Trade Creation Effect of Regional Trade Agreements in the Presence of Duty Drawbacks [*]

Kazunobu HAYAKAWA[#]
Development Studies Center, Institute of Developing Economies, Japan

Nuttawut LAKSANAPANYAKUL
Science and Technology Development Program, Thailand Development Research Institute, Thailand

Hiroshi MUKUNOKI
Faculty of Economics, Gakushuin University, Japan

Abstract: This study theoretically and empirically re-examines the trade creation effect of regional trade agreements (RTAs) under the presence of duty drawback regimes. We first theoretically demonstrate that firms who switch from the duty drawback regime to the RTA regime can either increase or decrease their imports. Then, by using the detailed firm-level trade data in Thailand, we empirically found that firms' switch from the duty drawback regime to the RTA regime increases their imports. However, this increase is to sell their goods for the domestic market rather than to expand their exports. It is also revealed that those firms switching to the RTA regime are medium-sized firms in terms of total exports. The large-sized firms keep using the duty drawback regime in their importing even after the entry of RTAs into force. These results have various implications for the gravity estimates on the trade creation effects of RTAs.

Keywords: Duty drawbacks; Trade creation effect; Regional trade agreement
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1. Introduction

The existence of other preference regimes plays a key role in the trade creation effect of regional trade agreements (RTAs). Most studies have (implicitly) assumed that firms use most favoured nation (MFN) tariffs before RTAs are concluded. When the entry of RTAs into force induces firms to switch from MFN tariffs to RTA tariffs, they will definitely increase their exports because of the reduction of tariff rates. Based on this preconception, we have expected the positive effect of RTAs on trade. However, this may not be true. Firms might use other preference regimes before RTA regimes become available. One of the examples is the duty drawback regime for raw materials imported for the production of export products. If the users of such a regime already enjoy duty-free imports even before the entry of RTAs into force, the importers switching from the duty drawback regime to the

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[#] Corresponding author: Kazunobu Hayakawa; Address: Wakaba 3-2-2, Mihama-ku, Chiba-shi, Chiba, 261-8545, Japan. Tel: 81-43-299-9500; Fax: 81-43-299-9724; E-mail: kazunobu_hayakawa@ide-gsm.org.

RTA regime may not increase their imports. The existing studies on RTAs have paid little attention to this possibility. It is important to re-consider the trade creation effect of RTAs under the existence of other preference regimes.

This study aims to examine how the users of other preference regimes change their trade when they switch to using an RTA regime. We mainly focus on the duty drawback regime in addition to some other similar regimes in terms of requirements and benefits. While both the duty drawback and RTA regimes may not require the importers of materials to pay tariffs, there are three crucial differences between the two regimes. First, the materials imported using the RTA regime can be used for the production of goods for the domestic market, while those imported using the drawback regime cannot be used for that. Second, the administrative works are carried out by the importers of the materials when claiming the drawback regime and by the exporters of the materials when claiming the RTA regime. Thus, the player who pays the costs for the administrative works is different between the two regimes. The last is that the use of the RTA regime may raise the import prices of the materials because it requires to comply with the rules of origin (RoO). These differences affect the choice of tariff regimes and thereby change firms' trade.

We first theoretically examine firms' choice of tariff regimes by employing the international trade model with firm heterogeneity in terms of productivity. We suppose that before the RTA enters into force, firms can import materials under either the MFN regime or the duty drawback regime. We show that firms with relatively high productivity choose to use the drawback regime while the rest do the MFN regime. After the conclusion of an RTA, the drawback users with the relatively low productivity switch to the use of the RTA regime in importing the materials. Although the use of the RTA regime raises the import prices of the materials, this switch becomes profitable because they no longer need to pay for the fixed costs when importing under the RTA regime. However, the rise of material costs hurts their imports by decreasing the import quantity. On the other hand, the positive effect comes from the use of duty-free materials for the production of goods for the domestic market. Since the drawback regime does not allow firms to use the materials for the production for the domestic market, the switch to the RTA regime expands the output for the domestic market and thereby increases the material imports. In sum, the magnitude relation between these positive and negative effects plays a crucial role in determining whether RTAs result in increasing trade when other preference regimes are available.

