Firm Exports and Quality Standards: Evidence from French Food Industry *

Anne-Célia Disdier, Paris School of Economics, INRA, France
(anne-celia.disdier@ens.fr)

Carl Gaigné, INRA & Université Laval, CREATE, Canada
(carl.gaigne@rennes.inra.fr)

Cristina Herghelegiu, Paris School of Economics, France
(cristina.herghelegiu@gmail.com)

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1 Introduction

Globalization has increased interdependencies between countries and therefore the need for effective regulation. Over the years, standards addressing health and environmental concerns have proliferated. As a consequence, trade has been affected (Andriamananjara *et al.* , 2004; Disdier *et al.* , 2008; Hoekman & Nicita, 2011). Even when quality measures are designed to correct market failures, such as information asymmetries, there can still be unintended negative trade effects and an increase in the costs of exporting. Although there is a growing body of empirical literature analyzing the effect of increasing standards on international trade, the main part of the evidence comes from macroeconomic trade models, usually gravity models. This literature has mainly pointed to evidence in support of the standards as barriers to trade. While the empirical evidence from gravity models is very informative, it fails to capture microeconomic effects. Individual producers may react differently to increasing standards, resulting in different trade impacts.

Understanding firms' exporting behavior is one of the most important open questions in international trade. A well-established stylized fact in the trade literature postulates that only the most productive firms are able to cover additional (fixed) costs and export (Melitz, 2003). Nevertheless, standards – or changes in their stringency – affect not only exporters with different productivity levels, but also the degree of competition in the importing market. Standards imply higher costs and may affect the distribution of output prices and product quality, the exit and entry of firms, the number of importers and exporters, and finally trade. Hence, the assessment of trade effects of standards on heterogeneous exporters is a crucial issue.

Food standards have drawn much attention lately. They have evolved over time in most countries around the world, becoming ever more stringent and complex, due to consumers' requests (Josling *et al.* , 2004). Hence, in this paper we investigate the effect of quality standards, such as Sanitary and Phyto-sanitary measures (SPS) and Technical Barriers to Trade (TBTs), on the different margins of trade in the agri-food sector, accounting for the hetero-

geneity of exporters. More precisely, we analyze whether these standards affect exporters with different productivity levels differently.

Our contributions to the literature are three-fold. First, we use the most recent and comprehensive dataset on NTMs, developed by UNCTAD (United Nations Conference on Trade and Development) with other international partners. Countries included cover as much as 80% of world trade. Also, all types of NTMs present in these countries are included. We merge this novel dataset which gives a good picture of the landscape of NTMs at a particular point in time with one covering all exporting French firms. Second, we focus on the impact of both SPS and TBT measures on French firms' exports of agri-food products, after controlling for the existence of other types of measures that can potentially affect trade. Third, we consider whether there are quality measures in France on a given product. French firms selling in the domestic market are required to comply with these quality standards. Therefore, exporting firms that already comply with standards at home are more likely to be able to comply with standards in their destination market.

Our main findings are as follows. We show a negative and significant impact of quality standards on the extensive margin of trade (i.e. firm participation in the export market). However, when firm heterogeneity is accounted for, we find a positive and significant impact of standards on the extensive margin for the most productive French firms in the agri-food sector. As for the intensive margin (i.e. the value of exports), we observe a positive and significant impact of quality measures on the value of agri-food exports of French firms. This effect is due to the most productive firms. All in all, results suggest that the exit of less productive domestic and foreign firms from the domestic market benefits the most productive foreign (here French) firms. The market share of the most productive firms tends to increase due to a reallocation of demand.

The rest of the paper is organized as follows. Section 2 reviews the literature on the impact of quality standards on firms' exports. Section 3 describes the data. Section 4 presents the empirical strategy, whereas Section 5 shows the results. Section 6 concludes.

2 Literature Review

Several theoretical and empirical papers have focused on the effect of standards on the firms' exporting behavior. First, we focus on the theoretical literature. Recently, there has been much interest in the introduction of vertical quality differentiation to explain why there is quality-sorting in international trade. For instance, Kugler & Verhoogen (2012) allow for vertical differentiation in product quality to explain why larger plants tend to specialize in higher quality products and pay higher input prices. They found evidence that larger, more productive Colombian plants operating in industries with possibility for vertical differentiation tend to specialize in higher quality products and pay more for their inputs.

Crozet *et al.* (2012) show that firms exporting to a larger number of destinations price their goods more dearly. Their empirical analysis relies on the Champagne industry, for which a direct measure of product quality is available. **?** introduce the concept of product quality productivity and show that a small firm producing a high quality product can export. Relying on Italian food producers, Curzi & Olper (2012) confirm that more efficient firms sell higher-quality goods at higher prices and serve more distant markets.

Finally, Gaigné & Larue (2016) study the impact of public quality standards on industry structure in a context of international trade. This paper is central to our paper, because our empirical analysis will be based on the conclusions of this study. The authors introduce vertical differentiation in a firm-based trade model, relying on monopolistic competition, in which firms differ in terms of their productivity and must incur both fixed and variable costs. The authors show that the absolute mass of firms in any country is decreasing with the domestic standard. Increasing public quality standards benefits highly productive foreign firms which gain from the quality induced exit of less productive domestic and foreign firms, through a reallocation of demand.

Second, we review the empirical literature. On the empirical side, studies exploring the impact of standards on firms' exports are scarcer. To the best of our knowledge, only five

studies have focused on this topic. Chen *et al.* (2008) are the first to analyze how complying with foreign standards affects firms' export performance in developing countries. More precisely, their study is based on the World Bank Technical Barriers to Trade Survey database of 619 firms in 17 developing countries. They show that testing procedures and lengthy inspection procedures by importers decrease exports by 9% and 3%, respectively. Standards negatively affect the extensive margin of trade, reducing the probability of exporting to more than three markets by 7%. A limitation of this study is the fact that it relies on subjective survey responses by firms of whether standards affected their exports.

Reyes (2011) shows that the harmonization of European Union (EU) electronics regulations with international standards increased U.S. exports to the EU, because more US firms were able reach the European market. These firms appear to be less productive than those already present on the European market. However, the exports of incumbent firms are reduced. All in all, Reyes argues that working toward a harmonization of product rules across markets could be a supportive policy to encourage small and medium size firms' ability to enter new export markets.

