least and alternatively 3 (column 1), 4 (column 2), or 5 (column 3), that is, average export presence across destinations. Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage tariff equation. Firms with stable portfolio of destinations: at least 3 to 5 years of presence in a given destination.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

TABLE 6 Effect of TBTs on the occupational composition of firms.

	TBT		
	IV + FE	IV + FE	IV + FE
Share of managers			
TBTs	0.011***	0.010***	0.013***
	(0.002)	(0.002)	(0.003)
Tariffs	−0.023**	−0.025	−0.048
	(0.010)	(0.016)	(0.029)
Share of professionals			
TBTs	−0.003*	−0.001	−0.002
	(0.002)	(0.002)	(0.003)
Tariffs	−0.017	−0.061***	−0.098**
	(0.013)	(0.022)	(0.040)
Share of white-collar workers			
TBTs	−0.0007	0.0006	−0.000
	(0.001)	(0.001)	(0.002)
Tariffs	0.029**	0.031*	0.050
	(0.010)	(0.018)	(0.030)
Share of skilled blue-collar workers			
TBTs	−0.003	−0.006**	−0.015***
	(0.002)	(0.003)	(0.003)
Tariffs	−0.018	0.091*	0.147**
	(0.027)	(0.047)	(0.069)
Share of unskilled blue-collar workers			
TBTs	−0.005**	−0.002	0.003
	(0.002)	(0.002)	(0.003)
Tariffs	0.03	0.03	−0.060
	(0.025)	(0.046)	(0.071)
IV: TBT	0.444***	0.479***	0.478***
IV: Tariffs	0.586***	0.564***	0.612***
Minimum export-spell at destination (average)	3	4	5
Observations	69,701	35,689	18,050
First stage Kleibergen-Paap rk Wald F statistic	113	88	47
Number of firms	6458	2792	1143
Firm FE & Sector × Year FE	YES	YES	YES

Note: This table includes French firms with an average export-spell into a given destination of at least and alternatively 3 (column 1), 4 (column 2), or 5 (column 3), that is, average (minimum) export-spell across destinations. Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage Tariff equation. Firms with stable portfolio of destinations: at least 3 to 5 years export-spell in a given destination.
***$p < .01$; **$p < .05$; *$p < .1$.
Source: DADS, WTO STCs and French custom data for 1995 to 2010.

where $\sum_{d,d\neq j} \text{export}_{isdt}$ and $\sum_s \sum_{d,d\neq j} \text{export}_{isdt}$ are, respectively, the total firm's exports for product s (net of export to destination j) and its total exports (net of exports to destination j). The weighted number of TBTs, $\text{TBT}^W_{i,t-1}$, gives more weights to TBTs in sectors that are of particular interest for the firm. The leave-one-out strategy in creating weights allows us to keep in the count of $\text{TBT}^W_{i,t-1}$ also those market-destination from which the firm exits as a consequence of TBT imposition. Results shown in Table 7 confirm both in magnitude and direction the baseline results shown in Table 3, for both OLS and IV.

4.1.4 | Differential effects by firm size

A last potential concern relates to the heterogeneous legal status of firms according to their size (number of employees). In France, firms with up to 49 employees benefit from weaker administrative *ad hoc* constraints in terms of human resources (including work organization, conditions of employment, measures likely to affect the size or structure of the labor force).[50] To account for a possible potential heterogeneous effect of TBTs on the workforce composition of firms above or below this threshold, we interact the TBT variable with a dummy indicating whether the firm's initial employment is above or below the 50 employee threshold. As a robustness check we use the 75th percentile of the firm size distribution as a threshold. Results are reported in Table 8.

It is noteworthy that the effect of imposing TBTs on the share of managers and skilled blue-collar workers is entirely due to large firms (i.e., firms with total employment above 50 or the 75th percentile of the firm size distribution). This means that, despite the administrative advantages granted to small firms, only large firms are able to adapt their workforce composition to the imposition of a new TBT at destination.

