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Impact of border rejection experience on export performance: Firm-level evidence from China

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March 2024

Abstract

When serving a foreign market, firms must comply with the country's technical regulations and product standards. If they fail to meet technical requirements, shipments are refused entry into the market due to consumer safety and public health concerns, which are known as import refusals or border rejections. To the best of our knowledge, this is the first study to examine firms' export performance concerning their experiences of border rejection. To do so, we use a unique dataset that connects US import refusal episodes against Chinese shipments (including manufacturer and product information) with Chinese firm-level customs and manufacturing survey data. We find evidence of substantial compliance costs in exporting: Prior border rejection increases the likelihood of exiting the market and discourages (re-)entry into the market at the extensive margin of exports. However, conditional on continued exporting, prior rejection increases export quantity, price, and quality at the intensive margin. Compliance with technical requirements appears to both hinder market entry and catalyze the firm's upgrading of capacity and competitive repositioning, especially in the case of firms based in developing countries and exporting to advanced economies with more stringent technical requirements.

Keywords: non-tariff measures; border rejections; import refusals; compliance costs; firm heterogeneity

JEL classification: F13, F14, L2

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1. Introduction

With decades of policy efforts and international coordination resulting in significant reductions and elimination of ordinary customs tariffs, non-tariff measures have emerged as prominent policy instruments affecting international trade. In particular, as corporate activities have become more globalized, the role of countries' internal regulations (such as technical regulations and product standards) in trade and welfare has become increasingly important. When serving an external market, firms must comply with a series of technical regulations and standards in the destination country. At the port of entry, shipments are inspected to check whether they meet the specified technical requirements. Otherwise, shipments are refused entry due to consumer safety and public health concerns. For instance, each year, thousands of shipments are refused entry to the US market by the Food and Drug Administration (FDA), mainly because the product does not meet US standards (adulteration) or because the label contains false information (misbranding).

The incidence of import refusals, also known as border rejections, implies that compliance with external market technical requirements may pose considerable challenges for exporting firms. Compliance costs faced by exporting firms consist of both fixed and variable costs (World Bank, 2005).[1] One-off, non-recurring costs are those for building compliance capacities, specifically, the costs for upgrading production or processing facilities, establishing or upgrading in-house laboratory infrastructure, instituting a new management system for production processes, and for the associated training of personnel. Recurring costs include those for maintaining regular surveillance, carrying out routine product-testing programs, documenting traceability, and obtaining certification for quality conformity inspection (per shipment).[2]

Due to these expenses, compliance with stringent requirements may act as a trade barrier and adversely affect a firm's decision on whether and how much to export. However, a firm's efforts to make the necessary adjustments to reach compliance may also catalyze progressive changes in its production and processing operations. Some firms that can afford to do so would decide to improve product quality controls, make minor modifications to the labels or other surface-level aspects of their products, or invest in upgrading technical, administrative, and managerial capacities for better compliance. Such a compliance process may result in enhanced competitiveness and increased exports for successful firms.

Although the former "standards as barriers" view is dominant in related literature, the latter "standards as catalysts" perspective has long been examined in the context of food safety standards in international commerce, mainly using conceptual frameworks and based on case studies (e.g., World Bank, 2005; Henson and Jaffe, 2008). Apart from conceptual and case studies, there are also a few empirical studies that provide some evidence conditionally in support of the "standards as catalysts" standpoint (e.g., Anders and Caswell, 2008; Maertens and Swinnen, 2009). These studies focus on developing countries and their firms (and households) because they often struggle to achieve compliance when gaining access to markets in advanced economies whose technical requirements tend to be more stringent (see, for example, a literature review by Beghin, Maertens,

[1] In this context of global commerce, compliance costs can be incurred by the government (in addition to private enterprises) of the exporting country. In the current paper, however, we focus on compliance costs incurred by exporting firms while examining exporting firms based in China only.
[2] In some cases, fixed and variable portions of compliance costs may be substituted for one another. For example, an exporter firm would decide on whether to invest in in-house lab infrastructure to lower unit costs for routine testing.

and Swinnen, 2015). Overall, there is ample room to fill the empirical gap in the literature and policy debate surrounding the "standards as catalysts" view for trade and development.

We investigate the export performance of firms concerning their prior experiences of border rejection. If the external market's technical requirements hamper trade, in light of a border rejection event, a firm may give up entering that market and serve domestically only or possibly switch to operating in the other country's market, which may have less stringent requirements. In contrast, if external market requirements serve as a catalyst, a firm may make the necessary adjustments to reach compliance and try to (re)enter the same market without interrupting exports. Surviving firms that can bear the necessary compliance costs may enjoy increased quantities of high-quality exports due to the compliance process.

To do so, we construct a novel dataset that connects episodes of US import refusal against Chinese shipments, including manufacturer and product information, with Chinese firm-level customs and manufacturing survey data. For the sample period of 2002–2007 (which we explore in the current paper), China is one of the countries subject to US import refusals most frequently, with the third largest number of refusal records following Mexico and India. The cumulative number of refusal records over the past two decades against China is the largest among US trading partners.

The FDA has provided the public with information on refused foreign products that have been judged as not meeting US technical requirements from 2002 onward, as the Import Refusal Report (IRR), which is updated monthly on the FDA's website.[3] The FDA IRR contains information on refused products and their origin countries as well as the manufacturer declared responsible for the refused product (i.e., the foreign exporting firm, in most cases).[4] We also use a matched dataset of Chinese firm-level manufacturing survey data obtained from the Annual Survey of Industrial Firms (ASIF) and customs data from the Chinese Customs Trade Statistics (CCTS). We connect the US import refusal data with the Chinese firm-level dataset using the firm's name and address as identifiers.

The resulting dataset provides firm-level evidence of the impact of border rejections on export performance after controlling for firm characteristics, which is missing in the existing literature. To the best of our knowledge, this study marks the first attempt to identify individual manufacturers whose products were refused entry into an external market and thereby estimate the direct effects of their rejection experiences on a firm's exports. More specifically, we examine how a prior border rejection experience affects Chinese firms' decisions about whether to exit the US market and whether to (re-)enter it after a certain period of interruption at the extensive margin as well as how much to export to the US market, conditional on continued exporting, at the intensive margin. The latter effects on export values are further decomposed into the quantity, price, and quality of exported goods.

Our main findings are as follows: First, a prior border rejection experience increases the likelihood of exiting the market and discourages (re-)entry, which can be interpreted as evidence of a substantial compliance cost burden in exporting. Second, when a firm succeeds in continued

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[3] The FDA's website (accessed August 7th, 2023).
[4] The FDA IRR does not include information on the quantity or value of refused shipments.

exporting after making the necessary adjustments to reach compliance, prior rejection experiences increase export quantity, price, and quality. The first finding is consistent with the "standards as barriers" view, whereas the second outcome suggests that the "standards as catalysts" hypothesis holds conditional on the firm's ability to bear and overcome the compliance cost burden. These results are robust to alternative specifications and address endogeneity issues.

This paper helps to fill the empirical gap in the literature highlighting the "standards as catalysts" perspective. For example, Henson and Jaffe (2008) summarize their findings from case studies that respond to new, more stringent standards, which can be catalysts for upgrading capacity and competitive repositioning for firms that can gain access to the required financial and technical resources. Our empirical findings on Chinese firms serve as supportive evidence for the information gathered in previous case studies based on interviews, surveys, or fieldwork covering specific commodities in selected countries.

Our firm-level findings also coincide with earlier empirical studies that provide country-level evidence conditionally supporting the "standards as catalysts" standpoint. Anders and Caswell (2009) conduct a gravity analysis to estimate the trade effects of the Hazard Analysis for Critical Control Points (HACCP) food safety standard on US seafood imports. Anders and Caswell conclude that the "standards as catalysts" view applies to larger, more established exporting countries among developing nations and the "standards as barriers" perspective to smaller exporting countries. Maertens and Swinnen (2009) investigate household data to assess the poverty implications of tightened food standards worldwide on fruit and vegetable exports in Senegal. Maertens and Swinnen find that export growth through responding to more stringent technical requirements help to reduce poverty, which they argue for as additional evidence for the "standards as catalysts" hypothesis.

From a broad perspective, this study also contributes to the wider literature on the trade effects of non-tariff measures using fact-based data, which have yet to be fully examined. The incidence of border rejection of interest indicates the presence of de facto non-tariff barriers to trade. As far as we know, Beestermöller, Disdier, and Fontagné (2018) is the only paper that explores the effects of border rejection on firm-level exports. As in the current study, Beestermöller et al. draw on Chinese firm-level customs data; however, they looked at European Union (EU) import refusal data, which record refused products and their origin countries but provide no details on the firms responsible for the transactions in question. Hence, they are limited to examining the effects of border rejection on Chinese shipments of a certain product category.

The remainder of this paper is organized as follows: Section 2 describes how US import refusals work and provides a brief review of the related literature on border rejections and non-tariff measures in general. Section 3 discusses the data and the construction of the variables of interest, along with the empirical model. Section 4 presents and discusses the estimation outcomes. Section 5 concludes the paper.

2. Background

2.1. US border controls and import refusals

To protect consumers, the FDA regulates a wide range of products, including foods, human and veterinary drugs, vaccines, other biological products, medical devices intended for human use, radiation-emitting electronic products, cosmetics, dietary supplements, and tobacco products.[5] All FDA-regulated products imported into the US must comply with the requirements prescribed by relevant laws and regulations, which apply equally to domestic products inside the US.