Fontagné *et al.* (2015) analyze the effect of SPS specific trade concerns on the different margins of trade, controlling for the heterogeneity of exporters. The study is focused on French firms. Only measures perceived as restrictive are considered. They find that SPS concerns discourage the presence of exporters in SPS-imposing foreign markets, except for larger firms. A negative effect of SPS imposition is also found on the intensive margin of trade. However, SPS concerns have a positive effect on trade for larger firms.

Fernandes *et al.* (2015) explore the effect of product standards on firms' export decisions. The study covers all exporting firms in 42 developing countries. Among standards, they focus on pesticide standards for 243 agricultural and food products in 63 importing countries over 2006–12. They show that more restrictive standards in the importing country, compared to the exporting country, reduce both the extensive (i.e. the probability of exporting) and the intensive margins of trade (i.e. export values and quantities). The relative restrictiveness

of standards also deters exporting firms from entering new markets and leads to higher exit rates from those markets. Smaller exporters are more negatively affected in their market entry and exit decisions by the relative stringency of standards than larger exporters.

As previously mentioned, our paper tests the predictions of Gaigné & Larue (2016) model and contributes to the empirical literature on the effects of standards on trade, accounting for heterogeneous exporters. We focus on French firms' exports of agri-food products. Our study is different from the others in that it analyzes the effect of both SPS and TBT measures, controlling for other NTMs that may potentially impact trade. The most recent and comprehensive dataset on NTMs is used. Also, we consider not only standards in the destination country, but also French standards (which are aligned with the European standards). The existence of a standard in France on a given product may facilitate trade, given the fact that the firm has to comply with the standard at home.

3 Data

This section presents the data used in the empirical analysis, their characteristics, the rationale behind their use, as well as some descriptive statistics.

3.1 NTMs

This study relies on the TRAINS (Trade Analysis Information System) database, released in July 2016 by UNCTAD, on the occasion of its 14th Ministerial Conference, and made publicly available through WITS (World Integrated Trade Solution). It is the most comprehensive NTM database, covering 56 countries, which account for 80% of world trade. Data are available for a single year over the 2012-2015 period, depending on the year of collection which varies across countries. The information refers to a broad range of policy tools, including traditional trade policy instruments such as quotas or price controls, but also instruments pursuing non-trade objectives, related to health and environmental protection (Sanitary and Phytosanitary (SPS) measures and Technical Barriers to Trade (TBT)). Overall, the dataset includes 38000 measures, which are classified according to the International Classification of

NTMs at the most detailed level. According to this classification, measures are categorized into chapters, depending on their scope and/or design, and each chapter is further divided into several subgroups. The classification of NTMs includes 16 chapters (A to P), and each individual chapter is divided into groupings of one, two and three digits. Although a few chapters reach the three-digit level of disaggregation, most of them stop at two digits. All chapters reflect the requirements of the importing country on its imports, with the exception of measures imposed on exports by the exporting country (chapter P). Data are coded at the 6-digit level of the Harmonized System (HS). All in all, the dataset provides information on the number of measures associated to each grouping within a chapter by HS6 product across countries.

In our analysis, we aggregate the information at the chapter level for each product and country. For instance, in the end, we will have the total number of SPS measures associated to an HS6 product in a given country. As previously mentioned, our analysis focuses on the impact of quality measures, more precisely SPS and TBT measures. However, as the other NTMs also impact trade, we will consider them in the analysis as control variables. NTMs are aggregated at the HS6 level, being spread over 5000 different products. France exports to 54 out of the 56 countries from the database, if we also consider imports towards the EU as a whole. Both developed and developing countries are included. This is the first dataset, with complete information on developed countries such as the United States, Canada, Australia, besides the European Union and Japan. We will rely on the total number of measures imposed by a country on an HS6 product for each NTM chapter (i.e. SPS, TBT, price measures etc.). A complete list of destination countries for French firms' exports as well as the years of collection of the data for each country are presented in Table 1.

Table 1 about here

In what follows, we analyze more carefully the data, in order to understand the importance of NTMs in the agri-food sector. Table 2 shows that the majority of countries impose some form of NTMs on more than 600 out of the 664 HS6 agri-food products. The only exceptions are Afghanistan, Costa Rica, Ecuador, El Salvador and Thailand. Also, for each country, the majority of the 664 agri-food products is affected by SPS and TBT measures. That

means that the share of products affected by SPS and TBT measures is greater than 80% for most of the countries. Also, in most of the cases, SPS and TBT measures are usually used together. As for the other NTMs, their share is also high, which is explained by the fact that we consider them all together.

Table 2 about here

Table 3 presents the average number of NTMs affecting the agri-food products in each country. We notice that in the developed countries, agri-food products are affected, on average, by a higher number of SPS measures (11.66) than the rest of the countries. There are also a few developing countries with a high average number of SPS measures, such as China, India, Liberia, New Zealand, Philippines, Thailand, Vietnam. The average number of TBT measures affecting the agri-food products is way lower than the number of SPS measures, which is normal since the focus is on the agri-food sector where SPS measures are prevalent. As for the other NTMs, their average number on a product is even lower than that of TBT measures.

Table 3 about here

Table 4 presents the previous statistics, with respect to French products actually exported to those destinations. Thus, we can notice that almost all French exports of agri-food products are affected by some form of NTMs. Two thirds of all countries impose NTMs on all agri-food products coming from France. The average number of NTMs affecting French exported products is high, especially in the case of developed countries. However, there are also many developing countries imposing, on average, a high number of NTMs on French exports. The overall average number of NTMs imposed on French exports is 11.24. As before, the average number of SPS measures is higher than the average number of TBT measures or other NTMs.

Table 4 about here

Moreover, Figure 1 shows how the number of French exported products is affected by different types of NTMs in each country. We notice that products exported towards high income countries, except for the European Union and Japan, are almost all affected by 3 or more categories of NTMs. In the case of Japan only half of the products are affected by 3 or more

categories of NTMs, the other half being affected only by 2 categories of measures. In only two countries the majority of agri-food products exported by France are affected by a single category of measures: Cote d'Ivoire and Senegal. In the rest of the countries, most agri-food products exported by France are subject to NTMs from at least two categories. In the case of Asia, French exports are affected by NTMs from at least 3 categories in the majority of cases.