4.2 | Managerial sub-layers

The main finding so far is the positive effect of TBTs on the share of managers in the firm. However, this latter macro-occupational group actually covers a wide range of occupations (from 21 to 38 PCS French occupational code), such as directors, sales managers, engineers and so forth. Thus, testing the effect of TBTs on each sub-layer belonging to the managerial layer can help uncover the specific channel behind the baseline results discussed above. We have therefore split the managerial layer into four finer sub-layers: (*i*) CEOs;[51] (*ii*) sale executives; (*iii*) engineers; and (*iv*) other top managers (lawyers, doctors, professors, etc.).[52]

CEOs account on average (as full time equivalent) for 3.4% of total employment, sale executives for 6.8%, engineers for 4.7% and other top managers for 1.2%. In Table 9, we report the shares of these categories for firms with or without TBTs. It is clear that, on average, firms facing at least one TBT have a higher proportion of engineers, suggesting that engineers are needed to adapt the production process to new technical standards and to overcome the fixed export cost implied by the presence of a TBT.

Table 10 shows the results of the baseline specification for each occupation category belonging to the managerial group. From Table 10 it emerges that the positive effect we observe in Table 3 on managers is mainly driven by a positive effect on both the share of engineers and the share of sales executives. Facing an additional TBT would increase the share of engineers by 0.7 percentage points and the share of sales executives by 0.3 percentage points (see IV specification in column 2). Firms faced with an additional TBT need to adapt their products or processes to meet the

TABLE 7 Effect of TBTs on the occupational composition of firms; weighted TBTs.

	TBT	
	FE	**IV + FE**
Share of managers		
TBTs	0.005***	0.022***
	(0.002)	(0.004)
Tariffs	−0.005***	−0.005***
	(0.0015)	(0.0017)
Share of professionals		
TBTs	0.0009	0.00034
	(0.0025)	(0.005)
Tariffs	0.0003	0.0009
	(0.0018)	(0.002)
Share of white-collar workers		
TBTs	−0.0006	−0.0015
	(0.0018)	(0.003)
Tariffs	0.0047***	0.005***
	(0.0014)	(0.0016)
Share of skilled blue-collar workers		
TBTs	0.002	−0.007
	(0.0035)	(0.007)
Tariffs	−0.002	−0.003
	(0.003)	(0.003)
Share of unskilled blue-collar workers		
TBTs	−0.007**	−0.015**
	(0.003)	(0.006)
Tariffs	0.003	0.003
	(0.0025)	(0.0027)
IV:TBT		0.419***
IV:Tariff		0.896***
Observations	145,586	145,512
First Stage Kleibergen-Paap Wald rk F statistic		710.07
Number of firms	21,626	21,618
Firm FE & Sector × Year FE	YES	YES

Note: Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation.
***$p < .01$; **$p < .05$; *$p < .1$.
Source: DADS, WTO STCs and French custom data for 1995 to 2010.

TABLE 8 Effect of TBTs on the occupational composition of firms.

	TBT	
	IV + FE	IV + FE
Share of managers		
TBTs	0.004	0.003
	(0.003)	(0.003)
TBTs × Size > 50	0.008**	
	(0.004)	
TBTs × Size > 75th pct		0.010***
		(0.003)
Share of professionals		
TBTs	−0.003	−0.001
	(0.004)	(0.003)
TBTs × Size > 50	−0.0005	
	(0.003)	
TBTs × Size > 75th pct		−0.002
		(0.003)
Share of white-collar workers		
TBTs	0.002	0.0009
	(0.002)	(0.002)
TBTs × Size > 50	−0.003	
	(0.002)	
TBTs × Size > 75th pct		−0.002
		(0.003)
Share of skilled blue-collar workers		
TBTs	0.004	0.003
	(0.004)	(0.003)
TBTs × Size > 50	−0.009*	
	(0.004)	
TBTs × Size > 75th pct		−0.009*
		(0.004)
Share of unskilled blue-collar workers		
TBTs	−0.006	−0.006*
	(0.003)	(0.003)
TBTs × Size > 50	0.003	
	(0.004)	
TBTs × Size > 75th pct		0.003
		(0.003)

TABLE 8 (Continued)

	TBT	
	IV + FE	**IV + FE**
IV: TBT	0.445***	0.445***
IV: TBTs × Size > 50	0.446***	
IV: TBTs × Size > 75th pct		0.445***
Observations	189,795	189,795
First stage Kleibergen-Paap rk Wald F statistic	87	84
Firm FE & Sector × Year FE	YES	YES

Note: Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. TBTs × Size > 50 (75th pct) is the coefficient of the instrument for TBT on large firms of the first-stage TBT coefficient on large firms. Results by firm size.
***$p < .01$; **$p < .05$; *$p < .1$.
Source: DADS, WTO STCs and French custom data for 1995 to 2010.