Next, we empirically investigate the net effect of regime-switching on imports by employing the detailed firm-level trade data in Thailand for 2007 and 2011. Unlike the firm-level trade data used in the other studies, our data include information on the tariff regime in importing. Therefore, we can directly examine how firms that switch from the drawback regime to the RTA regime in importing change their imports from RTA partner countries. In addition to the drawback regime, we take some other similar regimes as "other preference regimes," which include those for bonded warehouses, free zones, and investment promotion. Then, we classify firms according to their major import regime (i.e., the regime

with the largest imports). The imports by firms that mainly used the drawback regime in 2007 account for approximately 40% of total imports in 2011. Thus, the drawback users occupy a non-negligible fraction of the national imports. The simple regression analyses show that the import growth between 2007 and 2011 is 20-30% higher in firms that switched the major regime from the drawback to the RTA, compared with the non-switching firms, i.e., firms that used the drawback regime in both 2007 and 2011.

We further examine the causal effect of this switching on exports. There are various types of firms according to the main regimes in the two years, which are obviously not randomly chosen. Thus, the above results of the simple regression analyses suffer from the selection bias. However, due to the existence of many types and thereby that of many selection mechanisms, it is hard to address this endogeneity by using the instrumental variable method. In this study, therefore, we choose to use the propensity score matching (PSM) method. We restrict study firms to those in which the main regimes were other preference regimes in 2007 and either other preference regimes or RTA regimes in 2011. Then, by applying the PSM to these two kinds of firms, we correct the selection mechanism that separates the two firms. We estimate the propensity of switching by using some observable variables, including firms' total exports, tariffs, or foreign ownership. We choose the one-to-one nearest neighbor matching method as the matching algorithm. In the statistical test, we use the standard errors based on the innovation of Abadie and Imbens (2016).

Our findings can be summarized as follow. The analysis in estimating the propensity of switching to RTA regimes reveals that the smaller-sized firms in terms of exports are more likely to switch. If the firm size in terms of trade values is positively related to productivity, this result is consistent with our theoretical result that among the users of the drawback regime, those with relatively low productivity switch to the RTA regime in importing. The matching analyses are successfully carried out. The matched firms are well balanced. The results show the robust evidence that firms switching to the RTA regime increase their imports. However, we did not find evidence that such firms increase exports. These results imply that the switching firms increase the imports due to the increase of their outputs for the domestic market. Indeed, we also show that switching firms have a high share of domestic sales out of total sales. Another remarkable result is that the larger increase in imports can be found in firms that switched from the MFN regime to the RTA regime.

Our findings have substantial implications for the literature on the trade creation effect of RTAs. There are four types of importers according to their productivity and the tariff regimes before and after the RTA's effectuation; those with the high, medium-high, medium-low, and low ranges of productivity remain to use the drawback regime, switch from the drawback regime to the RTA regime, switch from the MFN regime to the RTA regime, and remain to use the MFN regime, respectively. The importers with the high or low ranges of productivity do not change their imports because they do not change their tariff regimes. Thus, those with a medium range of productivity play a key role in the trade

creation effect of RTAs. Despite that there are no further tariff advantages by switching to the RTA regime, the importers with the medium-high range increase their imports because of increasing production for the domestic market.[1] Those with the medium-low range also increase their imports simply because of the reduced tariff rates by switching from the MFN rate to the RTA rate.

In sum, the size of the trade creation effect in RTAs is determined by the magnitude of the import increase by the firms that switch from the drawback regime or the MFN regime to the RTA regime. Notice that these two types of firms have a medium range of productivity, not a high range, so that the absolute magnitude of their imports may not occupy a significant fraction in the national imports. Indeed, in our study sample, the imports by such switching firms account for 23 % of the total imports in a post-RTA year, 2011. Therefore, the increase in (national) imports by RTAs becomes not large. In the literature, many gravity studies have found small or *seemingly implausible results* in the RTA dummy variable (Baier and Bergstrand, 2007). For example, Cipollina and Salvatici (2010) conduct meta-analyses on RTA coefficients and show that the 312 out of 1827 estimates are even negative. Other meta-analyses (e.g., Kohl, 2014; Afesorgbor, 2017) also show similar results. Our results would provide one of the sources for such a small magnitude of the trade creation effect of RTAs. Namely, the trade creation effect becomes small if many productive firms keep using the drawback regime.