Figure 1 about here

3.2 French Firms

The two main datasets reporting information at the firm level and used in the analysis are the following. The first source is the balance sheet dataset BRN (Bénéfices Réels Nofirmaux). The BRN database relies on mandatory reports of French firms to the tax administration, further transmitted to INSEE (the French Statistical Institute). This dataset includes several pieces of information such as firms' total sales and export sales, employment, capital stock, value added, the industry, year, and other balance-sheet variables. This dataset encompasses both small and large firms, no threshold being applied the number of employees.

The second source of data used in this paper corresponds to the French customs data, which reports exports flows for each firm, destination and product. Both the quantity (in tons) and value of each flow are reported. We also construct unit values, as the ratio between export values and quantities. The product classification system is the European Union Combined Nomenclature at 8 digits (CN8).

The two datasets are merged. As NTMs are available for a single year over the 2012-2015 period, we retain a single year for French firms' exports dataset. The retained year is 2009. Some descriptive statistics for French firms export are presented in what follows.

Our dataset includes 14383 French firms which export 662 agri-food products towards 78 countries, if we also consider intra-european trade and the EU members separately. 56.52% of all firms export to developed countries only. 15.27% export to developing countries only and 28.20% export to both developed and developing countries. A firm exports, on average,

4.18 products. Also, a firm exports, on average, to 4.40 destinations.

Table 5 about here

4 Empirical strategy

Our empirical strategy seeks to explain both margins of trade - the extensive margin (i.e. the presence of an exporter on a given market) and the intensive margin (i.e. the value of exports) - with respect to quality measures and firms' characteristics. We control for bilateral tariffs, other NTMs that may affect trade and a set of fixed effects accounting for other factors with a potential impact on trade.

The first equation is the following:

$$y_{fkj} = \beta_0 + \beta_1 \cdot QualityNTMs_{kj} + \beta_2 \cdot QualityNTMs_{kj} \cdot Productivity_f + \beta_3 \cdot Tariffs_{kj} + \beta_4 \cdot otherNTMs_{kj} + \gamma_{fj} + \delta_k + \epsilon_{fkj} \quad (1)$$

where *f*, *k*, *j* stand for firm, HS6 product, and destination market, respectively.

The dependent variable is associated with measures for both the extensive and the intensive margins. First, we define the (firm-product) extensive margin as a dummy set to 1 if there is a positive trade flow into a certain product-destination market pair and 0 otherwise. Second, the measure for the intensive margin is firm's the value of exports of an HS6 product towards a given destination (in logs). As far as the extensive margin is concerned, the equation is estimated through a linear probability model, in order to avoid the incidental parameter problem that may arise from the use of a sizeable set of fixed effects. Moreover, it provides a direct estimate of the sample average marginal effect. As for the intensive margin, we rely on OLS estimates.

In this equation, we introduce the following independent variables. $QualityNTMs_{kj}$ is either a dummy set to 1 if at least a quality standard (SPS and/or TBT) affects a product k in the

destination market j (and 0 otherwise) or the total number of quality measures (SPS and/or TBT) affecting a product k, in market j (in logs). $Productivity_f$ is the firm productivity computed as the ratio between value added and the number of employees. The interaction of $Productivity_f$ with the $QualityNTMs_{fkj}$ variable is designed to capture heterogeneous export performance across firms. In order to be able to isolate only the effect of quality measures on heterogeneous exporters, we also control for other factors likely to affect trade, such as the other NTMs ($otherNTMs_{kj}$) - defined either as a dummy variable if other measures affect a product or the number of measures affecting a product - and bilateral tariffs ($Tariffs_{kj}$), in logs. Finally, we include firm-destination, γ_{fj}, and product fixed effects, δ_k. Firm-destination fixed effects capture all unobservable characteristics of a firm on a specific market, such as the preference of an importer for the goods of a given firm, for example. Product fixed effects control for systematic differences across goods in consumer appeal, comparative advantage, and other product characteristics that affect all manufacturers equally. We focus therefore on the variation between products.

We then change the set of fixed effects retained in the first equation and we estimate the following equation.

$$\begin{aligned} y_{fkj} =& \beta_0 + \beta_1 \cdot QualityNTMs_{kj} + \beta_2 \cdot QualityNTMs_{kj} \cdot Productivity_f + \beta_3 \cdot Tariffs_{kj} + \\ & \beta_4 \cdot otherNTMs_{kj} + \gamma_{fk} + \delta_j + \epsilon_{fkj} \end{aligned} \tag{2}$$

In equation 2, we introduce firm-product, γ_{fk}, and destination fixed effects, δ_j. Firm-product fixed effects control for firm-product specific characteristics that are invariant across export markets. Destination fixed effects control for systematic differences across destinations that affect all manufacturers equally. We focus therefore on the variation between destinations.

As mentioned, the existence of quality measures in France could make firms more likely to comply with quality measures in the destination country, that is why we proceed to other

estimations to account for this aspect. We estimate two other equations:

$$y_{fkj} = \beta_0 + \beta_1 \cdot QualityNTMs_{kj} + \beta_2 \cdot QualityNTMs_{kj} \cdot QualityNTMsinFrance_k + \beta_3 \cdot Tariffs_{kj} + \beta_4 \cdot otherNTMs_{kj} + \gamma_{fj} + \delta_k + \epsilon_{fkj} \quad (3)$$

$$y_{fkj} = \beta_0 + \beta_1 \cdot QualityNTMs_{kj} + \beta_2 \cdot QualityNTMs_{kj} \cdot QualityNTMsinFrance_k + \beta_3 \cdot Tariffs_{kj} + \beta_4 \cdot otherNTMs_{kj} + \gamma_{fk} + \delta_j + \epsilon_{fkj} \quad (4)$$

In equations (3) and (4), the dependent variable is associated with measures for both the extensive and the intensive margins, as in the previous case. The difference is that we introduce an interaction term between quality NTMs in the destination market and quality NTMs in France. $QualityNTMs_{kj}$ is a dummy variable set to 1 if there is a quality measure on a given product in the destination market. $QualityNTMsinFrance_k$ is a dummy variable set to 1 if there is a quality measure on a given product in France. The interaction of these two terms is likely to capture what happens to French exporters and to their exports towards a given market if there is already a measure in France. Are there more likely to comply with standards abroad if there is a standard at home? The difference between equations (3) and (4) lies in the types of fixed effects used. In the equation (3) we use firm-destination, γ_{fj}, and product fixed effects, δ_k, whereas in equation (4) we use firm-product, γ_{fk}, and destination, δ_j, fixed effects. The estimation techniques are the same as those used for the first two equations.