TABLE 9 Share of managers in managerial sub-layers.

	At least one TBT	TBT-free
Occupations (%)		
Share of CEOs	1.9	2.4
Share of sales executives	6.1	4.2
Share of engineers	9.4	5.7
Share of other managers	0.3	0.6

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

technical standard; engineers are the occupation most in demand for this purpose. The result on the CEOs is significant when estimated via IV, with TBT increasing their share by 0.1 percentage point. The proportion of other top-managers is only marginally (negatively) affected by TBTs at destination.

We next turn to the sample of top exporters serving more than six markets. In this sub-sample of firms the share of engineers is on average higher than in the full sample of firms used in our baseline (respectively 11% for firms with at least one TBT and 7% for firms without TBTs). Regression results reported in Table 11 confirm those of the full sample, with restrictive TBTs implying an increase in the share of engineers and CEOs needed to comply with the new technical standard at destination. The results for the sample of firms with stable destination portfolios, reported in Tables A2 and A3, are in line with results for the full sample.

4.3 | Probability to add layers

The change in the occupational composition of French firms may be associated with a change in the hierarchies within the firm. Indeed, in line with the literature exploring how firms (re)organize production within hierarchies to economize on the use of knowledge (Caliendo et al., 2020; Caliendo & Rossi-Hansberg, 2012; Garicano, 2000; Guadalupe & Wulf, 2010), the

TABLE 10 Effect of TBTs on managerial sub-layers; full sample.

	TBT	
	FE	**IV + FE**
Share of CEOs		
TBTs	−0.0001	0.001***
	(0.0002)	(0.0003)
Tariffs	0.001	0.002
	(0.0019)	(0.002)
Share of sales executives		
TBTs	0.0009*	0.003***
	(0.000457)	(0.0001)
Tariffs	−0.004*	−0.008***
	(0.002)	(0.002)
Share of engineers		
TBTs	0.002***	0.007***
	(0.0005)	(0.001)
Tariffs	−0.003*	−0.002
	(0.002)	(0.002)
Share of other top managers		
TBTs	−0.0002**	−0.0005***
	(0.0001)	(0.0001)
Tariffs	−0.0002	0−0.000
	(0.0008)	(0.0011)
IV: TBT		0.455***
IV: Tariff		0.827***
Observations	189,981	189,944
First Stage Kleibergen-Paap Wald rk F statistic		165.41
Number of firms	29,991	29,982
Firm FE & Sector × Year FE	YES	YES

Note: Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage Tariff equation.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

TABLE 11 Effect of TBTs on managerial sub-layers.

	TBT	
	FE	**IV + FE**
Share of CEOs		
TBTs	−0.00010	0.0006*
	(0.0002)	(0.0003)
Tariffs	0.007	0.01
	(0.005)	(0.006)
Share of sales executives		
TBTs	0.0002	0.001
	(0.0005)	(0.001)
Tariffs	−0.005	−0.001
	(0.006)	(0.007)
Share of engineers		
TBTs	0.002***	0.007***
	(0.0006)	(0.001)
Tariffs	−0.004	−0.007
	(0.005)	(0.005)
Share of other top managers		
TBTs	−0.0002*	−0.0005***
	(0.0001)	(0.0001)
Tariffs	−0.001	−0.0006
	(0.0029)	(0.003)
IV: TBT		0.467***
IV: Tariff		0.853***
Observations	64,045	64,045
First Stage Kleibergen-Paap Wald rk F statistic		169.55
Number of firms	7420	7419
Firm FE and Sector × Year FE	YES	YES

Note: Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage tariff equation. Top exporters serving more than six markets.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

TABLE 12 Effect of TBTs on the firm organization.