At the US port of entry, any product offered for import must be declared to US Customs and Border Protection (CBP). For review purposes, the CBP refers to the shipment of FDA-regulated products. The FDA is authorized to scrutinize a shipment under review and/or collect a sample, as needed, to determine the admissibility of the product. Inspections in this entry review process include a label examination to determine compliance with labeling requirements, a field examination or physical inspection of the product, and sample collection for further evaluation based on laboratory analysis. If the inspections indicate that the product appears to violate FDA laws and regulations, the FDA is authorized to detain the shipment. When a shipment is detained, the FDA issues an alert specifying the nature of the violation by the consignee or the importer. The consignee is entitled to an informal hearing to provide testimony regarding the admissibility of the product.

If the consignee fails to submit evidence that the product complies with the technical requirements (or a plan to bring the product into compliance), the FDA will issue the final notice and refuse admission; otherwise, the product is released and admitted for importation (after necessary reconditioning). The refused product must be re-exported or destroyed under FDA and CBP supervision within 90 days.[6] There are two major reasons for US import refusals: (i) adulteration, which means that the product is contaminated, is not safe, or does not otherwise meet applicable US product standards; and (ii) misbranding, which means that a label or package contains false or misleading information. In addition, unapproved new drugs and products that are forbidden or restricted for sale are refused entry into the US market.

To explore the effects of border rejection on exports at the firm level (as we do later on in this paper), we will need to consider the fact that inspections at the port of entry are conducted in a non-random manner, as mentioned by Jouanjean, Maur, and Shepherd (2015) and Grundke and Moser (2019). The FDA's webpage states that examinations and/or sample collections are conducted at the port of entry for shipments selected based on the product, manufacturer (or consignor), and the consignee's history of prior violations, if any.[7] Shipments are more likely to be chosen for inspection if border control officials suspect that the possibility of violating the technical requirements is higher. For example, suppose that a firm that manufactured a certain product was found to have committed a violation in the past. In this case, the same product (or a variant of the same product group) manufactured by the same firm is inspected almost automatically.

[5] For more details on FDA-regulated products, see the FDA's webpage (accessed August 7th, 2023). With regard to foods, aspects of some meat, poultry, and egg products regulated by the US Department of Agriculture are outside the FDA's scope.

[6] The entire process of importing FDA-regulated products is explained here (accessed August 7th, 2023).

[7] Please see this link (accessed August 7th, 2023) for more details. Other reasons for being selected for inspections include the suspected risk associated with a (new) product and routine surveillance.

Being selected for inspection does not necessarily imply a refusal to allow entry. Still, the shipment selected for inspection may be detained at the port of entry because of a suspected violation, and the consignee (importer) must provide evidence of the admissibility of the product to avoid the final decision of import refusal. Contesting the FDA's decision on detention (for example, demonstrating a conformity assessment) would be costly. The higher risk of being detained appears to impose uncertainty on exporting firms and might constitute another form of a non-tariff barrier to trade, as Beestermöller et al. (2018) argued, in addition to the incidence of border rejection. To address the border detention-related uncertainty cost burden facing exporting firms, in our empirical analysis, we consider the possible hysteresis of prior violation records regarding the probability of selection for border inspections.

2.2. The literature on border rejections and non-tariff measures

Border rejections of interest are cases in which technical regulations and product standards implemented by the importing country effectively restrict trade (i.e., non-tariff policy interventions). According to the United Nations Conference on Trade and Development (UNCTAD), non-tariff measures (NTMs) are defined as policy measures other than ordinary tariffs that can potentially have an economic impact on international trade in goods, changing the quantities traded, the prices, or both.[8] NTMs cover a wide range of policies, including traditional policy instruments with protectionist intent (e.g., quotas, price controls) and technical measures for protecting health, the environment, and ensuring food safety.

A large body of the empirical trade literature on NTMs is based on the premise that NTMs are trade-restrictive. However, most technical measures are internal regulations that are applied equally to domestically produced goods and imported goods sold inside a national market; thus, technical measures are not necessarily trade-restrictive, and their ultimate impact can be positive, negative, or neutral, which is an empirical question. Given the importance of technical measures, recent studies have attempted to estimate their trade effects or identify trade restrictiveness. There are two major approaches based on the types of NTM data used in the analysis. First, a direct approach is to employ data on de facto NTMs, such as notification-based data,[9] survey-based data,[10] and fact-based data. An alternative approach is to utilize data on de jure NTMs, such as legislation-based data,[11] to overcome the non-representativeness and incompleteness of the first approach.

Few studies have used fact-based NTM data to examine the trade effects of technical measures. First, Grundke and Moser (2019) estimate the effects of US import refusals on the value of imports to the US by origin country at the Harmonized System (HS) 4-digit product-group level in a gravity

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[8] Please see here for more details (accessed August 7th, 2023).

[9] For example, Fontagné, Orefice, Piermartini, and Rocha (2015) use notification-based data obtained from the World Trade Organization (WTO) database on the specific trade concerns (STCs) for technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures. It is not obvious how representative the concerned measures are among the entire spectrum of potentially restrictive measures.

[10] For example, Chen, Wilson, and Otsuki (2006) use survey-based data obtained from the International Trade Commission (ITC) business survey to identify NTMs that create major concerns for exporters. The respondent firms are not necessarily a representative sample of the universe of (potential) exporters.

[11] For example, UNCTAD and WTO (2019) compile descriptive statistics and preliminary estimates on the trade impact of NTMs based on the worldwide NTM data newly collected from national legal documents, which are publicly available from the UNCTAD Trade Analysis Information System (TRAINS) database.

analysis framework. They employ US import refusal data obtained from the FDA IRR database and draw EU alert data from the Rapid Alert System for Food and Feed (RASFF) database to construct an external instrument for US import refusals. The authors detect the trade-reducing effects of US import refusals, which are primarily triggered by refusals without any product sample analysis—in particular during the subprime mortgage crisis and its aftermath—and conclude that the previous pattern of US import refusals appears consistent with the hidden protectionism argument.

Second, although they do not directly examine the trade effects of the technical measures themselves, Jaud, Cadot, and Suwa-Eisenmann (2013) investigate how the sanitary risk of agri-food products affects the geographic concentration of origin countries in EU imports at the Combined Nomenclature (CN) 8-digit product level. Product-specific sanitary risk is estimated as the first step of the two-step procedure based on the EU alert data (over 85% of alerted shipments end up with import refusals) obtained from the RASFF database, controlling for confounding factors. Jaud et al. (2013) find that the higher the sanitary risk a product entails, the more EU import values are dominated by a small number of origin countries at the intensive margin, whereas the total number of origin countries is on the rise at the extensive margin.

Third, Beestermöller et al. (2018) predict the effects of EU border rejection events within the HS 4-digit product-group level on the margins of Chinese firm-level agri-food exports in that product category. They use EU alert data from the RASFF database in combination with Chinese firm-level customs data. Their analysis is constrained by data limitations in the sense that the RASFF database provides no information on the exporting firms responsible for refused shipments. Nevertheless, the authors design their analyses and interpretations to highlight the reputation effects of border rejection events that adversely affect competitor firms exporting in the same product category by raising the uncertainty of successful entry.

Moreover, apart from the trade effects of technical measures, Baylis, Martens, and Nogueira (2009) and Jouanjean et al. (2015) employ US import refusal data from the FDA IRR database to analyze the determinants of import refusal at the country-sector level, with a focus on the hysteresis effect of admitted imports or experiences of rejection. Furthermore, focusing on US import refusal events against Chinese food exports, Wen, Yang, Dong, Fan, and Wang (2018) provide a series of descriptive statistics based on data obtained from the website of China's food industry, FoodMate,[12] whose original data are from the FDA's IRR database. Wen et al., however, do not conduct an empirical analysis or connect refusal data with Chinese firm-level data.

3. Data and methodology

3.1. Data on US import refusals

We draw on the FDA's IRR database, as briefly described in the introduction, to examine US import refusals against Chinese shipments from 2002 to 2007 and their impact on Chinese firm-level export performance. In the IRR, import refusal events identified by firm, product, and date are recorded. **Table 1** shows the counted numbers and associated basic statistics of import refusal records by product category. We group the FDA-regulated industries into the following

[12] Please see this link for details (accessed August 7th, 2023).

categories:[13] (i) food and cosmetics;[14] (ii) animal-use products;[15] (iii) human drugs;[16] and (iv) medical devices, in vitro diagnostic products, and non-medical radiation-emitting products.[17] We construct categories (i)–(iii) based on the purpose of use, whereas we independently classify vitamins and antibiotics under separate codes, irrespective of the purpose of use in the database. Hence, these are listed as independent categories in the table.

As seen in **Table 1**, when aggregating raw data at the firm-year level, we record 3,732 Chinese firm-year pairs as having been rejected at the US border between 2002 and 2007. Out of the 3,732 firm-year pairs, 147 (3.9%) experienced border rejections of two or more different types of products and are counted multiple times across product categories. Similarly, 2,962 individual firms were rejected, while 192 firms (6.5%) are counted multiple times across product categories. More interestingly, border rejections of food and cosmetics are pervasive, accounting for about half of rejection records at any aggregation level, followed by medical devices, which comprise another 30% of the records. The latter observation can be regarded as an advantage of using the IRR over the EU's RASFF database, which covers only foods and feeds rejected at the EU border.