5 Results

In this section we present results from the estimations of equations (1) and (2). Subsection 5.1 shows findings for the extensive margin of trade, whereas subsection 5.2 refers to findings concerning the intensive margin of trade.

5.1 The extensive margin of trade

The regression results for the impact of SPS and TBT measures on the participation of a French firm in the export market, taking into account the heterogeneity of firms, for the case where quality measures are defined as a dummy variable are presented in Table 6. The first two columns present the results for the estimation with firm-destination and product fixed effects and the next two columns for the estimation with firm-product and destination fixed effects.

Table 6 about here

In the first column we study the effect of quality standards, without controlling for firm heterogeneity. We notice that the existence of quality measures does not impact significantly the probability of exporting, although the sign is negative. We have a positive and significant sign for the other measures. Tariffs, as expected, show a negative and significant coefficient. When we control for firm heterogeneity, in the second column, we notice that the existence of at least one quality measure reduces French firm participation in the export market. However, the existence of quality measures affects differently French exporters with different levels of productivity. The most productive exporters have a higher probability to export when there is a quality measure on a product in a destination market. We obtain the same sign as before for the other measures and for tariffs.

The third column differs from the first one in that we change the sets of fixed effects. In this case, the existence of quality measures leads to a higher firm participation. We still have a positive and significant sign for the other types of NTMs and a negative one for tariffs. When we control for firm heterogeneity, in column 4, results are not significant anymore, which means that we have a reallocation between products, but not between destinations.

The regression results for the impact of SPS and TBT measures on the participation of a French firm in the export market, taking into account the heterogeneity of firms, for the case where we consider the number of quality measures are presented in Table 7. As before,

the first two columns present the results for the estimation with firm-destination and product fixed effects and the next two columns for the estimation with firm-product and destination fixed effects.

Table 7 about here

Column 1 presents the case where we do not account for the heterogeneity of exporters. Results show a clearly negative effect of the total number of SPS and TBT measures on French firm participation in the export market. Thus, if the number of quality measures increases by 1%, the probability of exporting of French firms is reduced by 0.1%. This shows that quality measures constitute an additional cost and increase the productivity threshold for export participation. Tariffs are also negative and significant, whereas the other NTMs are positive and significant.

Column 2 presents results for the case where the heterogeneity of exporters is also taken into account. In this case, we notice that the effect of quality measures on the probability of exporting of French firms is still negative. However, when we take into account the heterogeneity dimension, the coefficient is positive and significant, meaning that more productive firms are more likely to participate in the export market. This result is in line with heterogeneous-firm theory. Thus, less productive firms will not participate in the export market as they cannot reach a given productivity threshold to do so.

Column (3) differs from the first one in that we change the sets of fixed effects. In this case, the existence of quality measures leads to a higher firm participation. We still have a positive and significant sign for the other types of NTMs and a negative one for tariffs. When we control for firm heterogeneity, in column 4, results show that the effect of quality measures on the probability of exporting of French firms is negative. However, when we take into account the heterogeneity dimension, the coefficient is positive and significant, meaning that more productive firms are more likely to participate in the export market.

Now we turn to the results from the estimation of equations (3) and (4), where we consider the existence of quality measures not only in the destination country, but also in the

French market (see Table 8).

Table 8 about here

Quality measures are represented by a dummy variable set to 1 if there is at least one quality measure on an HS6 product in the destination market and in the French market, respectively. The first two columns present results for the case where we include firm-destination and product fixed effects and the next two columns, for firm-product and destination fixed effects.

Results are in line with those expected. For the extensive margin, we notice that if there is a measure in France, the existence of measures abroad makes firms more likely to export, when we retain firm-destination and product fixed effects. Results are not significant anymore when we consider firm-product and destination fixed effects.

5.2 The intensive margin of trade

We now turn to the impact of SPS and TBT measures on the value of exports of a firm. Results are presented in Table 7, taking into account the heterogeneity of firms, for the case where quality measures are defined as a dummy variable are presented in Table 9. The first two columns present the results for the estimation with firm-destination and product fixed effects and the next two columns for the estimation with firm-product and destination fixed effects.

Table 9 about here

In column 1, we do not introduce firm heterogeneity. We notice that the impact of the existence of a quality measure on the value of exports is positive. This results is in line with the theory which states that the remaining firms benefit from the quality-induced exit of less productive firms and will see their market share increase.

In column 2, we control for heterogeneous firms. We notice that the existence of quality

measures implies a lower value of exports for French firms, but when the heterogeneity of exporters is taken into account, we show that the value of exports increases in the existence of a public quality standard. This supports the theory according to which quality standards eliminate less productive domestic and foreign firms, leading to a reallocation of demand towards the most productive foreign ones. Therefore, the most productive firms see the value of their exports increase.

In column 3, we show results for the case where we do not consider firm heterogeneity and we introduce firm-product and destination fixed effects. Results join those obtained before. In column (4) we account for exporters with different productivity levels. Once again, results are in line to those obtained before for the case where we introduce firm-destination and product fixed effects. This validates the theory according to which the exit of less productive firms benefits the highly productive ones which see their market share increase.

The regression results for the impact of SPS and TBT measures on the value of exports of French firms, taking into account the heterogeneity of firms, for the case where we consider the number of quality measures are presented in Table 10. As before, the first two columns present the results for the estimation with firm-destination and product fixed effects and the next two columns for the estimation with firm-product and destination fixed effects.

Table 10 about here

In column 1, we do not take into account firm heterogeneity. Results are not significant. However, in column 2, we control for heterogeneous firms. We notice that the higher the number of SPS and TBT measures, the lower the value of exports of French firms. When the heterogeneity of exporters is taken into account, we show that the value of exports increases with the number of measures. This supports the theory according to which quality standards eliminate less productive firms, leading to a reallocation of demand towards the most productive ones. Therefore, the most productive firms see the value of their exports increase.