	TBT	
	FE	**IV + FE**
Total layers		
TBTs	0.0001	0.012
	(0.004)	(0.007)
Tariffs	0.025	0.018
	(0.026)	(0.030)
Probability of adding a top manager		
TBTs	−0.001	−0.004
	(0.0015)	(0.003)
Tariffs	−0.0224	−0.0221
	(0.0148)	(0.0179)
Probability of adding a CEO		
TBTs	−0.0008	0.0113*
	(0.0034)	(0.0066)
Tariffs	0.0415**	0.0329
	(0.0194)	(0.0229)
IV: TBT		0.455***
IV: Tariff		0.827***
Observations	189,996	189,959
First Stage Kleibergen-Paap Wald rk F statistic		165.41
Number of firms	29,995	29,985
Firm FE & Sector × Year FE	YES	YES

Note: Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage Tariff equation.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

increase in skill-intensive fixed export costs implied by a TBT at destination may induce an *ad hoc* additional hierarchical layer in the firm. Hence, in this section we test whether the increasing complexity faced by firms in export markets has an impact on the number of hierarchical layers in the firm's organization, that is, on the extensive margin of the organizational structure, as defined in Table A1 following Caliendo et al. (2015).

Table 12 shows regression results both from OLS and 2SLS fixed effects models (along the lines of Equation (1)) but using, in turn, three different dependent variables: (*i*) the total number of hierarchical layers in the firm, (*ii*) the probability of adding a sub-layer among the top management positions (sale executives, engineers and other top managers), and (*iii*) the probability of adding a sub-layer among firm managers (including CEOs or firm directors).[53] Unfortunately, we could not replicate exactly the same dependent variable as in Guadalupe and Wulf (2010) because

we do not have information on who is reporting directly to the CEO and on who holds divisional management positions within the firm.

Results reported in Table 12 show that TBTs have a positive but imprecisely estimated effect on the total number of layers (t-stat 1.7, see column 2 in Table 12). Consistently, TBT have a positive and significant effect (2SLS specification) on the probability of adding a new sub-layer at the top of the firm's hierarchy (CEOs). These results suggest that the imposition of a new TBT does affect the number of layers in the firm—even the point estimate is somewhat imprecise—and that it also positively (and significantly) affects the probability of adding a new sub-layer at CEO level. In particular, TBTs increase the probability of firms to add a layer at CEO level by 1.1 percentage points.

The estimation results on the total number of layers in the firm and on the probability of adding a new sub-layer at CEO level, taken together, suggest that the imposition of a new TBT induces the firm to increase the number of sub-layers at the top of the hierarchy, thereby increasing the total number of layers in the firm.

5 | CONCLUDING REMARKS

This article provides an empirical assessment of the effect of restrictive technical standards at destination on the occupational composition of exporting firms. Using detailed data on employers and employees matched at the firm level for the universe of French exporters, together with information on exports by country of destination and STC on restrictive TBTs released by the WTO, we identify the effect these NTMs by exploiting (unexpected) changes in trade restrictive TBTs imposed on EU exports. The use of an IV strategy implies that identification is based on the assumption that the exclusion restriction holds. With this *caveat* in mind, our IV results—supported by an extensive set of robustness checks—suggest that TBTs, by increasing the fixed costs required to serve a given destination (adaptation cost), change the skill composition within the firms in favor of skill-intensive occupations. In particular, an additional restrictive TBT among the destination-product combinations served by the firm increases the share of managers by one percentage point, and reduces the share of professional, skilled and unskilled blue-collar jobs respectively by 0.3, 0.3, and 0.2 percentage points. Among the managerial occupations, the share of engineers in production is the most affected by the imposition of restrictive TBT at destination. This supports the idea that new restrictive technical standard at destination forces the firm to adapt its workforce composition by hiring workers (engineers) capable of adapting the product to the new standard.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Access to confidential data was provided by the Secure Data Access Center (CASD) (project LAMENTB). See: https://www.casd.eu/en/

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ENDNOTES

[1] Matsuyama (2007) argues that fixed export costs are skill intensive because they involve services and tasks related to marketing, research, communication, and logistic knowledge. Brambilla et al. (2012) provide empirical evidence in support of this view.