Table 2 presents the counted number and associated basic statistics of US import refusal records against Chinese shipments by category of reasons for refusal. In the IRR, each import refusal event is recorded with an average of 1.52 reason codes out of 303 codes, which can be aggregated into ten categories (plus, *No information available*) as listed in the leftmost column of the table. Adulteration and misbranding are the two major reasons for US import refusals against China. Looking into respective product categories, adulteration is the reason for more than 70% of the import refusals of food and cosmetics, while misbranding is the reason for 75% of the import refusals of medical devices. It follows from this observed fact that the RASFF database appears to include refusal cases of adulterated foods and feeds only, as touched upon by Baylis et al. (2009). Using the IRR, however, enables us to scrutinize refusal cases of a wider range of products, not only for adulteration but also for misbranding and other reasons, which lends another advantage to the current study.[18]

3.2. Data on Chinese firms

The firm-level manufacturing survey data are from the ASIF, which was conducted by the National Bureau of Statistics of China for 1998–2007,[19] and cover all state-owned enterprises (SOEs) and

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[13] Although tobacco products are also regulated by the FDA, there is no refusal record of tobacco products originating from China.

[14] Foods for human consumption, including dietary supplements, food and color additives, and food contact substances; and cosmetic products such as shampoo, make-up, face creams, and eyelash extensions.

[15] Animal food and feed, including pet food, as well as veterinary medicines and devices.

[16] Active pharmaceutical ingredients and both prescription (Rx) and over the counter (OTC) medications.

[17] Medical devices such as bandages, contact lenses, first aid kits, pacemakers, and surgical instruments; biologic products such as human blood, blood donor screening tests, human tissue, embryos, human plasma, and medical devices for use in blood banking operations; and radiation-emitting products such as X-ray machines, microwave ovens, CD-ROMs, light-emitting diodes (LEDs), and laser pointers.

[18] Furthermore, the two databases are different in structure, which coincides with different regulatory environments between the US and the EU. On the one hand, the FDA is a top-down or vertical organization throughout the US; on the other hand, the RASFF was designed as a flat platform for EU member states to exchange food safety information and collaborate on potential threats and risks, as mentioned in Mao, Jia, and Chen (2021). In this sense, the RASFF helps EU member states handle coordinated border rejections despite diverse safety concerns across member states. When using the EU import refusal data from the RASFF, we should take into account possible effects of a country's regulatory action on the other country's regulatory decision.

[19] The ASIF database after 2008 is also available. Nevertheless, most studies only use 1998–2007 data because there

non-SOEs with annual sales of over 5 million yuan. The sample size varies from year to year, but each year's dataset includes basic information on each of the surveyed firms (such as the firm identification number, location code, industry affiliation, and ownership structure) as well as financial and management information extracted from a typical balance sheet (such as total sales, employment, average wages, intermediate inputs, material purchases, value added, fixed assets, inventory, and profits).

We obtain firm-level customs data from the CCTS, which is administered by the General Administration of Customs of China. The CCTS database covers all merchandise transactions through Chinese customs from 2000 to 2013, including firm identification (name, address, and ownership), HS product code, export value and quantity, tariff regime, means of transport, tariff code, and destination country. Export values are reported as free-on-board (FOB) values in US dollars. We aggregate raw monthly data at the annual level to abstract seasonality and lumpiness. In addition, we aggregate product codes originally at the HS 8-digit level into HS 4-digit codes.

3.3. Construction of the dataset for estimation

First, we connect the ASIF data with the CCTS data by firm name, address, and phone code.[20] **Table 3** shows the number of firms appearing in and matched to the two datasets, respectively; the ASIF sample size almost doubled from 160,000 in 2000 to 330,000 in 2007. In 2007, there were 175,000 exporting firms. Most Chinese firms are non-trading firms; only 20% of above-scale firms (i.e., their annual sales exceed 5 million yuan) engage in international transactions,[21] as per the general picture in the literature (e.g., Brandt et al., 2012).

We then connect the IRR data with the ASIF-CCTS-matched dataset by firm name and address. As presented in **Table 4**, we could match only about a quarter (766) of the 2,962 Chinese firms recorded as manufacturers responsible for rejected shipments in the IRR data (Column 5). Of the 6,063 rejection episodes recorded in the IRR data, only 277 (4.6%) were matched using ASIF-CCTS (Column 6). The low matching rate can be attributed to several factors. First, the scope of firms differs between the IRR and the ASIF-CCTS: the IRR, in principle, records Chinese manufacturers or intermediary companies in some cases (suspected from the firm names) responsible for rejected shipments, while the ASIF includes only manufacturing firms above a certain size. That is, we do not include firms below a certain size or non-manufacturing firms recorded in the IRR in the ASIF-CCTS.

Second, although the CCTS records the known immediate destination of exported goods, some Chinese shipments arrive in the US market through entrepôt trade via a third country such as Hong

is a significant change in statistical methods and dimensions for data collected after 2008; moreover, the reliability of such data has been criticized. See Hsieh and Klenow (2009) for details.

[20] The two datasets do not completely match for the following reasons. First, the ASIF data include many non-trading firms that are absent from the CCTS data. Second, firms that export through trading agents are recorded as exporters in the ASIF data, but their exports are recorded under the name of the trading agent in the CCTS data. Third, the ASIF data only include large firms (annual sales of over 5 million yuan) in the manufacturing sector, while the CCTS data record all trade transactions, including those made by small firms and firms outside the manufacturing sector.

[21] This ratio does not necessarily represent the proportion of firms that have participated in the global market for all Chinese firms given that some trading firms in the CCTS may not be included in the ASIF because their annual sales are below the 5-million yuan threshold.

Kong (treated as an independent district/country in trade statistics). Even if the shipments of such re-exports are rejected and recorded in the IRR data, the CCTS may record shipments of concern as exports not destined for the US.

Third, there is a time lag between the timing of departure from Chinese customs and the timing of arrival at the US port of entry. The time lag varies across transactions, and if the lag spans the calendar year in some cases, it is impossible to match the IRR with the CCTS annually. Such matching difficulties become more pronounced in the case of sea route transportation.

Fourth, we have to manually match the English and Chinese names of exporting firms because the IRR only records firm names and addresses in English,[22] whereas the ASIF-CCTS records firm information in Chinese. This further increases the accuracy of the matching process.

In the current situation, where it is difficult to improve data matching, our priority should be to ensure that data that fail to match are determined randomly.[23] To eliminate the possibility of endogenous bias in subsequent estimates due to the non-random determination of border rejection cases that could not be matched, we replicate the specifications of Beestermöller et al. (2018). The results are presented in the Appendix. Based on **Table A1**, we conclude that the sample was randomly dropped during the process of matching the IRR data with the ASIF-CCTS data, thus introducing no serious bias into the estimation outcomes.

3.4. Empirical strategy

We examine how firms (based in developing countries) respond after being refused to enter a market (in advanced economies) with more stringent technical requirements. In this study, we focus on the impact of border rejection experiences on a firm's export performance.

The compliance cost burden implied by border rejection adversely affects both the extensive and intensive margins of a firm's exports; that is, the firm's decision about whether and how much to export. More importantly, however, the external market's technical requirements serve not only as a trade barrier but also as a catalyst for some firms. Upon experiencing border rejection, a firm may decide to strive to achieve compliance by improving product quality controls, making minor modifications to the labels or other surface-level aspects of the product, or even making investments in upgrading technical, administrative, and managerial capacities. Firms that can bear the cost of making these necessary adjustments in their production and processing operations will survive in the export market and enjoy increased exports of higher quality at the intensive margin.

With this in mind, we analyze the impact of prior border rejection experiences on the extensive and intensive margins of a firm's exports, controlling for firm characteristics, with a comprehensive set of fixed effects. The baseline estimation equation is as follows:[24]

[22] In particular, the spelling discrepancies of company names and address information in the IRR records are not negligible, and the problem of what appears to be a typographical error in the company information also adds to the difficulty of the matching process.

[23] The distribution of reasons for refusal in the records that could be matched is identical to that of the population depicted in **Table 2**, suggesting the randomness of the records that could be matched.

[24] Eq. (3) is estimated using ordinary least squares (OLS) rather than the non-linear binary choice models (such as logit models) to avoid the well-known incidental parameter problem due to the multitude of fixed effects included in

$$y_{i,p,t} = \alpha + \beta_1 Rejection_{(i),p,t-1} + \beta_2 \ln Size_{i,t-1} + \beta_3 Rejection_{(i),p,t-1} * \ln Size_{i,t-1}$$

$$+\mu_i + \psi_p + \phi_{HS2,t} + \epsilon_{i,p,t}, \quad (1)$$

where the dependent variable $y_{i,p,t}$ represents firm i's export performance of the HS 4-digit product-group level category p in year t[25]. To determine how a prior border rejection experience affects a Chinese firm's decisions about (i) whether to exit the US market; (ii) whether to (re)enter the US market after a certain period of interruption at the extensive margin; and (iii) how much to export to the US market—conditional on continued exporting—at the intensive margin, we employ the following versions of the dependent variable $y_{i,p,t}$:

(i) A dummy variable for exit equals 1 if firm i exports the HS 4-digit product-group level category p to the US market in year $t-1$ but not in t (0 if otherwise). The counterfactual refers to firms that export a given product p to the US market at $t-1$ and also at t.