These results are confirmed in columns (3) and (4) when we introduce firm-product and

destination fixed effects.

Now we turn to the results from the estimation of equations (3) and (4), where we consider the existence of quality measures not only in the destination country, but also in the French market (see Table 11).

Table 11 about here

Quality measures are represented by a dummy variable set to 1 if there is at least one quality measure on an HS6 product in the destination market and in the French market, respectively. The first two columns present results for the case where we include firm-destination and product fixed effects and the next two columns, for firm-product and destination fixed effects.

Results are in line with those expected for the first set of fixed effects (firm-destination and product fixed effects). We notice that if there is a measure in France, the existence of measures abroad increases the value of exports of French firms. Results are not significant anymore when we consider firm-product and destination fixed effects.

6 Conclusion

This paper has studied the effect of quality measures on both the presence of firms in the export market and the value of their exports, accounting for firm heterogeneity and relying on the agri-food sector. Our results show that the higher the number of SPS and TBT measures on a product, the lower the participation of firms in export markets, but the higher the value of exports of the firms that remain in the market. Our findings also show that the quality measures favor the most productive firms which are able to remain in the export market and see their market share increase through a reallocation of demand.

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Table 1: Countries available

Country	*Year*
Afghanistan	2012
Argentina	2015
Australia	2015
Benin	2014
Bolivia	2015
Brazil	2015
Brunei Darussalam	2015
Burkina Faso	2012
Cambodia	2015
Canada	2015
Cabo Verde	2014
Chile	2015
China	2012
Colombia	2015
Costa Rica	2014
Cote d'Ivoire	2012
Cuba	2015
Ecuador	2015
El Salvador	2014
Ethiopia	2015
European Union	2015
Gambia	2013
Ghana	2014
Guatemala	2014
Guinea	2012
Honduras	2014
India	2012
Indonesia	2015
Japan	2015
Kazakhstan	2012
Lao PDR	2015
Liberia	2014
Malaysia	2015
Mali	2014
Mexico	2015
Myanmar	2015
Nepal	2012
New Zealand	2015
Nicaragua	2014
Niger	2014
Nigeria	2013
Pakistan	2012
Panama	2014
Paraguay	2015
Peru	2015
Philippines	2015
Senegal	2012
Singapore	2015
Sri Lanka	2012
Tajikistan	2015
Thailand	2015
Togo	2014
United States	2014
Uruguay	2015
Venezuela	2015
Vietnam	2015

Table 2: Number and share of products affected by different types of NTMs

Destination Country	*Nb. of products with at least 1 NTM*	*Nb. of products with at least 1 SPS*	*Nb. of products with at least 1 TBT*	*Nb. of products with at least 1 other NTM*	*Share of SPS*	*Share of TBT*	*Share of other NTMs*
Afghanistan	396	282	85	282	71.21	21.46	71.21
Argentina	664	663	659	664	99.85	99.25	100
Australia	664	664	664	664	100	100	100
Benin	664	557	333	664	83.89	50.15	100
Burkina Faso	664	658	106	664	99.1	15.96	100
Bolivia	664	664	664	57	100	100	8.58
Brazil	664	661	663	288	99.55	99.85	43.37
Brunei Darussalam	658	640	575	588	97.26	87.39	89.36
Canada	664	633	664	664	95.33	100	100
Chile	662	658	615	62	99.4	92.9	9.37
China	647	641	533	83	99.07	82.38	12.83
Cote d'Ivoire	664	155	10	664	23.34	1.51	100
Colombia	664	656	664	661	98.8	100	99.55
Cabo Verde	664	556	550	664	83.73	82.83	100
Costa Rica	506	423	442	46	83.6	87.35	9.09
Cuba	614	274	572	572	44.63	93.16	93.16
Ecuador	383	383	382	294	100	99.74	76.76
Ethiopia	664	592	591	664	89.16	89.01	100
European Union	658	631	654	90	95.9	99.39	13.68
Ghana	664	632	563	664	95.18	84.79	100
Guinea	655	655	655	655	100	100	100
Gambia	663	548	533	663	82.65	80.39	100
Guatemala	659	655	580	34	99.39	88.01	5.16
Honduras	653	628	148	10	96.17	22.66	1.53
Indonesia	639	626	407	462	97.97	63.69	72.3
India	664	629	648	664	94.73	97.59	100
Japan	655	639	647	382	97.56	98.78	58.32
Kazakhstan	645	630	255	394	97.67	39.53	61.09
Cambodia	664	588	647	664	88.55	97.44	100
Lao PDR	664	642	163	664	96.69	24.55	100
Liberia	664	664	544	115	100	81.93	17.32
Sri Lanka	664	566	586	664	85.24	88.25	100
Mexico	664	644	644	287	96.99	96.99	43.22
Mali	664	658	82	664	99.1	12.35	100
Myanmar	664	650	569	587	97.89	85.69	88.4
Malaysia	661	630	659	315	95.31	99.7	47.66
Niger	664	611	47	664	92.02	7.08	100
Nigeria	664	532	253	249	80.12	38.1	37.5
Nicaragua	637	621	496	171	97.49	77.86	26.84
Nepal	664	554	664	664	83.43	100	100
New Zealand	664	631	599	664	95.03	90.21	100
Pakistan	664	514	30	664	77.41	4.52	100
Panama	649	624	137	610	96.15	21.11	93.99
Peru	664	632	653	57	95.18	98.34	8.58
Philippines	664	656	631	664	98.8	95.03	100
Paraguay	660	654	620	60	99.09	93.94	9.09
Senegal	634	627	90	123	98.9	14.2	19.4
Singapore	664	588	664	607	88.55	100	91.42
El Salvador	543	523	438	2	96.32	80.66	.37
Togo	664	133	525	664	20.03	79.07	100
Thailand	595	556	589	574	93.45	98.99	96.47
Tajikistan	642	637	203	30	99.22	31.62	4.67
Uruguay	652	628	631	188	96.32	96.78	28.83
United States	664	664	654	664	100	98.49	100
Venezuela	664	664	664	664	100	100	100
Vietnam	664	664	664	664	100	100	100