Our study is not the first that examines other preference regimes, especially the duty drawback regime. The existing studies include Hamada (1974), Panagariya (1992), Sargent and Matthews (2001), Cadot, de Melo, and Olarreaga (2003), Ianchovichina (2004, 2007), Egger and Egger (2005), Mah (2007), and Brandt and Morrow (2017). The first two are early theoretical studies on the duty drawback regime. Hamada (1974) shows that an increase in foreign investments into duty-free zones does not necessarily increase national income. Panagariya (1992) shows that increases in input tariffs with a duty drawback are more likely to be welfare-improving. The empirical studies exist particularly in the context of processing trade, perhaps because of the availability of the data (e.g., in the European Union or China). For example, Egger and Egger (2005) examine the determinants of processing trade by using the country pair-product-level data in Europe. A similar analysis can be found for China in Brandt and Morrow (2017). By using the industry-province data, they examine the role of input tariffs in the choice between ordinary trade and processing trade.

Our study is different from these existing studies in terms of some points. In the theoretical analysis, the basic structure is similar to Brandt and Morrow (2017). The choice between the drawback regime and the MFN regime in our model corresponds to the choice between the processing trade and the ordinary trade in their model. Brandt and Morrow

[1] If we consider a cumulation rule of RoO and firms export their outputs to partner countries of RTAs, only the inputs imported using the RTA tariffs are accumulated as "within-RTA inputs." Then, firms that switched to the RTA regime can comply with RoO and enjoy lower output tariffs. In this case, the switched firms may increase their exports of outputs. Our theoretical model takes into account this effect.

(2017) investigate the effects of the input tariff reduction when some firms choose the processing regime while some other firms choose ordinary trade. In our theoretical model, we consider another regime, i.e., an RTA regime, of which the utilization also reduces input tariffs. As mentioned above, there are some important trade-offs between the drawback and RTA regimes. Due to the compliance of RoO, the input prices under the RTA regime are higher than those under the drawback regime. On the other hand, importers have to bear some fixed costs for the utilization of the duty drawback regime. As a result, our theoretical model presents more fruitful results on the choice of tariff regimes and on the trade impacts of input tariff reduction.

In the empirical analysis, our estimation of the propensity of regime-switching contributes to uncovering the determinants of other preference regimes as the studies above did. However, we differentiate among three regimes, including MFN, RTA, and other preference regimes. Furthermore, we estimate such propensity at a firm (-country-product) level rather than at an aggregated level (e.g., an industry- or product-level). As a result, for example, our result that smaller-sized importers tend to switch from the duty drawback regime to the RTA regime has never been revealed in the literature. Moreover, our studies do not end with the *determinants*. We further investigate the *impacts* of regime-switching on trade at a firm level. Hayakawa (2015) and Hayakawa et al. (2019) investigate the firm-level impacts of utilizing RTA regimes on the import prices or some performance indicators (e.g., employment). However, these studies do not shed light on other preference regimes.[2]

The rest of this study is organized as follows. The next section discusses other preference regimes. Section 3 theoretically examines the choice of firms' tariff regimes and the effect of RTAs on trade. After explaining our empirical framework in Section 4, we present our empirical results in Section 5. Section 6 concludes this study.

2. Other Preference Regimes

In this section, we discuss preference regimes other than RTA and generalized system of preferences (GSP) regimes. The variety and benefits of those regimes differ by country. Therefore, we explain those regimes adopted in Thailand as an example. Specifically, we take five regimes; bonded warehouses, free zones, investment promotion, duty drawback for raw materials imported for the production of export products, and duty drawback for re-exportation. While benefits under the first three are realized immediately at the time of

[2] Several studies examine the determinants of the utilization of RTAs or generalized system for preferences. The example includes Francois, Hoekman, and Manchin (2006), Manchin (2006), Bureau, Chakir, and Gallezot (2007), Hakobyan (2015), Hayakawa, Kim, and Yoshimi (2017), and Hayakawa, Urata, and Yoshimi (2019). By using country pair-product-level trade data, these studies found the significant contribution of various elements such as preference margin (i.e., MFN tariff rates minus RTA tariff rates), rules of origin, or transaction sizes.

importation, those under the latter two regimes are essentially the refund of the duty already paid, which will be collected when the exportation or re-exportation is achieved. The benefits offered under these five regimes, which may also vary among regimes, are different from those under RTAs at least in the following five aspects.