(ii) A dummy variable for entry equals 1 if firm i exports the HS 4-digit product-group level category p to the US market in year t but not in $t-1$ (0 if otherwise). The counterfactual refers to firms that do not export a given product p to the US market at $t-1$ or in t.

(iii) The value (in logs) of firm i's exports of the HS 4-digit product-group level category p to the US market in year t. Here, we focus on surviving firms that are already active in exporting to the US at $t-1$ and which continue exporting to the US at t.

At the intensive margin, the dependent variable $y_{i,p,t}$ in (iii) is further decomposed into the quantity exported and the unit value (price) of exports. A higher export price may indicate a higher unit cost because of the compliance process or higher product quality. We then carefully distinguish between export quality and export price.

The explanatory variable of particular interest is $Rejection_{(i),p,t-1}$, which is a dummy variable indicating the firm's past border rejection experience; it equals 1 if firm i's exports of HS 4-digit product-group level category p were rejected at the US border in year $t-1$ and 0 if otherwise.

To control for firm heterogeneity and its impact on export performance, we include the firm size variable $\ln Size_{i,t-1}$, which is defined as the number (in logs) of employees in firm i in year $t-1$. We take a one-year lag in line with the rejection variable. In addition, to capture some heterogeneous effects on the impact of rejection experiences across firms, we introduce an interaction term for the rejection variable with the firm size variable $Rejection_{(i),p,t-1} * \ln Size_{i,t-1}$.

Lastly, we include a series of fixed effects, μ_i, ψ_p, and $\phi_{HS2,t}$. Firm fixed effects, denoted by λ_i, capture time-invariant, unobserved, firm-specific attributes (including the average size and potential compliance capacities) that affect the firm's export performance. Time-invariant firm

all regressions. Another trivial advantage of the OLS models is that they provide the direct estimation of the sample average marginal effect.

[25] Note that all explanatory variables are lagged one year, so data for the dependent variable can be used up to 2008.

attributes also include the geographic location and industry that firm i belongs to (which rarely changed throughout the sample period).

Product fixed effects, represented by ψ_p, capture time-invariant, unobserved, product-specific attributes affecting the firm's export performance, such as the sanitary risk and the durability or perishability of products. If the HS 4-digit product-group level category p is subject to more careful border controls, owing to the known sanitary risk that the product entails, the concerned exports would be more frequently checked at the port of entry, irrespective of actual compliance with US technical requirements. For perishable products, for example, shipments occur many times over the course of a year, which implies less frequent interruptions in exports observed on an annual basis, even if some shipments are refused entry to the US market due to incompliance.

Industry-year fixed effects, $\phi_{HS2,t}$, capture time-varying HS 2-digit industry-specific attributes, such as business cycles, import-demand shocks, and other industry-level shocks. They also account for industry-specific political and economic forces (Baylis et al., 2009) or trends in protectionism. Further, $\epsilon_{i,p,t}$ denotes an independent and identically distributed error term.

In estimating Eq. (1), we expect that the endogeneity issues resulting from omitted variables would be well addressed by a series of fixed effects, as mentioned above. A remaining concern is endogeneity owing to simultaneity and treatment selection bias. As described earlier, we include the firm size variable, defined by the number of employees, to control for firm heterogeneity. If a firm adjusts its labor force (in year $t-1$) in response to a border rejection event (in $t-1$) and the resulting changes in export activities (in t), the firm size variable and its interaction term with the rejection variable will cause endogeneity due to simultaneity. To address this problem, we employ an alternative definition of the firm size variable (defined in terms of the firm's fixed assets), which appears fairly stable over time despite the border rejection event.[26]

Our concern about treatment selection bias arises from the possible hysteresis of prior violation records of the product, manufacturer, and/or consignee of shipments regarding the probability of being chosen for border inspections (Jouanjean et al., 2015; Grundke and Moser, 2019). Although being selected for a border inspection does not necessarily indicate border rejection—which is determined by a fair assessment of compliance—the higher risk of being detained at the port of entry may impose an uncertainty cost burden on exporting firms (Beestermöller et al., 2018). Such hysteresis at the firm-product level is also discussed as the "stickiness" of border rejection in Baylis et al. (2009). To obtain the hysteresis of prior violation records under control, we employ an alternative definition of the rejection variable: Instead of a dummy variable for the firm's recent rejection experience in year $t-1$, we use another dummy variable for the firm's overall prior rejection experience, which equals 1 if firm i's exports of HS 4-digit product-group level category p have ever been rejected at the US border as of year $t-1$ and 0 if otherwise. Furthermore, we employ an instrumental variable (IV) approach for robustness checks, as described in the next section.

Note that using the alternative overall measure of prior rejection yields a side benefit: We no longer need to be concerned about the possible but unobservable time lag between the timing of

[26] Furthermore, we regress the firm size against the firm's past border rejection experiences. The estimation outcomes shown in the Appendix, **Table A3** indicate that firm size is not significantly correlated with past rejection experience.

departure from Chinese customs and the timing of arrival at the US port of entry, which partly accounts for the low matching rate of Chinese customs data and US import refusal data, as discussed above. In addition, by estimating the impact of overall prior rejection, we are freed from concerns about the possibly persistent effects of the rejection for an unobservable period that varies by rejection event.

In addition, to capture possible heterogeneous effects on the impact of rejection across products, we introduce the product-specific variable for US import elasticities of substitution (across similar goods produced in different countries)—the estimates of which are publicly provided by Broda and Weinstein (2006)—and its interaction term with the rejection variable. The higher the elasticities of substitution, the more likely that both the extensive and intensive margins of exports will be adversely affected by border rejection. The lower the elasticities of substitution, the more likely that the concerned exports will remain relatively unchanged or recover sooner, even if disrupted in response to a rejection event.

4. Empirical results

4.1. The extensive margin of trade

Table 5 reports the estimated effect of a firm's past border rejection experience on its exit from the US market. Columns (1)–(2) are related to a firm's recent boarder rejection. The positive and significant coefficients indicate that firms with recent rejection experiences are more likely to exit from the US market in the current year. However, since the coefficient of the interaction term in Column (2) is not significant, this impact does not significantly vary across firms of different sizes.

Columns (3)-(4) are responsible for the effect of the firm's past overall rejection experience. The coefficients of the past overall rejection dummy are positive and significant. That is, firms that have experienced border rejection in the past are also more likely to exit from the market in the current year. Note that the coefficient of the interaction term is again not significant, implying that this effect is not significantly heterogeneous in firm size.

Columns (5)-(6) present the results when fixed assets are used as a proxy variable for firm size. There is no qualitative change in the significance and sign of the coefficient regarding the border rejection dummies, but unlike in the case of firm size, the coefficient of the interaction term is negative and significant. This indicates that firms with larger firm size and more fixed assets are less adversely affected by their border rejection experiences. Assuming a positive correlation between firm size and productivity, this implies that NTMs are a heterogeneous barrier across firms since more competitive firms are more flexible and more effective at responding to the regulatory requirements revealed by the border rejection.

Columns (7)-(8) present results controlling for the product-level elasticity of substitution by Broda and Weinstein (2006) in addition to firm size. The findings show that the magnitude and significance level of the border rejection dummy remains the same. However, the interaction term between the elasticity variable and the firm's recent border rejection is not significantly estimated, meaning that we do not detect the product-heterogeneity impact of border rejection on the exit from the US market.

As for the control variables, firm size is negatively and significantly correlated with the explained variable for all specifications (firm size is proxied by the fixed assets in columns (5)-(8)), suggesting that firms of a larger size and with more fixed assets are less likely to exit the US market, which is in line with the Melitz model assertion.

Table 6 presents the impact of border rejections on a firm's entry into the US market. Columns (1)–(4) indicate that the firm's border rejection is negatively and significantly correlated with its entry in the current year. This result is intuitive as it implies that firms that have experienced border rejections are forced to respond to regulations, discouraging them from entering the market. The next two columns present the outcomes for when a firm's fixed assets are used as a proxy for size. We find that a firm's past overall refusal experience continues to significantly discourage it from entering the US in the current year. In columns (7)–(8), after further controlling for import demand elasticities and interaction terms, the estimation results do not change qualitatively from columns (1)–(4). Similar to all columns, the coefficients of the interaction terms are not significant, indicating that the effect of border rejection is not significantly heterogeneous in firm size. Regarding the control variables, the results suggest that firm size (and its proxy variables) has a positive and significant effect on the probability of market entry for all specifications.

In sum, a firm's border rejection experience increases the likelihood of exiting the US market and discourages entry into the market at the extensive margins of exports.

4.2. The intensive margin of trade

Next, we examine the impact of the border rejection experience on a firm's intensive margins. **Table 7** reports the impacts on firms' export values. Columns (1)–(4) indicate that both firms' recent and past overall border rejections have a positive impact, not significantly heterogeneous by firm size, on their export value in the current year. This effect is consistent when firm size is proxied by fixed assets in columns (5) and (6) and when import demand elasticities are further controlled for in columns (7) and (8). The firm size is not estimated to be statistically significant in any of the columns. One possible interpretation is that there is a minimum threshold for the quality of products imported into the US. Only firms that can produce products above the quality threshold are allowed to serve the US market. Firm size has no statistically significant effect on the intensive margin because a certain level of quality is ensured given the minimum quality requirements in the US market, and the quality of products exported by larger firms is not significantly superior across firms.