Table 3: Average number of different types of NTMs

Destination Country	*Avg nb. of SPS by product*	*Avg nb. of TBT by product*	*Avg nb. of other NTMs by product*	*Avg nb. of SPS by product without products without SPS*	*Avg nb. of TBT by product without products without TBT*	*Avg nb. of other NTMs by product without products without NTMs*
Afghanistan	2.33	.64	1.22	3.28	2.99	1.72
Argentina	7.86	2.76	3.3	7.88	2.78	3.3
Australia	12.63	6.15	3.24	12.63	6.15	3.24
Benin	7.91	1.2	8.68	9.42	2.39	8.68
Burkina Faso	2.77	.16	2.54	2.8	1	2.54
Bolivia	4.5	4.6	.15	4.5	4.6	1.72
Brazil	7.77	8.18	.52	7.81	8.19	1.19
Brunei Darussalam	5.7	2.61	1.32	5.86	2.98	1.48
Canada	8.49	8.32	2.23	8.91	8.32	2.23
Chile	6.45	2.21	.1	6.49	2.38	1.03
China	8.23	1.91	.2	8.31	2.32	1.54
Cote d'Ivoire	.35	.02	1.84	1.51	1	1.84
Colombia	5.56	5.31	1.9	5.63	5.31	1.91
Cabo Verde	6.15	2.53	7.23	7.34	3.05	7.23
Costa Rica	3.9	3.78	.1	4.67	4.32	1.07
Cuba	1.38	.97	.93	3.1	1.04	1
Ecuador	6.83	4.13	1.16	6.83	4.14	1.51
Ethiopia	7.17	3.01	9.63	8.04	3.38	9.63
European Union	12.22	3.35	.24	12.75	3.37	1.78
Ghana	5.39	4.85	4.13	5.66	5.72	4.13
Guinea	2.22	2.25	9.33	2.22	2.25	9.33
Gambia	8.43	4	2.27	10.2	4.97	2.27
Guatemala	10.21	1.71	.06	10.28	1.95	1.15
Honduras	7.27	.61	.02	7.56	2.69	1
Indonesia	7.15	1.65	1.06	7.3	2.59	1.47
India	8.84	3.16	3.19	9.33	3.24	3.19
Japan	10.95	2.62	.96	11.22	2.65	1.65
Kazakhstan	3.16	.43	.65	3.23	1.09	1.07
Cambodia	5.63	4.37	2.78	6.35	4.49	2.78
Lao PDR	4.8	.37	4.26	4.96	1.5	4.26
Liberia	9.89	1.04	.21	9.89	1.27	1.22
Sri Lanka	3.46	4.23	4.6	4.06	4.8	4.6
Mexico	5.45	3.35	.5	5.62	3.46	1.16
Mali	3.83	.19	8.49	3.86	1.54	8.49
Myanmar	6.83	2.16	1.83	6.97	2.52	2.07
Malaysia	5.34	3	1.08	5.6	3.01	2.26
Niger	2.51	.22	6.5	2.73	3.09	6.5
Nigeria	7.86	.44	.44	9.81	1.14	1.18
Nicaragua	8.38	2.4	.32	8.6	3.08	1.2
Nepal	1.09	2.15	6	1.31	2.15	6
New Zealand	11.18	3.17	3.06	11.77	3.51	3.06
Pakistan	1	.05	2.12	1.29	1.03	2.12
Panama	6.28	.47	1.01	6.53	2.25	1.07
Peru	6.62	4.98	.1	6.95	5.06	1.14
Philippines	11.45	3.25	8.53	11.59	3.42	8.53
Paraguay	3.5	2.91	.1	3.53	3.1	1.15
Senegal	3.1	.14	.25	3.13	1.01	1.28
Singapore	6.59	2.78	1.08	7.44	2.78	1.19
El Salvador	3.31	1.7	.01	3.44	2.1	2
Togo	.58	3.16	4	2.89	3.99	4
Thailand	9.47	3.06	1.1	10.14	3.09	1.14
Tajikistan	2.36	.35	.05	2.38	1.11	1
Uruguay	4.47	3.85	.31	4.64	3.98	1.06
United States	14.03	7.62	1.92	14.03	7.74	1.92
Venezuela	7.15	4.92	2.88	7.15	4.92	2.88
Vietnam	12.66	2.89	3.1	12.66	2.89	3.1

Table 4: Number of products exported by France and subject to NTMs and average number of NTMs on products exported by France

