How Exporting Firms Respond to Technical Barriers to Trade?

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Abstract: This paper investigates how Technical Barriers to Trade (TBT) affect firm export performance. The implementation of the "Children-Resistance" act (CR act) in the EU offers an ideal quasi-natural experiment to identify the causal effect of TBTs on firm performance. Using data on Chinese firms that export cigarette lighters between 2004 and 2008, empirical results show that firms that export to the EU not only adjust their product quality to meet the requirements in the CR act, but also upgrade their product quality in other dimensions. However, both the export value and export volume to the EU decline. At the same time, less productive exporters are forced to exit from the EU market. In addition, while the effect of the CR act on export quality is significant only in the implementation year, its impact on firm-level export scale last longer even after its implementation, which is referred to as a dynamic impact. Lastly, Heterogeneous effect of TBT is also documented.

Key Word: Technical barriers to trade; Children-Resistant Act; Difference in differences

JEL Classification: F13; F14; D21

1. Introduction

Despite World Trade Organization (WTO) objective to reduce and sustain lower applied tariffs in the past decades, non-tariff trade barriers (NTB) have remained persistent and have even been increasingly implemented by the governments of WTO members (Prusa, 2011; Zanardi, 2006; Bown, 2011). Non-tariff barriers are permissible under WTO rules and encompass a wide range of measures, in which technical-barriers to trade (TBT) account for a nontrivial share. During 2000-2014, a total of 19,141 NTB cases are reported among WTO members, and, of that 10,046 TBT account for 52.5% of all NTB cases. The pervasiveness of TBT measures has spurred researchers to study their effect on firm export behaviors.

Although the effects of TBT measures on protected domestic firms and industries has received substantial attentions, much less is known about their impact on affected foreign exporters.[1] It is of policy and research importance to understand how affected foreign exporters respond to TBT measures as their strategic responses (in price, quality, and exports) have significant influence on the market competition structure and welfare in both domestic and foreign countries. Further, examining firm-level heterogeneous response when facing a shock generated by TBT complements the firm heterogeneity literature. In the existing literature, the primary focus is how TBTs affect firms' export market entry and exit decisions, but very few papers explore how firm-level export price, quantity, and quality responses are related. In this work, we attempt to investigate the influence of TBTs on firm-level export quality, quantity, and entry/exit decisions.

China offers an ideal setting to study the impact of TBTs on firm-level export behaviors for three reasons. First, China is one of the world's largest recipients of NTB measures (Lu, et al. 2013). In 2012, China was involved in 77 cases of trade disputes initiated by 21 countries, and the amount of money involved accounted for more than 28 billion USD. Trade frictions between China and other countries lead to frequent adoptions of TBTs in foreign countries, which aim to restrict exports from China. Second, a considerable number of Chinese exporters have been influenced by TBTs in different forms. In 2013, among 3,152 randomly surveyed export firms from 31 Chinese provinces, 38% reported that they were subject to or influenced by TBT measures. In particular, chemical and allied, textile and cloth, vegetable products, machinery/electric, and foodstuffs industries are most likely to be subject to TBTs (AQSIQ, 2013). Third, exporters from China manifest substantial differentiation even in the same industry. For instance, in electronic heater industry, the largest exporters export more than 20,000 times of the smallest exporters in 2006. This feature enables us to study the heterogeneous impact of TBTs on different firms.

We mainly rely on the Children-Resistance (CR) Act implemented by EU in 2007 as an quasi-experiment to identify how Chinese exporters react to TBTs. According to CR Act in 2007,

[1] A few papers investigate how antidumping policy affect foreign exporters' pricing response (Blonigen and Park, 2004), export-destination choice (Bown and Crowley, 2006, 2007), and FDI strategies. (Blonigen, 2002).

all cigarette lighters are required to be child-resistant in order to reduce the injuries Children who end up with playing with them. This act forces all imported cigarette lighters to comply with the relevant specifications of the European standard. It provides a quasi-natural experiment to study the impact of TBTs on the performance of lighter exporters, especially from China.[2]

To identify the impact of the CR act on firm export performance, we employ a difference-in-difference (DID) approach at both the firm-destination (for export quality and quantity) level and firm (for import quality) level. Using firm-level transaction data of Chinese cigarette lighter exporters during 2004-2008,[3]we classify cigarette lighter exporters into treatment or control group according to their export destination. Specifically, the treatment group contains firms that export cigarette lighter to the EU, and the control group contains firms that export to non-EU regions. The DID results indicate that after the implementation of the CR act, the quality of cigarette lighters exported (by Chinese firms) to the EU has significantly increased relative to the exports in non-EU markets.[4] The result is valid for all three measures of quality. The first quality measure is unit price; the second quality measure is estimated by Khandelwal et al. (2013); the third one is new to this paper. Specifically, we track the imported materials of the treated firms and find that firms that export cigarette lighters to the EU not only adjust their export quality to meet requirements of the CR act, but also upgrade quality in other dimensions:[5]e.g. durability (upgrading from plastic shell to a galvanizing metal shell), serviceability (upgrading from not using a lighter filter to using one), features[6] (upgrading from roller lighter to an electronic lighter). This finding is in line with the literature which indicates substantial fixed costs in R&D activities (e.g. Aw, et al., 2011; Dai and Yu, 2013; Ludema and Yu, 2016), and once firms pay the large R&D costs, they will upgrade their quality in multiple dimensions.

In addition, results show that cigarette lighter firms (from China) shrink their exports, in both volume and value, to the EU in 2007, even though their export quality increases. The cigarette lighter exports from China to the EU continue to fall in 2008, which may reflect destination diversification or trade division. We also find that the impact of the CR act varies for different firms. In particular, relative to single-product firms, exports to the EU fall more for multi-product firms, which might be driven by the *cannibalization effect*[7]. At the meanwhile, comparing with

[2]Cigarette lighters from China are characterized by low prices but poor security conditions. As such, the CR act has been treated as targeting Chinese cigarette lighter exporters. Many Chinese Media report the severe situation faced by lighter producers after the CR Act of 2006, see for example:
http://biz.zjol.com.cn/05biz/system/2006/03/01/006495532.shtml

[3]We also conduct robustness checks by using data from 2000-2008.

[4]The results are robust to different measures of product quality.

[5]David A. Garvin (1987) defines eight dimensions of product quality management, which contain performance, feature, reliability, conformance, durability, serviceability, aesthetics, and perceived quality. The upgrading from plastic shell to galvanized metal share is an upgrade in the "durability dimension"; the use of a filter is an upgrade in the "serviceability dimension"; and upgrading from roller lighter to electric lighter is an upgrade in the "feature dimension".

[6] Features are additional characteristics that enhance the appeal of the product or service to the user.