[2] Pascal Lamy, the former Director General of the World Trade Organization (WTO), evoked the increasing role of NTMs as potential protectionist policies in his farewell statement: "The issue today is with the difficulties involved in trade opening. Domestic trade politics have become more difficult and trade deals have become more complex because the nature of obstacles to trade has evolved. We are no longer negotiating just the reduction of tariffs, but also of non-tariff barriers, which have gained enormous importance."

[3] A technical regulation is "a document that sets out product characteristics or related processes and production methods, including the applicable administrative provisions, with which compliance is mandatory. It may also include or deal exclusively with terminology, symbols, packaging, marking or labeling requirements as they apply to a product, process or production method" (UNCTAD, 2019). The International classification of NTMs is available at: https://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/NTMs-Classification.aspx. A detailed definition of TBTs is provided at: https://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/MAST-Group-on-NTMs.aspx.

[4] STCs on TBTs are cases raised at the WTO TBT Committee by a complaining country (one or more) against a technical standard imposed by another WTO member state on a (claimed) unjustified basis. An example of STC on a TBT measure is the concern raised by the European Union in 2011 at the dedicated TBT WTO committee on Australia's Tobacco Plain Packaging Bill that fixed the size of tobacco products' packaging to be sold in Australia.

[5] In earlier work, Fontagné and Orefice (2018) have shown that trade restrictive TBTs impact mainly the extensive margin of trade for French companies, with a small (weak) effect on the intensive margin. The same conclusion holds in sector-aggregated estimations. In the framework of trade models with heterogeneous firms (Chaney, 2008), this outcome is consistent with an increase in fixed rather than variable export costs, and justifies interpreting the imposition of new TBTs as an increase in fixed export costs. While TBTs arguably raise *fixed* export cost, other NTMs, such as Sanitary and Phyto-Sanitary or the Pre-Shipment Inspection measures represent a mix of fixed and variable export cost (see Fontagné et al., 2015; 2020), and therefore are less likely to affect firms' skill intensity. TBTs differ from Sanitary and Phyto-Sanitary measures (SPS) as the former relate to technical standard of mainly manufacturing products, while the latter concern mainly food and agri-food product and their ingredient composition (contents of pesticides, ingredient mix, etc.).

[6] Of course, the overall demand for labor may shift in reaction to changes in exports. Our analysis is not concerned with the impact of TBTs on the *level* of employment in exporting firms, but rather on the within-firm composition of the workforce.

[7] Of course, the fact that TBT concerns are raised by countries other than the EU does not make the decision to enter the market exogenous. However, for our IV-based identification strategy to work, it is sufficient that the instrument is uncorrelated with the (endogenous) entry decision (i.e., that the exclusion restriction holds).

[8] We try and provide further confidence that our results are not picking up the endogenous selection of firms into specific destination markets, by showing results from two additional stratification sample checks, based on different subsets of firms with arguably homogeneous productivity levels or serving a stable set of destinations over time.

[9] We use the "DADS-postes," which covers the universe of French firms. The drawback is that some individual characteristics of employees, such as education, are not observable.

[10] See Section 2.2 for detailed description of occupation groups.

[11] Using data on 16 Western European countries, Goos et al. (2014) study the role of offshoring and technological change on the job polarization of EU labor markets over the period 1993–2010. They show the rise

in employment shares for high-paid professionals, managers and low-paid personal service workers; and the contemporaneous fall in the employment share for manufacturing routine office workers. Using matched French employer-employee data from 1994 to 2007, Harrigan et al. (2020) find a polarization pattern particularly detrimental to middle wage occupations. Using matched employer-employee Danish data over the period 1999–2009 Keller and Utar (2016) attribute one sixth of the decline in mid-skills workers employment to the Chinese import competition. Kerr et al. (2019) show that the job polarization pattern observed in Finland over the period 2000–2014 has been fueled by the dynamics of entry firms for the low-level service tasks increase, and by continuing firms for the high-level abstract tasks.