Country	*Nb. of products exp. by Fr.*	*Nb. of pdcts exp. by Fr. and subject to no NTM*	*Nb. of pdcts exp. by Fr. and subject to at least one NTM*	*Avg Nb. of NTMs on French exp. (only pdcts with NTMs)*	*Avg Nb. of SPS on French exp. (only pdcts with NTMs)*	*Avg Nb. of TBT on French exp. (only pdcts with NTMs)*	*Avg Nb. of other NTMs on French exp. (only products with NTMs)*
Afghanistan	66	39	27	3.07	1.22	.81	1.04
Argentina	107	0	107	13.25	7.66	2.7	2.89
Australia	242	0	242	22.72	13.1	6.35	3.26
Benin	319	0	319	19.62	8.92	1.39	9.31
Burkina Faso	200	0	200	5.66	2.94	.07	2.64
Bolivia	23	0	23	9.74	4.3	4.78	.65
Brazil	217	0	217	16.41	7.35	8.62	.44
Brunei Darussalam	7	0	7	9.29	6.14	1.86	1.29
Canada	329	0	329	18.39	7.5	8.56	2.33
Chile	149	0	149	8.95	6.24	2.49	.21
China	299	6	293	10.11	7.81	2.12	.19
Cote d'Ivoire	394	0	394	2.31	.35	.03	1.94
Colombia	135	0	135	13.82	5.84	6.07	1.91
Cabo Verde	25	0	25	16.48	6.36	2.48	7.64
Costa Rica	40	3	37	6.11	2.16	3.57	.38
Cuba	47	2	45	3.4	1.49	.96	.96
Ecuador	58	30	28	11.14	6.29	3.86	1
Ethiopia	48	0	48	20.25	7.04	3	10.21
European Union	660	6	654	15.83	12.24	3.35	.24
Ghana	152	0	152	15.34	5.7	5.55	4.09
Guinea	162	2	160	13.95	2.32	2.21	9.42
Gambia	46	0	46	12.91	7.65	3.07	2.2
Guatemala	54	2	52	12.27	9.46	2.58	.23
Honduras	27	0	27	7.26	5.37	1.7	.19
Indonesia	165	4	161	8.89	5.01	2.73	1.16
India	189	0	189	15.16	8.87	3.06	3.23
Japan	382	3	379	14.4	10.73	2.64	1.02
Kazakhstan	99	1	98	4.91	3.15	.8	.96
Cambodia	133	0	133	9.92	4.23	3.87	1.81
Lao PDR	77	0	77	10.74	5.52	.84	4.38
Sri Lanka	61	0	61	11.85	3.07	4.07	4.72
Mexico	164	0	164	9.62	5.62	3.58	.43
Mali	181	0	181	12.56	3.75	.1	8.71
Myanmar	21	0	21	8.62	5.67	1.76	1.19
Malaysia	200	1	199	8.62	5.29	2.69	.64
Niger	190	0	190	8.82	2.42	.05	6.35
Nigeria	180	0	180	10.11	8.96	.73	.42
Nicaragua	12	0	12	10.17	6.92	2.67	.58
Nepal	17	0	17	9.18	1.12	2.06	6
New Zealand	153	0	153	18.46	11.51	3.75	3.2
Pakistan	89	0	89	3.26	1.02	.1	2.13
Panama	61	1	60	7.78	6.17	.58	1.03
Peru	74	0	74	12.04	6.66	5	.38
Philippines	180	0	180	21.68	10.17	3.84	7.67
Paraguay	29	0	29	6.14	2.52	3	.62
Senegal	336	17	319	3.16	2.86	.06	.24
Singapore	291	0	291	11.59	7.37	3.11	1.11
El Salvador	25	1	24	5.08	3.04	2.04	0
Togo	221	0	221	7.93	.41	3.52	4
Tajikistan	65	0	65	3.23	2.4	.68	.15
Uruguay	97	2	95	8.46	4.09	4.08	.28
United States	368	0	368	22.87	13.83	7.39	1.64
Venezuela	65	0	65	14.83	6.37	5.23	3.23
Vietnam	226	0	226	18.58	12.91	2.59	3.09

Figure 1: Types of NTMs by HS6 product across countries

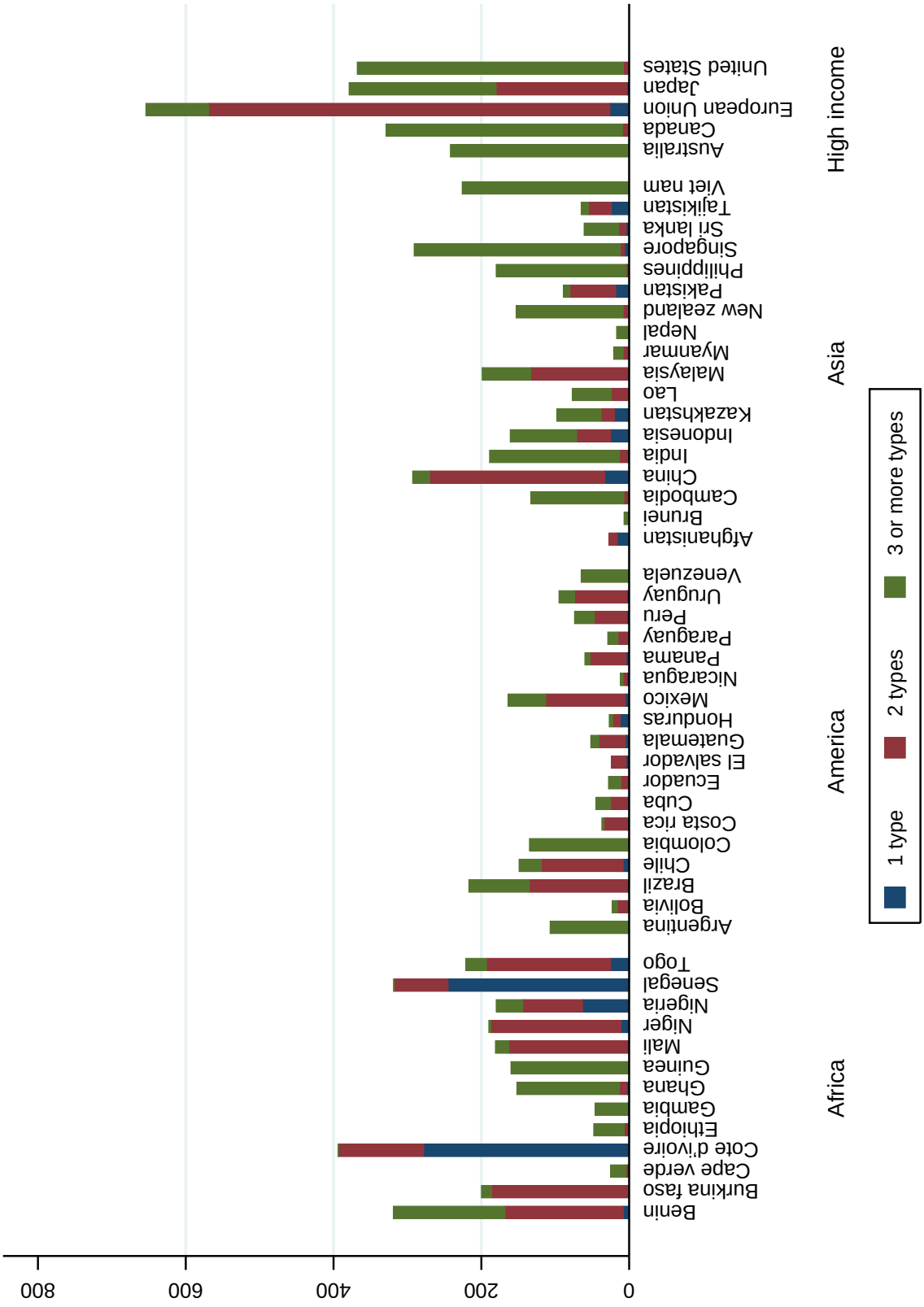

Table 5: Descriptive statistics for firms

Number of exporting firms	14383
Share of firms exporting only to developed countries	56.52%
Share of firms exporting only to developing countries	15.27%
Share of firms exporting to both developed and developing countries	28.20%
Number of export destinations (including EU25 countries separately)	78
Number of different HS6 exported products	662
Average number of exported products by firm	4.18
Average number of exported products by firm (towards developed destinations)	4.33
Average number of exported products by firm (towards developing destinations)	2.26
Average number of export destinations by firm	4.40