[7] Multi-product firms can flexibly adjust their export skewness in response to different degree of market competiveness (see Eckl and Neary, 2010), which is called cannibalization effect. The cannibalization effect leads different responses in export quantities between multi-product and single-product firms.

foreign-owned firms, domestic private firms improve their products quality more, but decrease their exports more. Last, the implementation of the CR act drives out less productive and affected firms from the EU market, but more productive exporters survive. This implies that the CR act brings temporary benefits to EU producers who expand their market share. In the long run, however, the CR act may put EU producer in a disadvantage position when competing with Chinese exporters, who conduct quality upgrading and become more competitive.

Our work contributes to the literature on four dimensions. First, most TBT related research is at the country or product level, and the firm-level analysis has rarely been studied. For instance, Chenvassus-Lozza et al. (2005) study the role of European import standards (NTBs) for new member states trade flows in the food sector. Czubala et al. (2009) and Portugal-Perez et al. (2009) investigate the impact of harmonized standards adopted by the EU on textile and electric exports from African countries. Bao and Qiu (2012) evaluate the impact of TBT notifications on the intensive and extensive trade flows at the country-level. Firm-level analysis may better reveal the micro-channels through which TBTs affect the aggregate trade flows, e.g. resource reallocation, quality upgrading, etc.

Second, we introduce a novel path to investigate the influence of TBTs on firm-level export quality to avoid quality estimation bias. That is, we examine how TBT notifications affect the firm-level imported intermediates. Specifically, we compare the intermediates that firms import before and after the CR act, and determine the quality changes in intermediate inputs, e.g. cigarette lighters made by galvanizing metal shell are better than those made by plastic shell. Since the quality of intermediate inputs is closely related to the quality of final products (e.g. Kugler and Verhoogen, 2012; Hallak and Sividasan, 2013;Rodrigue and Tan, 2016; Fan, et al., 2015), we can uncover the impact of the CR act on the firm-level export quality through observing its impact on the firm-level import quality. Further, examining the firm-level imported materials allows us to assess the influence of the CR act on the "extensive margin" of quality upgrading:[8] besides upgrading the safety standard, export firms may also upgrade their product quality along other dimensions in response to the CR act.

Third, although a few papers document the impact of technical regulations on firm-level export performance, they looked at a small set of questions because of data limitations. Maskus et al. (2005) study the influence of technical regulations on 619 firms from 17 developing countries, and find a positive correlation of the restrictiveness of the TBTs and firm-level variable/fixed production cost, which has pronounced influence on firms' exports. Using the same data, Chen et al. (2008) document that TBTs reduce firms' export propensity and number of export destinations. Therefore, there are some important questions which remain unresolved; namely how do firms upgrade their product quality to comply with the TBT standards? What types of firms will be most

[8] Product quality can be decomposed into different dimensions. The quality of cigarette lighters, for instance, is determined by whether it has a safety device; whether it uses galvanized metal shell or plastic shell; with or without a filter; or if it is an electronic or roller lighter.

influenced? Our paper is able to fill this gap in the literature by answering these questions.

Fourth, the literature focuses on the static effect of TBTs on firm performance. A vast number of papers investigate the effect of TBTs through comparing affected firms export performance before and after the technical barriers (Fischer and Serra, 2000; Baldwin, 2001; Ganslandt and Markusen, 2001), and therefore they cannot reveal the dynamic effect of TBTs. A natural question is whether firms further upgrade their product quality or adjust their exports to the protected destinations after the TBTs are applied? We try to track the evolution of quality and exports in the years after the TBT implementation. This allows us to better understand the dynamic impact of TBTs on firms' export behavior.

The rest of the paper will proceed as follows: section 2 introduces the background of CR act, and its impact on Chinese cigarette lighter exporters. Section 3 describes the data and estimate strategy. Section 4 reports the results. The robustness checks are reported in section 5, and we conclude in section 6.

2. The Background of the CR act and Hypothesizes

2.1 The background of the CR act

Cigarette lighter exports account for a nontrivial share in global trade. In 2014, the total exports of cigarette lighters are up to $700 million. Europe was originally the center for cigarette lighter production, and later the production center moved to Japan, Taiwan and South Korea. From 1980's onwards, Chinese cigarette lighter begin to lead world trade, especially lighters from Wenzhou city. The rapid growth of Chinese cigarette lighters impede the development of the cigarette lighter industry in other countries. As such, U.S. passed the CR act to refrain the cigarette lighter imports from China in 1994 to protect its own domestic cigarette lighter production. Since then, most Chinese firms switched exporting cigarette lighters from the U.S. to the EU. The rapid import growth of cigarette lighters from China led EU countries to consider technical barriers to prevent the dramatic market share expansion of China-made cigarette lighters.

In 2001, the EU started to discuss the details of the EU version of CR act. Initially, the EU version of the CR act was a simple copy of the American standards. The decision requires the government to ensure that the common cigarette lighters placed on the EU market are child-resistant: at least 85% children in the strike test cannot successfully strike the lighters. It also forbids lighters that resemble objects which children find attractive (also called "novelty lighters"). After negotiating with the commerce department and trade association of China, the EU postponed the implementation date of the CR act from 2004 to 2007, and 2006-2007 was decided as the transition period. The EU version of the CR act also required the working life of cigarette lighters to be no fewer than 5 years; otherwise they have to be equipped with a safety device.

Exports of Chinese cigarette lighters' are heavily influenced by the CR act. First, cigarette lighters produced in other countries are often produced with a safety device. As such, they directly comply with the standards outlined in the CR act. In contrast, Chinese cigarette lighters are often

characterized by their inexpensive price and their lack of safety devices. Second, the simple features of Chinese cigarette lighters makes their working life far fewer than 5 years. Without meeting the technical barriers, Chinese lighter exporters have to exit from the EU market.

2.2 The impact of the CR act on firm-level export behavior

The standards listed in CR act force Chinese lighter exporters to meet the technical barriers in order to continue exporting to the EU. Therefore, the continuing exporters have to improve their product quality, such as adding safety devices or changing the packaging to comply with the CR act. We have the following hypothesis:

Hypothesis 1: The CR act encourages Chinese lighter exporters to innovate, and improve their export quality to the EU.

In order to meet the technical barriers, firms have to invest substantially in R&D. This investment includes large sunk start-up costs, which on the one hand, increases firm-level fixed cost. On the other hand, after the quality improvement, the production of higher quality lighters increases firm-level variable costs. For instance, Maskus et al. (2005) demonstrate that the TBTs will increase the variable production costs by 0.06-0.13 percent, and increase the fixed costs by 5 percent in the affected countries. As the cost increases, especially the increase in the variable cost will decrease firm-level exports in the EU.[9] We have the following hypothesis:

Hypothesis 2: the CR act decreases the affected firms' exports to the EU.