Table 8 outlines the impacts on export quantity. The coefficients of border rejection dummies are positive and significant. Combined with **Table 7**, the results can be summarized as firms that experience border rejection but survive in the US market tend to increase their exports. Note that this effect is not significantly heterogeneous in firm size.

According to the impact on export unit prices presented in **Table 9**, past border rejections are positively related to higher export unit prices for firms in the current year. This is interesting because it would imply that firms that experienced border rejections met the regulatory requirements by paying compliance costs and increasing product quality. However, the estimates do not necessarily indicate an increase in quality since another possible interpretation of the change in the export unit price is that firms simply passed on some of the compliance costs to the product price. This point deserves further elaboration and is carefully analyzed in the robustness checks in the next section.

Overall, conditional on continued exporting, past rejection increases export value, quantity, and unit price at the intensive margin. Compliance with more stringent technical regulations and standards appears to serve not only hinder entry but also to catalyze the upgrading of capacity and competitive repositioning for exporter firms.

4.3. Robustness checks

For this section, we conduct a series of robustness checks on the estimates. The first is a falsification test that estimates whether a 1-year lead in the treatment indicator, rather than a lag, impacts a firm's trade performance. That is, the rejection dummy is one year before firms receive treatment. Accordingly, the firm's past rejection picks up the effect of all past years and is thus removed from the estimation because it does not necessarily depend on the treatment in year $t+1$. The results in **Table 10** indicate that the estimates of the impact on the extensive margin of trade in any column are close to zero and not statistically significant. **Table 11** presents the results of the intensive margin. Columns (1)–(2) and (7)–(9) demonstrate that falsification treatment has no significant effect on export value or unit price. However, in columns (3)–(6), the impact of the $t+1$ year treatment on the number of exports is still statistically significant, despite that these firms have not yet received the treatment. This finding suggests that at least part of the original effect is due to firm self-selection.

To address this potential selection bias, we employ an IV approach. We use the dummy for border rejections for the same product category, p, by firm i's peer competitors as an instrument for firm i's border rejections. The premise is that rejection records of firm i's competitors would correlate with the probability of rejecting firm i (the more border rejections of similar products, the more stringent border inspections the product is subject to, which would positively correlates with the probability of firm i's border rejection) but does not directly affect firm i's own export strategy.

Although Beestermöller et al. (2018) argue that records of border rejections of similar products by other firms in the same country affect firm i's own exports, we regard such a reputation effect (referred to as "sector reputation" in Jouanjean et al., 2015) as affecting the outcome of firm i's export activity only through increasing the probability of border rejection. In addition, we consider such a reputation effect as a matter of reputation only in the destination country's market. That is, if the export of product p of firm $j \neq i$ (which sells similar products of the category p as firm i) is rejected at the border of a certain country, then the export of product p of firm i is likely to be subject to stringent border inspections by that country's regulatory authority, thus possibly increasing the probability of border rejection. As long as the reputation effect influences the firm i's export activity only through firm i's border rejections, the exclusion restriction assumption is satisfied.

The remaining concern is that the exclusion restriction may not be satisfied if competitors' border rejections are observed by firm i. If firm i observes the rejections of its competitors and refrains from exporting to that rejecting country's market, or if it reacts to competitors' rejections and strengthens compliance to ensure that its product will not be rejected by the same coutnry, then the border rejections of competitors correlate with firm i's export strategy and is not plausible as the IV. However, although firm i can observe that competitors in the same industry have been rejected, it cannot determine the compliance status of those firms; thus, there is no direct impact on firm i's export behavior. Based on these assumptions, we believe that the choice of our IV is appropriate.

The results of the IV estimation on the extensive margin, portrayed in **Table 12,** support the robustness of our findings from the main specifications. Tests for under-identification and weak instruments further confirmed the validity of our IV. **Table 13** presents the results of IV estimation on the intensive margin. We confirm the qualitatively same results for the impact on export value and quantity.

To better control the hysteresis of past violation records, we re-examine Eq. (1) only for firms that experienced their first border rejection in year $t-1$. The findings in **Table 14** are generally consistent with those of the full sample, except that the effect on export quantity is no longer statistically significant. Given the results of the IV estimation, the impact of border rejection on export quantity may be weakly robust.

As noted earlier, we view the export unit price as an indicator of product quality, but there is not necessarily a direct link between the two. To analyze the impact of past border rejections on export product quality in the current period more precisely, we conduct additional estimates as follows. We first deflate the export unit price, calculated from the CCTS, by the industry-specific output deflators from Brandt et al. (2012) and we re-examine Eq. (1). Further, we adopt the measure of product quality provided by Fan et al. (2015), which originates from the approach of Khandelwal et al. (2013), where quality is defined as the unobserved attributes of a variety that make consumers willing to purchase relatively large quantities despite the somewhat high prices charged for the variety.

Specifically, we estimate the following empirical demand equation, and we infer product quality from the residual:

$$\ln(q_{i,p,t}) + \sigma_p \ln(p_{i,p,t}) = \varphi_p + \varphi_t + \varepsilon_{i,p,t}, (2)$$

where $q_{i,p,t}$ is the export quantity directly available from the CCTS, and $p_{i,p,t}$ is the deflated export unit price mentioned above. σ_p is the product-level elasticity of substitution by Broda and Weinstein (2006). By predicting the residual $\varepsilon_{i,p,t}$, we obtain the estimated product quality. We then regress the deflated unit price and product quality on the border rejection experience dummies and control variables.

The results can be found in **Table 15**. Columns (1)–(6) show the effects of the deflated unit price. Both the significance and magnitude of the coefficient on border rejection remain unchanged from the primary specification. Columns (7)–(12) present the effects on product quality indicators. The coefficients of the rejection dummies suggest a positive and significant relationship between border rejection experiences and quality upgrades. This means that firms that survive in the US market, despite past border rejections, pay the cost of compliance with regulations to improve product quality and choose to export upgraded products with better quality to the US market in the current year. The coefficients of the control variables are consistent with our expectations.

While Khandelwal et al. (2013)'s approach suggests that demand also increases when prices rise, it is not clear whether this is due to quality upgrading. We would like to distinguish between demand shock, in which "the existence of border inspections in accordance with the US technical regulations increases consumer demand for imports," and quality upgrading, in which "Chinese exporters improve the quality of their products in response to the US technical regulationss." In the case of demand shock, prices will rise because firms will be able to raise their markups on identical products (independent of quality upgrading) as consumer demand increases. If demand for a product increased more than the price of that product, then it is highly likely that quality upgrading (more than demand shock) occurred. Therefore, we add as an explanatory variable the product-year-level aggregate share of all Chinese firms in the US total imports to control for the magnitude of US import demand for Chinese products and capture the impact on firm quality upgrading. The results in **Table 16** show no qualitative changes from the baseline specification estimates for both the extensive margin (Columns (1)–(6)), and intensive margin (Columns (7)–(15)), indicating that our findings are robust.

We are further interested in firms' subsequent strategies after their products are rejected at the US border. The strategies include (i) retrying to export to the US market, (ii) exiting the US market and serving other foreign markets, and (iii) exiting the international market and serving the domestic market only. Thus, we perform additional tests to ensure a comprehensive discussion of firms' trade strategies. Specifically, we first create a dummy variable for firms that exited the US market in the current year (inferred from one of the dependent variables for extensive margin analysis) and began exporting to foreign markets other than the US ($= 1$ if the firm served other foreign markets and $= 0$ if otherwise) and regressed it on the same set of explanatory variables with the main specifications. The results are presented in Column (1) of **Table 17**. The positive and significant coefficient of the border rejection dummy indicates that when firms exit the US market, firms that experience border rejections are more likely to begin exporting to another foreign market.

Technical regulations implemented in the US, a developed country, are generally more stringent than those in other countries, especially developing nations. This would suggest a strategy in which firms that cannot adapt to the US regulatory requirements change their destination to another market with less stringent regulations. Columns (2)–(4) of **Table 17** portray the effect of firms' trade with other countries that exit the US market on intensive margins. The positive and significant coefficients of the border rejection dummies in the first two columns imply that while the value and quantity of exports to other countries are higher for firms that exit the US market because of border rejections, the unit price is not significantly different. In other words, firms with border rejection experiences tend to export the same product to other countries without making any improvements to the unit price or product quality.

Furthermore, Column (5) shows that domestic market sales are not significantly different for firms exiting the US market because of border rejections. Connecting to the previous scenario, this means that the option to exit the international market and return to the home market is not a priority for these firms because they believe that the products they produce for sale in the US can also be exported to other foreign markets.

Finally, the above analysis suggest that firms decide the value of exports, product quality, and whether to continue exporting to the US in response to the boarder rejection experience. Given that technical regulations in developed countries such as the US are generally more stringent than those in other countries, it is inferred that firms that have continued serving the US market have little incentive to differentiate their products to be exported to countries other than the US from those destined for the US market. Based on this presumption, we estimate the Eq. (1) using data on the Chinese firms' total exports to the world. During estimation, the aforementioned product-year-level aggregate share of Chinese firms in the US total imports is further controlled. The results are shown in **Table 18**. The positive and significant coefficients of the border rejection on export value, quantity, and quality remain unchanged from the baseline in all specifications.