[12] Trade shocks may also affect the portfolio composition of exporting firms. This channel has also been analyzed in (Bernard et al., 2011; Fontagné et al., 2018; Mayer et al., 2014).

[13] Exceptions in this respect are Bas and Bombarda (2013) and Maurin et al. (2002) who consider the labor market consequences of trade liberalization at destination.

[14] Using French data, Caliendo et al. (2015) find evidence that French manufacturing firms grow by actively managing the number of layers in their organization, while Caliendo et al. (2020) find that expanding Portuguese firms add layers of (middle) managers.

[15] The present paper also adds to the literature on the relationship between executive team structure, market competition and firm's product choice (Bresnahan et al., 2002; Guadalupe et al., 2014; Guadalupe & Wulf, 2010), and to the literature studying the link between management practices and propensity to export that finds that management is disproportionately more important for trade operations than for domestic ones (Bloom et al., 2021).

[16] We discard trade concerns raised on Sanitary and Phytosanitary measures (SPSs) because they constitute a mix of fixed and variable costs with unclear expected consequences on the occupational structure of firms. Following Matsuyama (2007) we do expect only fixed export cost related shocks affect the skill composition of firms. SPSs are mostly related to the contents of food products (ingredient mix) and do not concern technological and/or technical standard to be complied with (small fixed costs component attached to SPS). Indeed, as showed in Fontagné et al. (2015) the imposition of a new SPS measure implies a mix of variable and fixed costs for the exporting firms.

[17] Notice that raising a STC is a prerogative of member states. Single firms are not allowed to raise autonomously STC at the WTO committee. The possibility that a single firm may lobby its government to raise a STC is discussed in Section 3 and addressed by both the inclusion of firm fixed effects and our IV strategy.

[18] The discussion at the WTO Committee can be on existing (in force) or TBT measures still in the pipeline.

[19] Information and official documents concerning each TBT STC are publicly available through the TBT Information Management System of the WTO. See http://tbtims.wto.org/

[20] The STC dataset is available at http://www.wto.org/english/res_e/publications_e/wtr12_dataset_e.htm.

[21] Technical standards may reveal consumer tastes at destination.

[22] See https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds231_e.htm

[23] See document G/TBT/N/CHN/20/Rev.1.

[24] Each concern can be raised by one or more countries. In few cases, the same STC is raised by both EU and non-EU countries.

[25] Given the nature of our exercise, ideally one should use a more disaggregated product classification. French custom data are provided at HS 6-digit level, and this would be the ideal product-aggregation to test whether a firm is affected by the presence of a technical standard at destination. However, in the STCs notified at the WTO the sector information is almost exclusively reported at the broad HS 4-digit level (only very few STCs give information at HS 6-digit level).

[26] This represents an additional advantage to the use of alternative dataset (e.g., by WITS) who provide only cross-sectional information on the presence of TBTs.

[27] The publicly available dataset does not include the year of resolution of STCs. On this respect we benefited from a confidential data by the WTO, in which a STCs on TBT is assumed to be solved if it is not raised in WTO committee for two years or more. The date of the last raising at the TBT committee is assumed to be the date of the resolution of the STCs. In our dataset, the great majority of STC on TBT last between 2 and 3 years.

[28] Provided by the DGDDI (*Direction Dénérale Des Douanes et Droits Indirects*), these data are subject to statistical secrecy and are quasi exhaustive of the universe of French exporters. There is only a declaration threshold of 1000

euros that applies to any extra-EU destinations (for European countries such threshold is higher and around 150,000 euros).

[29] A full list and description of the French occupation categories defined by the French Statistics Institute (INSEE) can be found here: https://www.insee.fr/fr/information/2406153.

[30] The left panel of Figure 1 shows only active STCs on TBT.

[31] In 2000-2001 many concerns raised by the EU were resolved. In particular, the sudden reduction in the number of active TBT concerns in 2000–2001 is due to the resolution of two big STCs raised by the EU against measures imposed by Egypt on 219 HS4 chapters and solved in 2000–2001 (see minute G/TBT/Notif.98.206).

[32] For all French firms in each HS 4-digit sector and year, we calculate the number of destination-product combinations covered by TBT, and we compute the average across firms in our sample in each HS4-year combination. The horizontal axis of Figure 2 reports the 2010–1995 change of such averages.