The literature indicates that the increase in fixed costs decrease firm-level export propensity (Dixit, 1989a, 1989b; Krugman, 1989). Aw, et al. (2011) document that among incumbent exporters, only larger ones can afford the fixed R&D costs. Melitz (2003) shows that larger exporters are often more productive. Taking all of these together, we predict that the CR act will drive those small and less productive firms out of the EU market, as they cannot afford the R&D investment to comply with the standards of the CR act. We have the following hypothesis:

Hypothesis 3: the CR act drive less productive firms out of the EU market.

In the following sections, we attempt to test these three hypothesizes to better understand the impact of the CR act on firm-level export behavior. Since the CR act gives one year transition period for Chinese lighter exporters, we try to separately identify the impact of the CR act on firm-level export behaviors during the transition and implementation period. The data and estimation strategies will be introduced in the subsequent section.

3. Date and Estimation

3.1. Data

We use the firm-level transaction data from Chinese Custom Trade Statistics (CCTS) over the

[9] We notice that although the variable costs increase for continuing exporters after the implementation of the CR act, product quality also increases. It is not necessary for that Chinese cigarette lighter exporters will experience a reduction in exports to the EU. However, note that Chinese exporters initially export low quality lighters to the EU market, while cigarette lighters the EU imports from other countries are characterized by high quality. As such, Chinese exporters have to compete with exporters from other countries in the high quality lighter market, which is not their comparative advantage.

2004-2008 period. The CCTS data in 2004-2006 record firm-level transaction information at a monthly level, and during 2007-2008, the information is reported at the annual level. We first aggregate the observations from the 2004-2006 period into an annual series by firm, product, and destination. After combining the two pieces of export information, we keep only observations from firms that export cigarette lighters, which include HS codes "96131000" (Pocket Lighters, Gas Fueled, Non-refillable) and "96139000" (Parts of Cigarette Lighters & Other Lighters). The dataset contains information of firm-level export quantity, value, destination, trade regime, etc. In this sample, every year there are, on average, 369 Chinese firms that export cigarette lighters. Each firm exports, on average, to 21 countries. Among all cigarette lighter exporters, 22.6% of them export to EU and about 80% of them export to at least two destinations.

Table 1 straightforwardly describes key patterns with which we are concerned. First, the export share in value to the EU relative to all other countries declines after the CR act, from 44.21% to 29.47%, and export share in volume to the EU relative all other countries declines from 45.26% (before the CR act) to 33.68% (after the CR act). Second, while the average export price in other countries increases 2.69 times after the CR act, the price in EU increases 4.61 times. This evidence indicates differential path of Chinese exporters in EU and non-EU countries. However, it is unclear whether this difference is caused by the implementation of the CR act or just represents the differential trends over time of firms exporting to EU and non-EU countries. In order to evaluate the impact of the CR act on Chinese cigarette lighter exporters, we adopt a difference-in-difference (DID) strategy.

[Table 1 is to be here]

3.2. Estimation strategy

The EU carried out the CR act in three important stages: the determination (in 2006), the transition period (2006-2007), and the implementation (in 2007). To identify the possible effects of the CR acts on Chinese exporters and test hypotheses, we employ a DID estimation strategy at the firm-product level. Specifically, the identification relies on two sources of variation: time variation (before and after a critical date during the CR act process), and cross-sectional variation (affected products/firms and unaffected products/firms).

In our baseline regression, we classify firms that export cigarette lighters to the EU into the treatment group, and firms that export cigarette lighters to the non-EU countries as the control group. It must be pointed out that if a firm exports to both the EU and non-EU countries, it belongs to both the treated group and control group. One reason we proceed in this way is because firms could differentiate their product quality and price across export countries (Manova and Zhang, 2012). Therefore, even for the same firm, the implementation of the CR act in the EU can differently affect the firm's export behavior in the EU and non-EU countries, and this difference identifies the treatment effect. However, if firms that export to both the EU and non-EU countries upgrade their export quality simultaneously, the treatment effect will be underestimated. To

address this concern, we conduct a robustness check in section 5 to classify firms into control group if they export cigarette lighters to non-EU countries only.[10] The baseline regression is as follows:

$$Y_{ijt} = \alpha_0 + \alpha_1 Transition_{jt} \times Group_j + \alpha_2 Implementation_{jt} \times Group_j + \lambda X_{ijt} + \varepsilon_{ijt} \quad (1)$$

where Y_{ijt} represents the firm-level outcome variables including quality, total export value and volume for firm *i* to destinations *j* in year *t*. $Group_j$ is a dummy variable which takes value 1 if firm *i* belongs to the treatment group, 0 otherwise. X_{ijt} contains year, destination, and firm fixed effects.[11] In addition, after the exchange rate reform in China in 2005, the exchange rate for the RMB was relatively volatile, which might affect the quality of exported products. Therefore, we also control for the exchange rate between China and destination countries in our estimation. $Transition_{jt}$ and $Implementation_{jt}$ are dummies denoting the start of the transition and implementation date of the CR act respectively, which are defined as follows:

$$Transition_{jt} = \begin{cases} 1, \text{ when } t \in [2006,2007) \\ 0, \text{ otherwise} \end{cases}$$

$$Implementation_{jt} = \begin{cases} 1, \text{ when } t \geqslant 2007 \\ 0, \text{ otherwise} \end{cases}$$

The coefficients, α_1 and α_2, capture the average difference between the treatment and control group before and after the transition and implementation period, respectively.

While it can be easily get the export value and export volume from the dataset, export quality is not readily available. As such, we have three ways to measure the export quality. First, in the baseline regression, we follow Schott (2004), Hummels and Skiba (2004)； Hallak (2006), and Manova and Zhang (2012), and use the unit price of cigarette lighters, p_{ijt}, to proxy export quality in different countries. The unit price is constructed by using the aggregate export value divided by aggregate export volume: $p_{ijt} = \frac{expValue_{ijt}}{expVolume_{ijt}}$. Second, as a robustness check, we also construct the quality measure following Khandelwal et al. (2013). Lastly, we also check firm-level quality upgrading evidence by tracking firms' imported materials. Kugler and Verhoogen (2012), Hallak and Sividasan (2013), Rodrigue and Tan(2016), Fan, et al.(2015) confirm the quality connection between intermediate inputs and final products.

In our last approach, instead of estimating the quality of imported intermediate goods, we examine how the probability of importing better intermediates increases the probability that firms export to the EU after the CR act. Specifically, we deem lighters with filters, galvanizing metal

[10] i.e. we exclude firms that simultaneously export to the EU and non-EU market from control group.