5. Conclusion

We empirically analyze the impact of border rejection on export performance. To the best of our knowledge, this is the first study to identify individual manufacturers whose products were refused entry into an external market, thereby estimating the effects on a firm's exports of its own rejection experiences. We construct a novel dataset by connecting US import refusal records against Chinese shipments with Chinese firm-level customs and manufacturing survey data. We find robust evidence of the substantial compliance cost burden faced by firms exporting to external markets with stringent technical requirements. In addition, we find supportive evidence that compliance with more stringent technical requirements both impedes market entry and catalyzes the firm's upgrading of capacity and competitive repositioning.

Our empirical findings suggest that the "standards as catalysts" hypothesis holds for firms that can gain access to the required financial and technical resources to bear the cost burden to reach compliance. On the other hand, the compliance costs faced by firms—especially those based in developing countries and exporting to advanced economies with more stringent technical requirements—appear to marginalize weaker or smaller-sized firms. To facilitate compliance, government quality controls may need to be strengthened to mitigate the compliance cost burden, ideally inclusively.

The compliance capacities of exporting firms can be enhanced not only through public sector support and technical assistance but also through government policy efforts (as discussed in detail, for example, in World Bank, 2005). Institutional structures may need to be reformed to establish a competent authority to be recognized by the counterpart regulatory agencies of the destination market. Meanwhile, a government may consider taking revolutionary steps to harmonize the country's regulatory environment "up to" international standards.[27]

Furthermore, public and private actions may be substituted for one another (e.g., private testing instead of public testing) or complement each other (e.g., improved public sampling and testing procedures alongside enhanced safety management systems at the factory level). Although we

[27] Disdier et al. (2015), for example, find that harmonization with international standards is often benign or trade-expanding for developing countries in contrast to the trade-impeding effect of harmonization with regional standards. Nevertheless, Beghin et al. (2015) extensively review existing empirical studies and concluded that the direction and magnitude of the effects of international harmonization of technical measures on trade are sector-specific and unique for different standards. Further, the reality is more complex as both public standards and standards applied by individual private companies are ubiquitous.

overlook such interrelationships, future research should consider both public and private actions to improve compliance.

Another direction for future research is to investigate the impact of border rejection on a firm's performance in general. Responding to more stringent technical requirements in external markets may also provide an incentive for the modernization or sophistication of supply chains (Henson and Jaffe, 2008). That is, a firm's efforts to achieve compliance may help to improve the performance and productivity of evolving firms. This line of possible regulation-induced innovation can be assessed through the Porter hypothesis argument (Porter and van der Linde, 1995) in the literature on environmental regulations.

Finally, future research should move in the direction of assessing possible economic benefits brought to US consumers through the improved quality of imported products. US import refusals against adulterated foods and feeds, misbranded medical devices, and other products may result in maintaining the average quality of products that are imported successfully and which enter the US market upon compliance, and import refusals may induce efforts by exporting firms to upgrade product quality, leading to higher quality in the long term. Such potential consumer benefits through import refusals could be evaluated using a similar approach to Amiti, Dai, Feenstra, and Romalis (2020), who measure the impact of China's entry into the World Trade Organization (WTO) on US consumers.

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Table 1. FDA import refusals by product category

Category of FDA regulated industries	Import refusals		Firm-product-		Firm-year pairs		Firms	
	N.	Percent	N.	Percent	N.	Percent	N.	Percent
[1] Food and Cosmetics	2,964	49%	2,710	50%	1,802	48%	1,399	47%
[2] Human Drugs	802	13%	756	14%	624	17%	534	18%
[3] Animal Use Products	78	1%	70	1%	56	2%	50	2%
[4] Vitamins for Human Use, Used as Drugs, or for Animal Use	518	9%	474	9%	389	10%	328	11%
[5] Antibiotics for Human Use or for Animal Use	81	1%	70	1%	63	2%	57	2%
[6] Medical Devices, In-vitro Diagnostic Products, Non-medical Radiation Emitting Products	1,620	27%	1,329	25%	960	26%	828	28%
Total	**6,063**	**100%**	**5,409**	**100%**	**3,732**		**2,962**	

Notes: An import refusal evet is originally identified at the firm-product-date level. The table shows the counted number and associated basic statistics of
In the US FDA webpage, industries subject to the FDA regulations are grouped into five categories: Food, Cosmetics and Vitamin Products; Human
Among the five categories, there is no refusal event of Tobacco Products recorded in the 2002-2007 IRR database. The category for Tobacco Products is
Categories [1], [2] and [3] are constructed based on the purpose of use (i.e., used for human use non-drug products, for human drugs or for animals).
When aggregating raw data into the firm-year level, there are 3,732 obs. Out of 3,732 firm-year pairs, 3,585 firm-year pairs (96.1%) were subject to import
There are 2,962 individual firms included in the 2002-2007 IRR database.Out of 2,962 firms, 2,770 firms (93.5%) were subject to import refusal(s) for a
Source: US FDA Import Refusal Report (IRR) data, 2002 - 2007.

Table 2. FDA import refusals by refusal reason

Category of reasons	Recorded reason codes			Affected firms	
	N.	Percent	Cum.	N.	Percent
Adulteration	4,042	44%	44%	1,746	59%
Misbranding	4,027	44%	88%	1,476	50%
Unapproved new drug	588	6%	94%	453	15%
Failure to file initial report	194	2%	96%	162	5%
Nonstandard	173	2%	98%	91	3%
No information available	112	1%	99%	48	2%
Insanitary manufacturing, processing or packing	34	0%	100%	31	1%
Not certified	23	0%	100%	16	1%
Unapproved & misbrading & PHS act	12	0%	100%	4	0%
Non conforming manufacturing practices	6	0%	100%	4	0%
Importation restricted	4	0%	100%	2	0%
Total	**9,215**	**100%**		**2,962**	..

Notes: An import refusal evet is identified at the firm-product-date level. Each import refusal event is recorded with one or more reason codes for the refusal. There are 303 different reason codes, which can be aggregated into ten categories (i.e. adulteration, misbranding, and so on) and an additional category for those without detailed information as listed above. The table shows the counted number of recorded reason codes for import refusals by the reason category.
Source: US FDA Import Refusal Report (IRR) data, 2002 - 2007.

Table 3. Sample size of ASIF and CCTS databases

	ASIF	CCTS (Exp.)	Matched	
			Export	Ratio (%)
2002	177,914	74,949	26,270	14.8
2003	190,321	89,610	30,296	15.9
2004	265,632	109,047	47,084	17.7
2005	264,353	116,472	48,338	18.3
2006	296,572	162,931	54,738	18.5
2007	331,225	176,254	83,201	25.1
Total	1,849,868	858,262	332,561	18.0

Source: Authors' calculation based on ASIF and CCTS data.

Table 4. Matching results

	(1)	(2)	(3)	(4)	(5)	(6)
	FDA		**ASIF-CCTS (FDA targeted goods exp. to the US)**		**Matched**	
	Firm	**Firm-HS4-year**	**Firm**	**Firm-HS4-year**	**Firm**	**Firm-HS4-year**
2002	314	559	8,097	16,812	73	19
2003	394	850	9,771	21,079	91	32
2004	455	1,116	15,512	33,244	95	55
2005	564	1,260	15,789	33,387	161	56
2006	490	1,093	18,932	40,852	119	63
2007	745	1,185	26,317	67,075	227	52
Total	2,962	6,063	94,418	212,449	766	277

Source: Authors' calculation based on FDA, ASIF and CCTS data.

Table 5. Extensive margin: Exit from the US market

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Exit from the US market in year t							
Firm's rejection in *t*-1	0.215***	0.417**			0.215***		0.226***	0.199***
	(0.0345)	(0.209)			(0.0345)		(0.0342)	(0.0471)
Firm's rejection in t-1 * Firm size		-0.0331						
		(0.0338)						
Firm's overall rejection in *t*-1			0.173***	0.271*		0.173***		
			(0.0262)	(0.164)		(0.0262)		
Firm's overall rejection in *t*-1 * Firm size				-0.0161				
				(0.0263)				
Firm's rejection in *t*-1 * Elasticity								0.340
								(0.440)
Ln firm size *t*-1	-0.0124***	-0.0124***	-0.0124***	-0.0124***			-0.0124***	-0.0124***
	(0.00197)	(0.00197)	(0.00197)	(0.00197)			(0.00198)	(0.00198)
Ln firm's fix asset *t*-1					-0.00373***	-0.00372***		
					(0.000928)	(0.000928)		
Ln elasticity *t*-1							-0.0168*	-0.0169*
							(0.00910)	(0.00910)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	246,267	246,267	246,267	246,267	246,267	246,267	246,287	246,287
R-squared	0.197	0.197	0.197	0.197	0.197	0.197	0.191	0.191

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Extensive margin: Entry to the US market

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Entry in the US market in year t							
Firm's rejection in *t*-1	-0.0906***	-0.0801			-0.0904***		-0.0896***	-0.0818***
	(0.00978)	(0.0498)			(0.00978)		(0.00948)	(0.0122)
Firm's rejection in t-1 * Firm size		-0.00173						
		(0.00793)						
Firm's overall rejection in *t*-1			-0.0460***	-0.0147		-0.0459***		
			(0.0136)	(0.0768)		(0.0136)		
Firm's overall rejection in *t*-1 * Firm size				-0.00511				
				(0.0120)				
Firm's rejection in *t*-1 * Elasticity								-0.0985
								(0.100)
Ln firm size *t*-1	0.00649***	0.00649***	0.00648***	0.00648***			0.00650***	0.00650***
	(0.00147)	(0.00147)	(0.00147)	(0.00147)			(0.00147)	(0.00147)
Ln firm's fix asset *t*-1					0.00116	0.00116		
					(0.000778)	(0.000778)		
Ln elasticity *t*-1							-0.0139**	-0.0139**
							(0.00699)	(0.00699)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	246,267	246,267	246,267	246,267	246,267	246,267	246,287	246,287
R-squared	0.076	0.076	0.076	0.076	0.076	0.076	0.072	0.072