[33] Although from French custom data allow us to observe over one hundred thousands firms, the sample of firms is considerably reduced as we exclude firms with fewer than five employees (as job composition being meaningless for micro-firms), and firms that do not appear in matched employer-employee DADS data (i.e., French exporters not obliged to declare their workforce composition).

[34] Occupation groups are defined in Section 2.2.

[35] We use effectively applied bilateral tariffs from the MAcMap-HS6 database (http://www.cepii.fr/CEPII/fr/bdd_modele/presentation.asp?id=12).

[36] We prefer to compute the simple rather than the weighted average across product-destination tariffs to avoid the endogeneity concern of any export-based weight used to compute the weighted average.

[37] We keep the number of TBTs at $t-1$ as we assume that any adjustment in the workforce composition of firms takes time. Taking the lagged number of concerns faced by the firm also reduces reverse causality concerns.

[38] In a robustness check discussed in Section 4.1.3 we control (i.e., weight) for the importance that different TBT-imposing destinations have for the specific firm.

[39] We address the concern that the $TBT_{i,t-1}$ variable may simply reflect the *total* number of destinations served by a given firm in Section 4.1, where we check the robustness of our results on different sub-samples of firms with stable portfolios of destinations over time.

[40] Since the $TBT_{i,t-1}$ variable captures both the imposition or the resolution of a TBT restrictive measure, its effect on the occupational composition has to be interpreted as symmetric.

[41] Finally, one may worry about the residual endogeneity of TBTs if unobserved HS 4-digit specific shocks (as opposed to shocks at the 1-digit sector level controlled for by $\gamma_{s,t,k}$) affect both the workforce composition of firms and the probability of observing a TBT at destination.

[42] One obvious option would be to select firms with a constant set of destinations over the entire period. However, this dramatically reduces the size of the sample.

[43] For each firm we count the total number of years of presence in a destination country and then compute the average across all destinations.

[44] We count number of consecutive years in which each firm exports into a specific destination (export-spell) and take its minimum. Thus, for each firm-destination, we have the shortest export-spell. Next, we average across destinations.

[45] The endogeneity concern is particularly remote when the effectively applied tariff corresponds to the applied MFN rate. Indeed, MFN applied tariffs are not set to face imports from a specific country.

[46] Recall that average firm productivity is captured by fixed effects.

[47] By switching from the full sample to multi-destination firms (i.e., those with more than 6 destinations) the number of observations is reduced by 66%, as we lose small firms with very incomplete time span and firms exporting to a very small number of destinations.

[48] The table also reports the first-stage coefficients of the instruments and the Kleibergen-Paap Wald F test that shows no evidence of weak instruments problems.

[49] The simple count of TBTs among firms' product-destination markets reduces if the firm exits the market when a TBT is imposed.

[50] In practice the Social and Economic Committee of the company has extended tasks and competencies *above* 49 employees. It is in particular informed and consulted on matters concerning employment conditions or the introduction of new technologies.

[51] In the French occupation classification the CS=2 refers to "*Chef d'entreprise salarié*" which is loosely translated here as CEO. For simplicity we keep this definition of CEO in what follows with the disclaimer of imperfect translation.

[52] We divide the category management into the following categories: CEOs: CS=2; Sales Executives: CS = 37; Engineers: CS = 38 and Other professionals: CS = 31-33-34-35.

[53] We grouped sales executives, engineers and other top-managers in a single category for the sake of table readability. The effect of TBT on each specific managerial job is not statistically significant. Results are available upon request.

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APPENDIX A. DATA DETAILS AND ADDITIONAL RESULTS

A.1 Occupations

Table A1 reports the definition of the occupation breakdown.

TABLE A1 Occupations.

Occupation	Definition	Description
Management	CS=2	CEO
	CS = 38	Engineers
	CS = 37	Sales executives
	other CS = 3	Other managers
Professionals	CS = 4	Interm. profess. (sales, administration) and technicians
White-collar workers	CS = 52-56	Administration and sales employees
Skilled blue-collar workers	CS = 62-65	Qualified production workers
Unskilled blue-collar workers	CS = 67-69	Non-qualified production workers

TABLE A2 Effect of TBTs on managerial sub-layers.