[11] Since we control for year fixed effects, the $Transition_{jt}$ and $Implementation_{jt}$ dummies will be dropped, and hence, we do not add them in the benchmark regression. For the similar reasons, after we control for firm fixed effects, the dummy $Group_j$ will be automatically dropped. As such, we do not include $Group_j$ in regression (1) neither.

shells, and electric parts (other than flints) as high quality relative to lighters without filters, using plastic shells and flints.[12] Therefore, if the probability of importing filters, or galvanizing metal shells, or electric parts increases more for firms which export lighters to the EU, we can say that the CR act leads firms to upgrade export quality. Since it is unclear how to allocate firm-level intermediates across products which are exported to different countries, we can only conduct a DID test at firm-level rather than at firm-destination level in regression (1). We note that although we have only included firms which import intermediate inputs in this regression, the large majority of firms in our sample do so.[13] The specification we run is as follows:

$$Y_{it} = \beta_0 + \beta_1 Transition_{it} \times Group_i + \beta_2 Implementation_{it} \times Group_i + \eta_{it} + \varepsilon_{it} \qquad (2)$$

where, Y_{it} represents a dummy variables at firm-level. If firm i imports higher quality intermediates, Y_{it} takes value 1, and 0 otherwise. The definition of *Transition* and *Implementation* is the same as above. In this estimation, we classify firms that continuously export to the EU (before and after the CR act) into the treatment group, and firms that do not export to the EU or firms that stop exporting to the EU after 2007 into control group. We aim to examine whether firms that continue to export to EU after 2007 upgrade their importing relative to other firms.[14] $\eta_{it} = \eta_i + \eta_t$ captures the firm and year fixed effects.

In order to investigate the dynamic impact of the CR act on firm-level export behavior, we add an interaction term between $\text{Implementation}_{jt} \times \text{Group}_j$ and year 2008 according to Han et al. (2012) as follows:

$$Y_{ijt} = \beta_0 + \beta_1 Implementation_{jt} \times Group_j + \beta_2 Implementation_{jt} \qquad (3)$$

$$Group_{jt} \times year2008 + \eta X_{ijt} + \varepsilon_{ijt}$$

where *year2008* is a dummy variable which takes value 1when *year=2008*, 0 otherwise. The coefficient β_2 captures the effect of the implementation of CR act in 2008. Comparing the magnitude of $\beta_1$and β_2, we can disentangle the dynamic impact of the CR act on firm-level export behavior.

To test hypothesis 3, we do not use the DID method. Instead, following Lu et al. (2013), we estimate the following regression:

$$Exit_{it} = \phi_0 + \phi_1 Productivity_i + \varepsilon_{it} \qquad (4)$$

[12] Lighter filters can improve the gas combustion efficiency; galvanizing metal shells are rust-proof and provide thermal insulation; and electric lighters are safer and cleaner than roller lighters.

[13]More than 95% of cigarette lighter exporters are simultaneous intermediate importers. As such, in this approach, we are still focus on the majority of the cigarette lighter exporters (see Rodrigue and Tan, 2016 for a similar argument).

[14]The advantage of this method is to avoid estimating the elasticity of substitution across different export varieties, which may cause estimation bias when estimate export quality. For instance, Khandelwal et al. (2013) estimate product quality by imposing an invariant elasticity of substitution, σ. Note that σ also captures firm-level markup, which would be variant when the firm-level product quality changes.

where $Exit_{it}$ is a dummy variable taking the value 1 if firm *i* exits from the EU market after the implementation of the CR act, and 0 otherwise. *Productivity*$_i$ is firm *i*'s productivity in 2007, the implementation year of the CR act. Following Lu et al. (2007), we use the log total firm-level exports to proxy firm-level productivity.

4. Empirical Results

4.1 Identifying assumption and checks

The validity of our DID estimation hinges on one key assumption: the treatment group would have the same trend as the control group before the CR act. To check this identifying assumption, we first show that treatment and control groups follow the same trends in export quality, export value and export volume until the CR act. Following Han et al.(2012) , we augment regression (1) by replacing the CR act transition and implementation dummies with a vector of year dummies λ_t, indicating the year from 2005 to 2008 (2004 is the reference year). We plot the estimated coefficients of the interaction $group_j \times \lambda_t$ and their 95% confidence intervals in Figure 1a-1c for exported quality, export value and export volume in order. Figure 1a-1c shows that prior to the implementation of the CR act, export quality, export value and export volume exhibits similar evolution patterns for treated and control groups. However, after the implementation of the CR act, the trend for export quality, export value and export volume is significantly varies across treatment and control groups. Therefore, DID approach is applicable in this study.

[Figure 1a is to be here]

[Figure 1b is to be here]

[Figure 1c is to be here]

4.2 The impact of the CR act on quality

This section mainly discusses the impact of the CR act on firm-level export quality. We report the results of benchmark regression in Table 2.

[Table 2 is to be here]

Columns 1-4 of Table 2 report the estimation results from equation (1). In columns 1 and 2, we use firm-level export unit value to proxy product quality. Column 1 contains firm and country fixed effects, while column 2 contains firm, country and year fixed effects. The results indicate that the coefficient of $Transition \times Group$ is statistically insignificant. In contrast, the coefficient of $Implementation \times Group$ is positive and statistically positive. In column 3 and column 4, we construct the quality measure following Khandelwal et al. (2013),[15] and use the

[15]Khandelwal et al. (2013) show the relationship among firm-level export volume, product price and quality. According to the relationship, we can have a regression equation $log(y_{ihct}) + \mu\, log(p_{ipct}) = \varphi_h + \varphi_{ct} + \tau_{ihct}$,

constructed quality as the dependent variable to estimate equation (1) again. The coefficient of $Transition \times Group$ is still statistically insignificant, while the coefficient of $Implementation \times Group$ is still positive and statistically significant. These results simply that the firm-level export quality does not significantly improve in the EU during the transition period of the CR act (2006). Instead, it increases when the CR act is implemented (2007). There are several reasons which explain the empirical results. First, it takes time to improve the product quality. Improving product quality usually requires higher technology. When such technology is unavailable, firms have to invest in R&D before they can upgrade their product quality, which requires time. Second, during the transition period, low quality cigarette lighters still can be exported to the EU. Therefore, the exporters do not need to improve their product quality in EU during the transition period.

Column 5 and 6 report the results for equation (3). In these two columns we drop the interaction, $Transition \times Group$, and track the dynamic impact of the CR act on the firm-level export quality. Not surprisingly, we find that the CR act increases the firm-level product quality that exports to the EU in the implemented year (2007). In addition, the statistically insignificant coefficient of $Implementation \times Group \times year2008$suggests that Chinese exporters do not continuously increase their quality once their export lighters reach the standards in the CR act.

To alleviate the concern that the estimated coefficient on export quality is biased, we examine whether firms that export lighters to the EU market tend to import higher quality materials after the CR act, since higher quality of inputs are typically related to higher quality of final products (e.g. Kugler and Verhoogen, 2012; Hallak and Sividasan, 2013; Rodrigue and Tan, 2016; Fan, et al., 2015). Here, we check the probability that a firm imports intermediate inputs which could produce higher quality of final products instead of estimating the quality of imported product. In particular, we treat cigarette lighter producers using filters, galvanizing metal shell and electronic parts as high quality relative to producers using no filter, plastic shells and flints. For visual comparison purpose, we show the difference between plastic shell lighters and galvanizing metal shell lighters in Figure 2a, and the difference between roller lighter and electronic lighters in Figure 2b, respectively.