Table 6: Effect of quality standards on the extensive margin accounting for the heterogeneity of exporters

	Extensive margin			
	(1)	(2)	(3)	(4)
Dummy SPS/TBT Dest.	-0.000	-0.010***	0.001***	0.002
	(0.000)	(0.003)	(0.000)	(0.002)
Dummy SPS/TBT Dest. * Productivity		0.002***		0.000
		(0.001)		(0.001)
Dummy other NTMs Dest.	0.004***	0.004***	0.006***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
ln(1+tariffs)	-0.002**	-0.004***	-0.005***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	4062630	3125538	4709796	3298776
R^2	0.540	0.527	0.191	0.224
Firm-Destination & Product FE	Yes	Yes		
Firm-Product & Destination FE			Yes	Yes

Note: Robust standard errors in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$
Quality measures: dummy variable set to 1 if there is a quality measure on an HS6 product

Table 7: Effect of quality standards on the extensive margin accounting for the heterogeneity of exporters

	Extensive margin			
	(1)	(2)	(3)	(4)
ln(1+nb SPS/TBT Dest.)	-0.001***	-0.004***	0.000**	-0.002**
	(0.000)	(0.001)	(0.000)	(0.001)
ln(1+nb SPS/TBT Dest.)*Productivity		0.001**		0.001***
		(0.000)		(0.000)
ln(1+nb other NTMs Dest.)	0.004***	0.004***	0.013***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
ln(1+tariffs)	-0.003***	-0.005***	-0.008***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	4062630	3125538	4709796	3298776
R^2	0.540	0.527	0.191	0.224
Firm-Destination & Product FE	Yes	Yes		
Firm-Product & Destination FE			Yes	Yes

Note: Robust standard errors in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$
Quality measures: log (1 + number of quality measures on an HS6 product)

Table 8: Effect of quality standards on the extensive margin accounting for the existence of quality measures in the French market

	Extensive Margin			
	(1)	(2)	(3)	(4)
Dummy SPS/TBT Dest.	-0.000	-0.013***	0.001***	-0.007**
	(0.000)	(0.004)	(0.000)	(0.003)
Dummy SPS/TBT Dest. * France		0.013***		0.009***
		(0.004)		(0.003)
Dummy other NTMs Dest.	0.004***	0.004***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)
ln(1+tariffs)	-0.002**	-0.002**	-0.005***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	4062630	4062630	4709796	4709796
R^2	0.540	0.540	0.191	0.191
Firm-Destination & Product FE	Yes	Yes		
Firm-Product & Destination FE			Yes	Yes

Note: Robust standard errors in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$
Quality measures: dummy variable set to 1 if there is a quality measure on an HS6 product

Table 9: Effect of quality standards on the intensive margin accounting for the heterogeneity of exporters

	Intensive margin			
	(1)	(2)	(3)	(4)
Dummy SPS/TBT Dest.	0.210**	-1.193*	0.254***	-0.585
	(0.089)	(0.709)	(0.084)	(0.480)
Dummy SPS/TBT Dest. * Productivity		0.335**		0.179*
		(0.155)		(0.104)
Dummy other NTMs Dest.	0.096**	0.032	0.005	-0.015
	(0.045)	(0.051)	(0.042)	(0.048)
ln (1 + tariffs)	-0.295*	-0.356*	-0.563***	-0.624***
	(0.178)	(0.211)	(0.115)	(0.136)
Observations	128289	103653	136338	104329
R^2	0.608	0.599	0.659	0.656
Firm-Destination & Product FE	Yes	Yes		
Firm-Product & Destination FE			Yes	Yes

Note: Robust standard errors in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$
Quality measures: dummy variable set to 1 if there is a quality measure on an HS6 product

Table 10: Effect of quality standards on the intensive margin accounting for the heterogeneity of exporters

	Intensive margin			
	(1)	(2)	(3)	(4)
ln(1+nb SPS/TBT)	-0.007	-0.660***	0.113***	-0.573***
	(0.046)	(0.250)	(0.040)	(0.134)
ln(1+nb SPS/TBT) * Productivity		0.135**		0.150***
		(0.055)		(0.028)
ln(1+nb other NTMs)	0.056	-0.047	0.049	0.029
	(0.040)	(0.046)	(0.036)	(0.041)
ln(1+tariffs)	-0.321*	-0.341	-0.568***	-0.633***
	(0.177)	(0.209)	(0.115)	(0.136)
Observations	128289	103653	136338	104329
R^2	0.608	0.599	0.659	0.656
Firm-Destination & Product FE	Yes	Yes		
Firm-Product & Destination FE			Yes	Yes

Note: Robust standard errors in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$
Quality measures: log (1 + number of quality measures on an HS6 product)

Table 11: Effect of quality standards on the intensive margin accounting for the existence of quality measures in the French market

	Intensive Margin			
	(1)	(2)	(3)	(4)
Dummy SPS/TBT Dest.	0.210**	-0.499	0.254***	-0.258
	(0.089)	(0.435)	(0.084)	(0.562)
Dummy SPS/TBT Dest. * France		0.732*		0.526
		(0.444)		(0.569)
Dummy other NTMs Dest.	0.096**	0.095**	0.005	0.004
	(0.045)	(0.045)	(0.042)	(0.042)
ln(1+tariffs)	-0.295*	-0.295*	-0.563***	-0.563***
	(0.178)	(0.178)	(0.115)	(0.115)
Observations	128289	128289	136338	136338
R^2	0.608	0.608	0.659	0.659
Firm-Destination & Product FE	Yes	Yes		
Firm-Product & Destination FE			Yes	Yes

Note: Robust standard errors in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$
Quality measures: dummy variable set to 1 if there is a quality measure on an HS6 product