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Intensive margin: Export value

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Export value to the US market in year t							
Firm's rejection in *t*-1	0.723***	0.186			0.724***		1.098***	1.308***
	(0.233)	(1.227)			(0.233)		(0.269)	(0.350)
Firm's rejection in t-1 * Firm size		0.0870						
		(0.205)						
Firm's overall rejection in *t*-1			1.105***	-1.392		1.107***		
			(0.221)	(1.101)		(0.221)		
Firm's overall rejection in *t*-1 * Firm size				0.400**				
				(0.180)				
Firm's rejection in *t*-1 * Elasticity								-2.780
								(2.374)
Ln firm size *t*-1	0.0350	0.0348	0.0342	0.0330			0.0189	0.0188
	(0.0408)	(0.0408)	(0.0408)	(0.0408)			(0.0417)	(0.0417)
Ln firm's fix asset *t*-1					-0.00923	-0.00946		
					(0.0177)	(0.0177)		
Ln elasticity *t*-1							2.413***	2.416***
							(0.295)	(0.295)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,893	41,893	41,893	41,893	41,893	41,893	41,926	41,926
R-squared	0.542	0.542	0.542	0.542	0.542	0.542	0.483	0.483

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8. Intensive margin: Export quantity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Export quantity to the US market in year t							
Firm's rejection in *t*-1	0.502**	1.680			0.503**		0.802***	0.969***
	(0.247)	(1.644)			(0.246)		(0.267)	(0.342)
Firm's rejection in t-1 * Firm size		-0.191						
		(0.267)						
Firm's overall rejection in *t*-1			0.964***	0.0328		0.966***		
			(0.239)	(1.397)		(0.238)		
Firm's overall rejection in *t*-1 * Firm size				0.149				
				(0.222)				
Firm's rejection in *t*-1 * Elasticity								-2.203
								(2.446)
Ln firm size *t*-1	0.0496	0.0499	0.0489	0.0484			0.0317	0.0316
	(0.0441)	(0.0441)	(0.0441)	(0.0441)			(0.0472)	(0.0472)
Ln firm's fix asset *t*-1					-0.00540	-0.00566		
					(0.0181)	(0.0181)		
Ln elasticity *t*-1							0.725***	0.727***
							(0.273)	(0.273)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,881	41,881	41,881	41,881	41,881	41,881	41,914	41,914
R-squared	0.635	0.635	0.635	0.635	0.635	0.635	0.588	0.588

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9. Intensive margin: Export unit price

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Export unit price to the US market in year t							
Firm's rejection in *t*-1	0.274**	-0.572			0.274**		0.301**	0.368**
	(0.116)	(0.628)			(0.116)		(0.125)	(0.178)
Firm's rejection in t-1 * Firm size		0.137						
		(0.102)						
Firm's overall rejection in *t*-1			0.144	-0.420		0.144		
			(0.103)	(0.580)		(0.103)		
Firm's overall rejection in *t*-1 * Firm size				0.0903				
				(0.0920)				
Firm's rejection in *t*-1 * Elasticity								-0.888
								(0.887)
Ln firm size *t*-1	0.000776	0.000550	0.000743	0.000477			0.00153	0.00149
	(0.0159)	(0.0159)	(0.0159)	(0.0159)			(0.0200)	(0.0200)
Ln firm's fix asset *t*-1					0.00355	0.00359		
					(0.00583)	(0.00583)		
Ln elasticity *t*-1							1.645***	1.646***
							(0.196)	(0.196)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	41,813	41,813	41,813	41,813	41,813	41,813	41,847	41,847
R-squared	0.828	0.828	0.828	0.828	0.828	0.828	0.736	0.736

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10. Falsification test of the extensive margin

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Exit from the US market in year t			Entry in the US market in year t		
Firm's rejection in *t*+1	-0.00241	-0.00239	0.0136	0.00674	0.00670	0.00729
	(0.0337)	(0.0337)	(0.0337)	(0.0361)	(0.0361)	(0.0362)
Ln firm size *t*-1	-0.0124***		-0.0124***	0.00647***		0.00648***
	(0.00197)		(0.00198)	(0.00147)		(0.00147)
Ln firm's fix asset *t*-1		-0.00370***			0.00115	
		(0.000928)			(0.000778)	
Ln elasticity *t*-1			-0.0168*			-0.0139**
			(0.00910)			(0.00699)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	No	Yes	Yes	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	246,267	246,267	246,287	246,267	246,267	246,287
R-squared	0.197	0.197	0.191	0.076	0.076	0.072

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11. Falsification test of the intensive margin

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Value to the US market in year t			Quantity to the US market in year t			Unit price to the US market in year t		
Firm's rejection in *t*+1	0.392	0.389	0.606*	0.566**	0.565**	0.693*	-0.0845	-0.0852	-0.0517
	(0.242)	(0.243)	(0.340)	(0.284)	(0.285)	(0.404)	(0.0832)	(0.0831)	(0.106)
Ln firm size *t*-1	-0.0795		-0.0817	-0.0438		-0.0531	-0.0207		-0.0183
	(0.0550)		(0.0604)	(0.0621)		(0.0748)	(0.0248)		(0.0324)
Ln firm's fix asset *t*-1		-0.0100			-0.00318			-0.00263	
		(0.0223)			(0.0236)			(0.00775)	
Ln elasticity *t*-1			2.120***			0.903**			1.181***
			(0.463)			(0.398)			(0.311)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,156	16,156	16,186	16,156	16,156	16,186	16,141	16,141	16,171
R-squared	0.664	0.664	0.584	0.730	0.730	0.664	0.872	0.872	0.779

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12. Instrumental variable analysis: Extensive margin

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	Exit from the US market in year t					Entry in the US market in year t				
Firm's rejection in t-1	0.211***		0.210***		0.211***	-0.0936***		-0.0934***		-0.0936***
	(0.0413)		(0.0412)		(0.0413)	(0.0118)		(0.0118)		(0.0118)
Firm's overall rejection in t-1		0.229***		0.229***			-0.102***		-0.102***	
		(0.0447)		(0.0447)			(0.0129)		(0.0129)	
Ln firm size t-1	-0.0135***	-0.0135***			-0.0135***	0.00699***	0.00698***			0.00699***
	(0.00218)	(0.00218)			(0.00218)	(0.00162)	(0.00162)			(0.00162)
Ln firm's fix asset t-1			-0.00402***	-0.00403***				0.00119	0.00119	
			(0.00104)	(0.00104)				(0.000865)	(0.000865)	
Ln elasticity t-1					-0.0165					-0.0126
					(0.0114)					(0.00874)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of instruments	2	2	2	2	3	2	2	2	2	3
Under indentification test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Weak indentification teset (F-stat)	386.37	371.53	386.37	371.53	386.37	386.37	371.53	386.37	371.53	386.37
Weak instrument-robust inference test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	223,255	223,255	223,255	223,255	223,255	223,255	223,255	223,255	223,255	223,255
R-squared	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	-0.000	0.000

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13. Instrumental variable analysis: Intensive margin

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Exports to the US market in year t					Export quantity to the US market in year t					Export unit price to the US market in year t				
Firm's rejection in *t*-1	0.899**		0.900**		0.884**	0.647**		0.649**		0.643**	0.372**		0.371**		0.361*
	(0.358)		(0.358)		(0.358)	(0.309)		(0.309)		(0.309)	(0.188)		(0.188)		(0.188)
Firm's overall rejection in *t*-1		1.278***		1.280***			0.921**		0.923**			0.528**		0.527**	
		(0.495)		(0.496)			(0.422)		(0.422)			(0.269)		(0.269)	
Ln firm size *t*-1	0.0204	0.0195			0.0189	0.0322	0.0315			0.0317	0.00253	0.00215			0.00151
	(0.0417)	(0.0417)			(0.0417)	(0.0473)	(0.0472)			(0.0472)	(0.0199)	(0.0199)			(0.0200)
Ln firm's fix asset *t*-1			-0.00414	-0.00429				-0.00261	-0.00272				0.00487	0.00480	
			(0.0184)	(0.0184)				(0.0191)	(0.0191)				(0.00726)	(0.00727)	
Ln elasticity *t*-1					2.413***					0.725***					1.645***
					(0.295)					(0.273)					(0.196)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of instruments	2	2	2	2	3	2	2	2	2	3	2	2	2	2	3
Under indentification test (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Weak indentification teset (*F*-stat)	266.15	145.7	266.11	145.69	266.14	266.14	145.69	266.1	145.69	266.13	266.33	145.55	266.29	145.55	266.31
Weak instrument-robust inference test (*p*-value)	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06
Observations	41,926	41,926	41,926	41,926	41,926	41,914	41,914	41,914	41,914	41,914	41,847	41,847	41,847	41,847	41,847
R-squared	0.000	0.001	0.000	0.001	0.003	0.000	0.001	0.000	0.001	0.000	0.000	-0.000	0.000	-0.000	0.007

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14. Main specifications with the first rejection