[Figure 2a is to be here]

[Figure 2b is to be here]

The dependent variable is equal to 1 if a firm imports a filter, or galvanizing mental shell, or electronic parts, and is 0 otherwise. Since the dependent variable is a dummy variable, we estimate equation (2) using linear and nonlinear DID, respectively. The results are reported in Table 3.

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where y_{ihct} is the total export volume of product h by firm i to country c in year t, and p_{ipct} is the corresponding price. μis the substitution elasticity across products, and following literature we set it to be 5. $\varphi_h$andφ_{ct} are product, and country-year fixed effect. The quality measure has the form: $\tilde{q}_{ihct} = \tau/(\mu - 1)$.

[Table 3 is to be here]

Column 1 and 2 report imported filter response to the CR act. The results indicate that firms that export lighters to the EU are more likely to import lighter filters during and the transition period. Since lighter filters can effectively filter impurities in the gas, and improves combustion, the usage of a lighter filter is a signal of quality upgrading. Column 3 and 4 show the galvanizing metal shell response to the implementation of the CR act. We also find that lighter exporters which export to the EU (treatment group) are more inclined to import galvanizing metal shells relative to the control group. Compared to plastic shells, galvanizing metal shells are rust-proof and more thermal insulated, and hence, the latter is treated as high quality. Columns 5 and 6 report the results for the decision to import electric parts. The results demonstrate that the treated firms are more likely to import electric parts rather than flints in response to the CR act implementation. Usually, flints are used for producing roller lighters and electric parts are used for electronic lighters. The electronic lighters are safer and cleaner than roller lighters in terms of not making flint chippings. As such, firms that import electric parts (HS:961390) can be treated as high quality. Notice that, in Table 3 the coefficients of $Implementation \times Group$ are statistically insignificant in all columns. The result is in line with the results for export quality response in Table 2: in order to upgrade export quality, firms usually improve their imported intermediate in the previous year (e.g. see Roberts, et al. 2012, Dai and Yu, 2013), and because firms do not continuously upgrade their export quality, we find no evidence that firms continuously upgrade their import quality after the transition period.

All results in Table 3 indicate that firms which export to the EU region after 2007, tend to improve the quality of their imported intermediates more than firms export to non-EU countries. This implies an improvement of their export quality. Importantly, the treated group not only improves their quality to comply with the requirements in the CR act (the safety requirements), but also improve their export quality in other dimensions. This implies that technical barriers lead exporters to upgrade more than required, which is consistent with the literature. Quality upgrading usually associated with huge fixed costs (e.g. Roberters et al., 2012, Maskus et al., 2005). As such, after firms incur huge fixed costs, they can upgrade the quality of their products in numerous dimensions in a relatively low marginal cost rather than upgrade only one quality dimension to comply with the CR act.[16] This is also the reason why we do detect insignificant dynamic effect of the CR act on the firm-level export quality: the treated firms have upgraded their export quality in numerous dimensions at one time.

4.3 The impact of the CR act on firm-level export scale

We next study the impact of the CR act on Chinese firms' exports, in terms of export volume and value (hypothesis 2). We estimate regression (1), and (2) by changing the dependent variable

[16]Maskus et al., (2005) demonstrate that quality upgrading increases the variable production cost by 0.06 to 0.13 percent, but increases the fixed costs increase by 5 percent.

to be firm-level log export value and volume. All results are reported in Table 4.

[Table 4 is to be here]

Column 1 and column 2 of Table 4 report the estimation results of regression (1). Similar to the quality results, the coefficient on the $Transition \times Group$ variable is insignificant no matter whether we use firm-level export value or volume. These results imply that during the transition period, firm-level exports to the EU do not fall. This is consistent with quality response result: market structure does not change, and low quality lighters still can be exported to the EU during the transition period. As such, firm-level exports in this period are not affected. In contrast, the coefficient on $Implementation \times Group$ is negative and statistically significant. This demonstrates that the exports of Chinese cigarette lighters fall in the EU when the CR act is implemented. One possible interpretation is that Chinese exporters increase their export price (quality) in the EU after the implementation of the CR act. As such, they have to compete in the high quality cigarette lighter market, which is not the comparative advantage of Chinese lighter firms, and hence, this reduces the demand for Chinese cigarette lighters.

Since export scale is unaffected during transition period, we drop the interaction term, $Transition \times Group$, and estimate regression (1) again. Results in column 3 and column 4 shows that coefficients on our interactive terms are still negative significant, indicating that the implementation of CR act led to decline of exports to EU market.

Results on dynamic impact of CR act on firm-level exports are presented in columns 5 and 6. The results demonstrate that not only is the coefficient of $Implementation \times Group$ is negative and statistically significant, but so is the coefficient of $Implementation \times Group \times year2008$. This suggests that the implementation of the CR act reduce the firm-level exports, and it will further decrease firm-level exports in the subsequent period, which may imply market switching among Chinese exporters. One possible interpretation is that after the implementation of the CR act, some foreign firms which cannot profitability export to the EU before the CR act come back to compete with Chinese firms, which intensifies the competition in the EU and aggravates the export difficulty for cigarette lighter exporters from China. As a result, some Chinese exporters who upgrade their product quality need to switch their exports from the EU to other profitable countries.

4.4 The heterogeneous impact of the CR act

In this section, we examine the heterogeneous impact of the CR act on different firms. We first investigate how firms with different types of ownership respond to the CR act, and next examine whether the CR act affects single product firms and multi-product firms differently.

Firms with different ownership significantly differ in their economic behavior (Lu, 2011; Qin, 2011). For instance, state-owned enterprises (SOEs) are larger than their private counterparts, and

are more closely connected with the government (Li and Xu, 2015; Berkowitz et al., forthcoming). In contrast, foreign-owned and private firms are less affected by the government, and they can more flexibly adjust their economic behavior to maximize profits. In addition, relative to SOEs and private firms, foreign-owned firms are more likely to use advanced technology, and are often highly productive (Tao et al., 2012; Helpman et al., 2004).[17] Therefore, firms with different ownership may respond to the CR act differently. To investigate possible heterogeneous effects, we estimate the benchmark regression for subsamples of firms with different types of ownership. The results are reported in Table 5.