	TBT		
	IV + FE	**IV + FE**	**IV + FE**
Share of CEOs			
TBTs	0.00125***	0.00108***	0.00148***
	(0.000368)	(0.000404)	(0.000460)
Tariffs	0.00644*	0.00309	0.000236
	(0.00331)	(0.00432)	(0.00605)
Share of sales executives			
TBTs	0.00312***	0.00377***	0.00358***
	(0.00103)	(0.00109)	(0.00121)
Tariffs	−0.0122***	−0.0177***	−0.0188**
	(0.00376)	(0.00490)	(0.00788)
Share of engineers			
TBTs	0.00709***	0.00668***	0.00796***
	(0.00103)	(0.00108)	(0.00121)
Tariffs	−0.00345	−0.00519	−0.00159
	(0.00322)	(0.00433)	(0.00655)
Share of other top managers			
TBTs	−0.000447***	−0.000465***	−0.000530***
	(0.000160)	(0.000173)	(0.000184)
Tariffs	−1.69e−05	−0.000247	−0.00128
	(0.00151)	(0.00187)	(0.00238)
IV: TBT	0.452***	0.448***	0.449***
IV: Tariff	0.815***	0.812***	0.807***
Years of presence at destination (average)	3	4	5
Observations	144,322	102,701	65,181
First Stage Kleibergen-Paap Wald rk F statistic	153.67	141.39	115.06
Number of firms	18,418	11,969	7216
Firm FE and Sector × Year FE	YES	YES	YES

Note: This table includes French firms with an average export presence into a given destination of at least and alternatively 3 (column 1), 4 (column 2), or 5 (column 3), that is, average export presence across destinations. Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage tariff equation. Firms with stable portfolio of destinations: at least 3 to 5 years of presence in a given destination.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.

TABLE A3 Effect of TBTs on managerial sub-layers.

	TBT		
	IV + FE	IV + FE	IV + FE
Share of CEOs			
TBTs	0.00115**	0.00122*	0.00240***
	(0.000476)	(0.000634)	(0.000882)
Tariffs	0.00677	−0.000773	0.00844
	(0.00544)	(0.00951)	(0.0170)
Share of sales executives			
TBTs	0.00447***	0.00194*	0.00158
	(0.00112)	(0.00110)	(0.00150)
Tariffs	−0.0233***	−0.0155	−0.0213
	(0.00634)	(0.0118)	(0.0222)
Share of engineers			
TBTs	0.00674***	0.00744***	0.00987***
	(0.00119)	(0.00144)	(0.00227)
Tariffs	0.00191	−0.00318	−0.0127
	(0.00512)	(0.00865)	(0.0131)
Share of other top managers			
TBTs	−0.000600***	−0.000560**	−0.000541*
	(0.000192)	(0.000241)	(0.000303)
Tariffs	0.000182	0.00257	0.00137
	(0.00185)	(0.00364)	(0.00413)
IV: TBT	0.443***	0.459***	0.469***
IV: Tariff	0.807***	0.761***	0.693***
Minimum export-spell at destination (average)	3	4	5
Observations	69,774	35,743	18,090
First Stage Kleibergen-Paap Wald rk F statistic	104.39	63.46	115.06
Number of firms	8532	4236	2151
Firm FE & Sector × Year FE	YES	YES	YES

Note: This table includes French firms with an average export-spell into a given destination of at least and alternatively 3 (column 1), 4 (column 2), or 5 (column 3), that is, average (minimum) export-spell across destinations. Standard errors in parentheses clustered by firm. The middle panel reports the main first-stage coefficients. IV: TBT is the coefficient on the instrument for TBT of the first-stage TBT equation. IV: Tariff is the coefficient of the instrument for tariffs of the first-stage tariff equation. Firms with stable portfolio of destinations: at least 3 to 5 years export-spell in a given destination.

***$p < .01$; **$p < .05$; *$p < .1$.

Source: DADS, WTO STCs and French custom data for 1995 to 2010.