	(1)	(2)	(3)	(4)	(5)
	Extensive margin		Intensive margin		
VARIABLES	Exit	Entry	Export value	Export quantity	Unit price
Firm's rejection in *t*-1	0.338***	-0.0880***	0.625**	0.399	0.333**
	(0.0431)	(0.0103)	(0.295)	(0.325)	(0.160)
Ln firm size *t*-1	-0.0124***	0.00654***	0.0328	0.0480	8.75e-05
	(0.00197)	(0.00147)	(0.0408)	(0.0440)	(0.0159)
Firm FE	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	Yes
HS2-year FE	Yes	Yes	Yes	Yes	Yes
Observations	246,169	246,169	41,806	41,794	41,726
R-squared	0.197	0.076	0.542	0.634	0.828

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15. Quality upgrade after rejection

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Deflated export unit priceto the US market in year t						Export unit quality to the US market in year t					
Firm's rejection in *t*-1	0.236**		0.235**		0.262**		0.444*		0.445*		0.745***	
	(0.107)		(0.107)		(0.118)		(0.257)		(0.257)		(0.280)	
Firm's overall rejection in *t*-1		0.137		0.137		0.140		0.956***		0.957***		1.273***
		(0.0870)		(0.0870)		(0.0930)		(0.240)		(0.240)		(0.243)
Ln firm size *t*-1	-0.0120	-0.0121			-0.0137	-0.0138	0.0463	0.0454			0.0357	0.0347
	(0.0158)	(0.0158)			(0.0205)	(0.0205)	(0.0462)	(0.0462)			(0.0456)	(0.0456)
Ln firm's fix asset *t*-1			0.000735	0.000767					0.000522	0.000192		
			(0.00617)	(0.00617)					(0.0195)	(0.0195)		
Ln elasticity *t*-1					1.722***	1.721***					0.186	0.175
					(0.204)	(0.204)					(0.278)	(0.278)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	0.460	0.460	0.676***	0.674***	0.542*	0.543*
Product (HS4) FE	Yes	Yes	Yes	Yes	No	No	(0.294)	(0.294)	(0.192)	(0.192)	(0.290)	(0.290)
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes						
Observations	37,486	37,486	37,486	37,486	37,518	37,518	37,486	37,486	37,486	37,486	37,518	37,518
R-squared	0.844	0.844	0.844	0.844	0.753	0.753	0.515	0.515	0.515	0.515	0.488	0.488

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 16. Baseline result with Chinese firms' market share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
VARIABLES	Exit from the US market			Entry in the US market			Export value to the US market			Export quantity to the US market			Export quality to the US market		
Firm's rejection in *t*-1	0.215***		0.226***	-0.0901***		-0.0899***	0.728***		1.150***	0.504**		0.848***	0.444*		0.746***
	(0.0346)		(0.0342)	(0.00985)		(0.00957)	(0.234)		(0.270)	(0.246)		(0.267)	(0.257)		(0.280)
Firm's overall rejection in *t*-1		0.171***			-0.0447***			1.096***			0.949***			0.956***	
		(0.0263)			(0.0136)			(0.221)			(0.235)			(0.240)	
Ln firm size *t*-1	-0.0137***	-0.0137***	-0.0137***	0.00695***	0.00694***	0.00694***	0.0409	0.0401	0.0274	0.0570	0.0563	0.0420	0.0463	0.0454	0.0357
	(0.00220)	(0.00220)	(0.00220)	(0.00163)	(0.00163)	(0.00163)	(0.0410)	(0.0409)	(0.0416)	(0.0442)	(0.0442)	(0.0471)	(0.0462)	(0.0462)	(0.0456)
Ln elasticity *t*-1			-0.0246**			-0.0153*			1.946***			0.278			0.184
			(0.0115)			(0.00878)			(0.290)			(0.275)			(0.279)
Ln CHN firm share *t*-1	0.104***	0.105***	0.103***	-0.0247	-0.0248	0.0135***	-0.235	-0.222	2.241***	-0.0210	-0.00906	2.144***	0.00909	0.0211	0.0109
	(0.0280)	(0.0280)	(0.00536)	(0.0203)	(0.0203)	(0.00391)	(0.561)	(0.561)	(0.132)	(0.563)	(0.563)	(0.133)	(0.590)	(0.590)	(0.134)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	221,730	221,730	221,736	221,730	221,730	221,736	41,820	41,820	41,853	41,808	41,808	41,841	37,486	37,486	37,518
R-squared	0.188	0.188	0.184	0.074	0.074	0.071	0.542	0.542	0.489	0.635	0.635	0.593	0.515	0.515	0.488

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17. Trade strategies after rejection

	(1)	(2)	(3)	(4)	(5)
	Switch	Intensive margin of trade to other countries (Switched firms only)			
VARIABLES		Value	Quantity	Unit price	Domestic sale
Firm's rejection in *t*-1	0.151**	2.317***	2.065***	0.104	-0.0428
	(0.0625)	(0.505)	(0.487)	(0.0909)	(0.107)
Ln firm size *t*-1	0.00849*	0.324***	0.284***	0.0140	0.129***
	(0.00485)	(0.0631)	(0.0588)	(0.0143)	(0.0224)
Firm FE	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	Yes	Yes	Yes	Yes
HS2-year FE	Yes	Yes	Yes	Yes	Yes
Observations	43,835	43,835	43,835	33,416	36,231
R-squared	0.368	0.574	0.596	0.814	0.917

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 18. Export to the world

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Export value to the world in year t				Export quantity to the world in year t				Export quality to the world in year t			
Firm's rejection in t-1	0.664***	0.928***	0.667***	0.924***	0.524**	0.711***	0.525**	0.708***	0.566**	0.848***	0.566**	0.848***
	(0.202)	(0.227)	(0.202)	(0.231)	(0.208)	(0.230)	(0.208)	(0.234)	(0.233)	(0.249)	(0.233)	(0.249)
Ln firm size t-1	0.0809**	0.0765**	0.0808**	0.0758**	0.0782**	0.0613	0.0781**	0.0609	0.0668*	0.0777**	0.0665*	0.0777**
	(0.0339)	(0.0349)	(0.0339)	(0.0347)	(0.0366)	(0.0396)	(0.0366)	(0.0395)	(0.0403)	(0.0393)	(0.0403)	(0.0393)
Ln elasticity t-1		2.117***		1.804***		0.926***		0.652***		0.0866		0.0864
		(0.237)		(0.231)		(0.227)		(0.238)		(0.273)		(0.274)
Ln CHN firm share t-1			-0.562	3.366***			-0.315	2.964***			0.767	0.00319
			(0.440)	(0.213)			(0.449)	(0.215)			(0.542)	(0.223)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product (HS4) FE	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
HS2-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,653	49,701	49,653	49,701	49,589	49,637	49,589	49,637	33,488	33,535	33,488	33,535
R-squared	0.586	0.524	0.586	0.529	0.662	0.602	0.662	0.605	0.605	0.567	0.605	0.567

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A1. Replication of Beestermöller et al. (2018) (extensive margin)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Exit from the US market in year *t*			Entry in the US market in year *t*			# of firms
Dummy for industry-level rejection in *t*-1	0.0995***	0.440*		-0.122***	-0.149**		
	(0.0316)	(0.236)		(0.0107)	(0.0673)		
Dummy for spill-out in *t*-1 * Firm size		-0.0239			0.00186		
		(0.0161)			(0.00470)		
Cumulative past industry-level rejections			0.187			-0.125**	0.771
			(0.183)			(0.0531)	(0.822)
Cum. Past industry-level rejection * Firm size			-0.00857			0.00274	-0.0215
			(0.0124)			(0.00368)	(0.0573)
Ln firm size	0.0259***	0.0259***	0.0259***	-0.0152***	-0.0152***	-0.0152***	0.0453***
	(0.000728)	(0.000728)	(0.000728)	(0.000691)	(0.000691)	(0.000691)	(0.00467)
Observations	243,860	243,860	243,860	243,860	243,860	243,860	243,860
R-squared	0.225	0.225	0.225	0.104	0.104	0.104	0.245

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2. Replication of Beestermöller et al. (2018) (intensive margin)

	(1)	(2)	(3)	(4)	(5)
	Exports to the US market in year *t*			Quantity	Unit value
Dummy for industry-level rejection in *t*-1	0.961***	-5.310***			
	(0.204)	(1.606)			
Dummy for spill-out in *t*-1 * Firm size		0.434***			
		(0.114)			
Cumulative past industry-level rejections			-3.696***	-1.432	-1.149**
			(1.172)	(1.140)	(0.526)
Cum. Past industry-level rejection * Firm size			0.296***	0.134*	0.0877**
			(0.0839)	(0.0790)	(0.0375)
Ln firm size	0.0331***	0.0322***	0.0324***	0.0303***	0.000784
	(0.0112)	(0.0112)	(0.0112)	(0.0113)	(0.00384)
Observations	69,412	69,412	69,412	69,412	69,232
R-squared	0.529	0.530	0.529	0.620	0.815

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A3. Endogeneity of firm size

	(1)	(2)
VARIABLES	Firm size	
Firm's rejection in *t*-1	0.00589	
	(0.0362)	
Firm's overall rejection in *t*-1		-0.00143
		(0.0353)
Firm FE	Yes	Yes
Product (HS4) FE	Yes	Yes
HS2-year FE	Yes	Yes
Observations	36,087	36,087
R-squared	0.949	0.949

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1