[Table 5 is to be here]

The results in Table 5 verify our expectation. According to estimated results SOEs and privately owned firms tend to increase their product quality, and decrease their export scale in response to the implementation of the CR act (although the results are not statistically significant for SOEs). Interestingly, the export scale of foreign owned firms tend to increase after the implementation of the CR act, and their export quality has no significant change. These results might suggest that foreign-owned firms export high quality cigarette lighters even before the implementation of CR act, and hence their products comply with the CR act already. When a large number of Chinese lighter exporters exit from the EU market after 2007, the foreign owned firms face a much less competitive market, and hence they increase their exports to the EU. The insignificant impact of the CR act on the SOEs might arise because of their connection with the government, and they receive notifications to upgrade their product quality or exit from the EU earlier than other firms. All results indicate that the patterns we find are mainly driven by the private cigarette lighter exporters.

We next investigate whether the impact of the CR act is identical among single-product and multi-product exporters. In China, multi-product firms account for a non-negligible share in total exports. During 2000-2006, more than 70% exporting firms in China are multi-product firms (Tan, et al., 2015). Relative to single-product firms, multi-product firms frequently adjust their product and export destination mix over time (Bernard et al., 2010). Therefore, the comparison of responses between single-product and multi-product firms is of both policy and academic interest. We estimate the benchmark regression for single-product and multi-product exporters, respectively, and all results are reported in Table 6 below.

[Table 6 is to be here]

The results in Table 6 indicate that both single-product and multi-product exporters are influenced by the implementation of the CR act, although they are not affected during the transition period. The results show that relative to the control group, exports to the EU by the

[17] Helpman et al., (2004), for instance, demonstrate that the most productive firms carry out FDI. The foreign-owned firms are invested by foreign companies, and hence they are, on average, more productive than the domestic Chinese firms (including domestic and private).

multi-product firms decline more than exports by the single-product firms. One possible reason is that multi-product firms can more flexibly adjust their product mix and destination mix. After the CR act, the multi-product firms can introduce new product which are not affected cigarette lighters by the CR act (*cannibalization effect*), or switch the exports of their affected products to non-EU countries. As such, the cannibalization effect and market switching both lead exports to the EU market decline more for the multi-product firms.

4. 5 The impact of the CR act on firm exit

In the above analysis we investigate the impact of the CR act on the firm-level export quality, volume and value. Now we turn to study the impact of the CR act on firm-level extensive margin (hypothesis 3). We are primarily interested in how firms with different productivity respond to the CR act. According to the heterogeneous firm literature, fixed export cost leads only more productive firms to export. (e.g. Bernard and Jensen, 1995; Aw et al., 2000; Girm et al., 2004; Arnold and Hussinger, 2005; De Loecker, 2007; Greenaway and Kneller, 2007; Hahn and Park, 2007). The implementation of the CR act potentially requires all exporters to invest a fixed R&D cost to improve their product quality. The literature predicts that low productivity firms can not afford the fixed cost and will choose to exit from the export market. In order to test this hypothesis, we estimate equation (4) and report all results in Table 7.

[Table 7 is to be here]

Column 1 of Table 6 reports the results for the full sample (containing all cigarette lighter exporters). The result shows that low productivity firms are more likely to exit from EU after the implementation of the CR act. Column 2 repeats the same regression but excludes intermediary firms, which are identified by the Chinese characters in their name (i.e., “Jinchukou”, “Jingmao”, and “Maoyi”). The results still indicate more productive firms are more likely to survive after the CR act.

Column 3 reports the difference in the likelihood of exiting between direct trade and intermediary trade firms. The variable *Trade intermediaries* take a value of 1 if a firm is an intermediary trade firm, and is 0 otherwise. The result indicates that after the implementation of the CR act, intermediary trade firms are more likely to exit from the EU market. This may because that intermediary firms are engaged in trade on behalf of a number of firms which have no export license. The firms that export through intermediary firms are normally small and characterized by low productivity, and hence they cannot overcome the technical barriers. This makes the intermediary firms more likely to exit.

Column 4 reports the difference in the likelihood of exiting between single-product and multi-product firms. The variable *Single-product* takes value 1 if a firm is a single-product exporter, and 0 otherwise. The result implies that single-product exporters are more likely to exit from the EU after the CR act. One possible reason is that normally single-product firms are often

small, relative to multi-product firms, and they cannot afford the R&D cost to improve product quality. As such, single-product firms exhibit a higher turnover rate in the EU market than multi-product exporters. This result is consistent with the results in Table 5. Since single-product firms are more likely to exit from the EU, the continuing single-product firms are of higher productivity. Therefore, their exports are not influenced as much as those of multi-product firms.

A natural consequence of the less productive firms' exit from EU is to increase the average productivity distribution of continuing exporters. We depict the productivity distributions in 2004 and 2008 to compare the changes in productivity distribution. The solid curve in Figure 3 is the productivity distribution in 2008, while the dashed curve is the productivity distribution in 2004. Clearly, the average productivity shifts to the right after the implementation of the CR act. The welfare implication is that after the CR act, less productive firms exit from EU, and more productive firms' production share increases. As such resources reallocates to more productive firms, and the welfare in affected country increases due to the resource reallocation (e.g. Hsieh and Klenow, 2009).

[Figure 3 is to be here]

5. Robustness Check

As we have shown in Table 1, a considerable share of cigarette lighter firms export to EU and non-EU countries simultaneously. This implies that some firms belong to both treatment and control groups. It is quite possible that after some firms invest in R&D in order to improve their product quality, their export quality increases in both the EU and non-EU countries. If this happens, we underestimate the quality increase in the EU. At the same time, firms that export to more destinations are often more productive and produce higher quality products (Manova and Zhang, 2012). If firms that export to both the EU and non-EU countries produce high quality products, we expect their exports in the EU are less affected by the CR act, which leads to a underestimate of the impact of the CR act on firm-level exports. To address these concerns, we construct alternative treatment and control groups as follows: the treatment group contains firms that export cigarette lighters to the EU, and the control group contains firms that export cigarette lighters only to non-EU countries.[18] Using the alternative treatment and control groups, we re-estimate the benchmark regression, and the results are reported in Table 8.

[Table 8 is to be here]

The results in Table 8 indicate that after re-defining the treatment and control groups, the firm-level export quality increases more relative to the benchmark regression (1.21 V.S. 0.99), and the firm-level export value and volume decrease more (-0.96 V.S. -0.85; -2.15 V.S. -1.81). This implies that no matter how we define the treatment and control groups, our previous results still

[18] In this way, we drop all observation that firms export cigarette lighters to both the EU and non-EU countries, and also firms that switch their export destinations.

hold.

6. Conclusion

TBT is a main NTB tool to strict imports from other countries and protect domestic production. With the development of trade liberalization, these technical barriers are frequently adopted by different countries, especially developed countries, to adjust their trade balance. While a substantial number of research studies the effect of TBTs on trade at the country or product level, few studies have documented about their effect on firm-level export behavior.

Using the CR act as a quasi-natural experiment, this paper investigates the impact of TBTs on firm-level export behavior. The results demonstrate that during the *transition* period, Chinese cigarette lighter firms did not upgrade their export quality in the EU, and their exports to the EU where unaffected. However, firms which will met the technical barriers started upgrading their import materials during the transition period. Further, we find that the firm-level export quality in the EU significantly increases relative to that in the non-EU markets after the *implementation* of the CR act. Interestingly, cigarette lighter firms that export to the EU not only adjust their export quality to meet requirements by the CR act, but also upgrade their product quality in other dimensions. After the implementation of the CR act, less productive exporters start to exit from the EU market, and survivors exhibit a significant fall in their exports to the EU. Although the CR act does not display any dynamic impact on firm-level export quality, it exhibits a significant dynamic impact on the firm-level export scale: e.g., the firm-level exports to the EU will continue to fall in the subsequent years after the implementation of the CR act.

The CR act has heterogeneous impacts on firm-level export behavior. When privately owned firms lose their market share after the implementation of the CR act, foreign owned firms benefit from this act. In addition, relative to single product firms, the exports of multi-product firms decline more in the EU market.

All of our results imply that although technical barriers are a negative shock to the affected countries, it also generates positive effects. Such positive effects are revealed in two dimensions. First, TBTs lead affected firms to upgrade their product quality, and the extent of quality upgrading extent is greater than that required by TBTs. Second, along with the exit of less productive firms, TBTs result in resource reallocation within the affected countries: more productive firms choose to upgrade their product quality, and hence occupy a larger market share. Although the exit of less productive exporters leads to a welfare loss in the affected countries, the resource reallocation brings welfare gains. Without taking the gains into account, we tend to overestimate the loss caused by TBTs.

Appendix: Figures and Tables

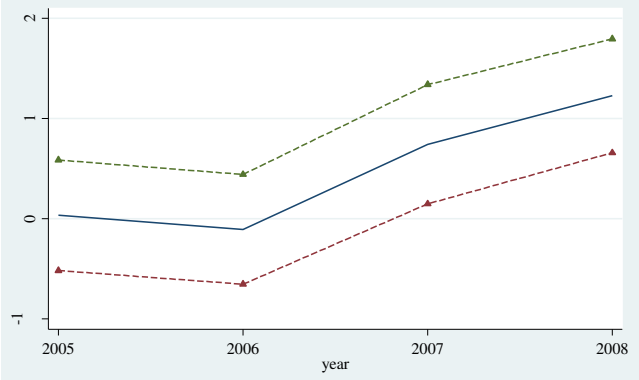

Figure 1a: Flexible estimates of the relationship between CR act and export quality

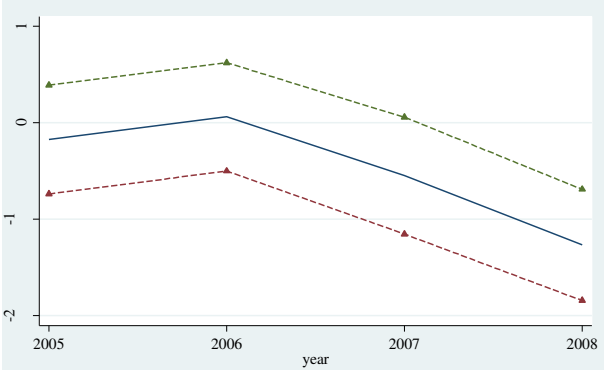

Figure 1b: Flexible estimates of the relationship between CR act and export value

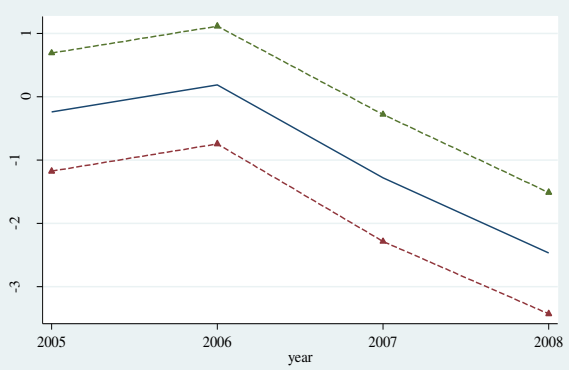

Figure 1c: Flexible estimates of the relationship between CR act and export volume

Figure 2a: Plastic shelled lighters and galvanized metal shelled lighters

Figure 2b: Roller lighters and electric lighters

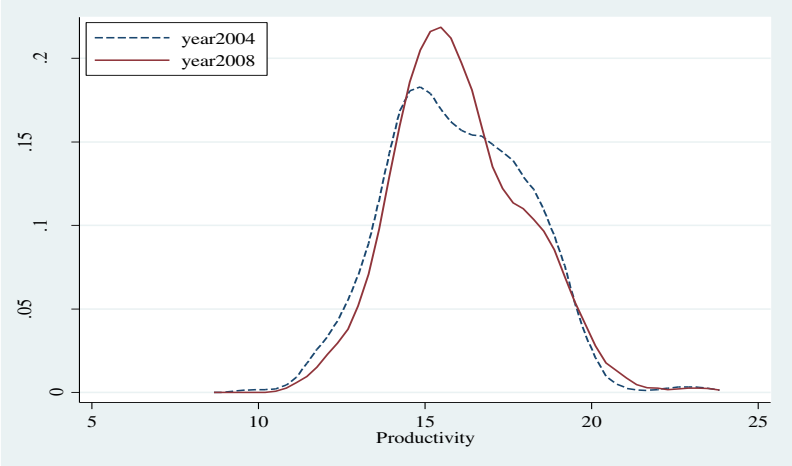

Figure 3 Firm-level productivity distribution before and after the CR act

Table 1 Comparison before and After CR Act

	Before CR Act EU Market (1)	Before CR Act non-EU Market (2)	(1)/(2)	After CR Act EU Market (3)	After CR Act non-EU Market (4)	(3)/(4)
Export Share(Value)	0.42	0.95	44.21%	0.28	0.95	29.47%
Export Share(Volumn)	0.43	0.95	45.26%	0.32	0.95	33.68%
Unit price	1.61	1.29	1.25	7.43	3.47	2.14

Note: Before CR Act refers to 2004~2006; After CR Act refers to 2007~2008; Export share is the weighted average for firm with weight equaling to firm's export in the EU/non-EU market; Unit price is simple average for each firm.

Table 2 The impact of the CR act on firm-level export quality in EU

	(1)	(2)	(3)	(4)	(5)	(6)
Transition×Group	0.042	-0.128	-0.011	0.067		
	(0.19)	(-0.54)	(-0.06)	(0.83)		
Implementation×Group	1.501***	0.990***	0.958***	0.356**	1.035***	0.769***
	(7.69)	(4.66)	(5.62)	(3.80)	(5.29)	(3.02)
Implementation×Group×year2008						0.485
						(1.63)
ER	-0.704***	-0.328*	-0.003	-0.352***	-0.320*	-0.277
	(-4.58)	(-1.90)	(-0.12)	(-5.87)	(-1.85)	(-1.59)
Constant	-3.356***	-3.686***	-4.073***	1.020***	-3.682***	-3.689***
	(-7.62)	(-8.28)	(-10.68)	(5.73)	(-8.28)	(-3.30)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes
Obs	4113	4113	4113	4113	4113	4113
R^2	0.36	0.36	0.31	0.36	0.36	0.36

Note：The t-statistics are in the parenthesis. ***, ** and * denote 1%, 5% and 10% significant level

Table 3 The impact of the CR act on firm-level import quality

	Filter		Galvanizing metal Shell		Electric Parts	
	OLS	Logit	OLS	Logit	OLS	Logit
Transition×Group	0.080**	0.488**	0.068**	0.419*	0.079**	0.521**
	(2.27)	(2.30)	(2.00)	(1.91)	(2.12)	(2.10)
Implementation×Group	0.025	0.191	0.013	-0.043	0.024	0.226
	(0.70)	(0.76)	(0.37)	(-0.16)	(0.60)	(0.88)
Cons	0.099***		0.091***		0.110***	
	(6.31)		(6.03)		(6.24)	
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	1,518	1,518	1,518	1,518	1,518	1,518
R^2	0.53	0.09	0.47	0.09	0.54	0.08

Note：The t-statistics are in the parenthesis. ***, ** and * denote 1%, 5% and 10% significant level

Table 4The impact of the CR act on firm-level exports in EU

Dep Var	Export Value	Export Volume	Export Value	Export Volume	Export Value	Export Volume
Transition×Group	0.159	0.321				
	(0.65)	(0.79)				
Implementation×Group	-0.854***	-1.807***	-0.909***	-1.919***	-0.511**	-1.265***
	(-3.95)	(-5.04)	(-4.58)	(-5.83)	(-1.97)	(-2.96)
Implementation×Group×year2008					-0.720**	-1.190**
					(-2.40)	(-2.39)
ER	-0.052	0.101	-0.063	0.079	-0.128	-0.025
	(-0.30)	(0.35)	（-0.36）	(0.27)	（-0.73）	(-0.08)
Cons	10.741***	14.432***	10.736***	14.423***	10.746***	14.439***
	(23.81)	（19.34）	(23.80)	(19.33)	(23.84)	(19.37)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	4113	4113	4113	4113	4113	4113
R^2	0.14	0.27	0.14	0.27	0.14	0.27

Note：The t-statistics are in the parenthesis. ***, ** and * denote 1%, 5% and 10% significant level

Table 5:The impact of the CR act on different ownership firms

Sample	SOE			Private			Foreign Owned		
Dep Var	Price	Export Value	Export Volume	Price	Export Value	Export Volume	Price	Export Value	Export Volume
Transition	-0.205	0.430	0.590	0.119	-0.033	-0.034	-0.642	0.939*	1.504
×Group	(-0.35)	(0.75)	(0.60)	(0.40)	(-0.11)	(-0.07)	(-1.13)	(1.68)	(1.63)
Implementation	0.353	-0.609	-1.072	1.579***	-1.775***	-3.314***	-0.523	1.138**	1.596*
×Group	(0. 69)	(-1.23)	(-1.25)	(4.99)	(-5.63)	(-6.28)	(-0.99)	(2.20)	(1.87)
ER	-0.326	-0.099	-0.061	-0.696**	0.533	1.208**	-0.441	-0.504	-0.292
	(-0.35)	(-0.22)	(-0.08)	(-2.12)	(1.63)	(2.20)	(-1.22)	(-1.44)	(-0.51)
Cons	-3.747***	10.476***	14.231***	-3.621***	10.509***	14.122***	-3.039	10.684***	13.780***
	(-2.65)	(7.72)	(6.05)	(-8.24)	(24.07)	(19.31)	(-1.41)	(4.47)	(4.02)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	774	774	774	1903	1903	1903	917	917	917
R^2	0.47	0.29	0.41	0.39	0.24	0.35	0.33	0.16	0.21

Note：The t-statistics are in the parenthesis. ***, ** and * denote 1%, 5% and 10% significant level

Table 6: The impact of the CR act on single-product and multi-product firms

Sample	Single-product firms			Multi-product firms		
Dep Var	Price	Export Value	Export Volume	Price	Export Value	Export Volume
Transition	-0.018	0.327	0.406	-0.161	-0.026	0.127
×Group	(-0.06)	(1.08)	(0.82)	(-0.46)	(-0.07)	(0.21)
Implementation	0.699**	-0.478*	-1.016**	0.883***	-0.829***	-1.742***
×Group	(2.39)	(-1.71)	(-2.19)	(3.00)	(-2.68)	(-3.51)
ER	-0.162	-0.165	-0.398	-0.609**	0.078	0.715*
	(-0.73)	(-0.79)	(-1.13)	(-2.40)	(0.29)	(1.68)
Cons	-3.784	10.847***	14.698***	-3.635***	10.753***	14.370***
	(-7.67)	(23.02)	(18.89)	(-4.51)	(12.75)	(10.62)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	2053	2053	2053	2060	2060	2060
R^2	0.33	0.15	0.22	0.41	0.18	0.33

Note：The t-statistics are in the parenthesis. ***, ** and * denote 1%, 5% and 10% significant level

Table 7 The impact of the CR act on firm-level exit rate in EU

	(1)	(2)	(3)	(4)
productivity	-0.149***	-0.131**	-0.165***	-0.255***
	(-3.57)	(-2.26)	(-3.84)	(-5.02)
Trade Intermediaries			0.571***	
			(3.28)	
Single-product				1.249***
				(5.81)
Cons	3.352***	2.751***	3.290***	4.201***
	(4.98)	(3.00)	(4.77)	(5.41)
Obs	333	125	333	333
Pseudo R^2	0.04	0.04	0.08	0.17

Note：The t-statistics are in the parenthesis. ***, ** and * denote 1%, 5% and 10% significant level

Table 8 Robustness Check

Dep Var	Export Quality	Export Value	Export Volume
Transition×Group	-0.004	1.745	0.207
	(-0.01)	(0.60)	(0.44)
Implementation×Group	1.207***	-0.956***	-2.153***
	(4.89)	(-3.69)	(-5.14)
ER	-0.519**	-0.008	0.251
	(-2.12)	(-0.03)	(0.61)
Cons	-3.726***	11.180***	14.918***
	(-3.99)	(19.34)	(9.47)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes
Obs	1901	1901	1901
R^2	0.34	0.13	0.22

Note：The t-statistics are in the parenthesis. ***, ** and * denote 1%, 5% and 10% significant level

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