The first aspect is the beneficiaries. RTA regimes can be chosen whatever imported goods are used for. Those goods can be used to produce goods for the domestic market or export market or be distributed to firms or customers. On the other hand, beneficiaries under bonded warehouses, free zones, and duty drawback regimes are required to import goods only for their production and exporting activities. For imports under investment promotion, beneficiaries depend on imported goods. For imports of machinery, beneficiaries could be manufacturers for either domestic or export markets, while only manufacturers for export markets benefit from the investment promotion regime during the importation of raw materials.

The second is eligibility in goods. The goods eligible to RTA regimes are listed in the legal text of RTAs. Namely, subject to negotiations among RTA members, eligible goods can be either raw materials, machinery, or final products. In contrast, eligible goods under the other privilege regimes are mainly raw materials. All the other regimes grant eligibility to goods if those goods are used to produce finished products. Machinery to be used in the production process can be eligible only under free zones and investment promotion regimes. Duty drawback for re-exportation applies to any goods – either raw materials, machinery, or final products, provided that such goods do not undergo any transformation from the time of importing to that of exporting.

Third, the depth of tariff reduction differs by regimes. Under the RTA regimes, while tariffs for a large portion of traded goods are eliminated, some goods keep positive rates because of their sensitiveness in the economy. In the other privilege regimes, most of them allow the deeper tariff reduction. Tariffs for all raw materials imported under free zones, investment promotion, and bonded warehouses regimes are virtually exempted. For machinery, imports under free zones are tariff-free while those under the investment promotion regime may be either tariff-free or subject to a 50% tariff reduction, depending upon the decision by the Board of Investment of Thailand. The duty drawback regime allows a full refund if raw materials are imported for the production of the export, or the nine-tenths or the excess of one thousand Thai Baht of the duty already paid, whichever is higher if goods are imported for re-exportation.

The fourth aspect is that the originating status of goods has different impacts on eligibility. Goods are qualified under RTA regimes if those are *substantially* produced in RTA member countries and meet the relevant originating criteria specified in the RoO. On the other hand, such status is not an issue for the importation under the other privilege regimes. Goods qualified for these regimes may be produced in and exported from anywhere in the world.

Last, except for the RTA regime, importers are required to submit evidence of compliance to the authority in charge. The evidence of compliance includes production formula, necessity claim that explains why imports are preferred to locally produced goods, and other relevant documents. This inevitably results in higher compliance costs. On the other hand, this evidence is not required for importers to claim for preferential benefits under the RTA regime because all RTAs concluded by Thailand adopt the third-party approvement in the certification of the origin of goods. The only evidence needed is a certificate of origin issued by a competent authority in the exporting country. As a result, the burden and cost of proving the eligibility under the RTA regime are imposed mainly on exporters.[3]

While we explained several preference regimes adopted in Thailand above, many countries in the world introduce similar regimes. In particular, the duty drawback for raw materials imported for the production of export products is a popular regime. For example, WTO (2003) introduces this regime adopted in Argentina, Brazil, Chile, Dominican Republic, Egypt, Guatemala, India, Indonesia, Kenya, Malawi, Malaysia, Nigeria, South Africa, Slovakia, Turkey, and Uganda. In addition, the JETRO website introduces a similar preference in South Korea, Cambodia, Sri Lanka, Taiwan, Vietnam, Australia, Canada, the U.S., Colombia, Peru, European Union, Iran, and Ethiopia.[4] In short, these preference regimes are adopted not in specific regions/countries but all over the world. Therefore, we should always take into consideration their existence when considering the effect of RTAs on trade.

3. Theoretical Analysis

This section builds a theoretical model with firm heterogeneity to examine firms' choices of tariff regimes in importing inputs and their decisions of exporting final products. Productivity difference plays a key role in determining how firms react to the formation of RTA. Each firm chooses one regime in input procurements among the following three regimes: (1) the MFN regime in which MFN tariffs are applied to all inputs, (2) the DD regime in which a firm uses the duty-drawback (DD) system in exporting, and (3) the RTA regime in which a firm imports inputs from RTA partner countries by using the RTA tariffs that are lower than the MFN tariffs. In the MFN regime and the RTA regime, firms sell their products to the domestic market and also export them to a foreign country if exporting

[3] Furthermore, on top of tariff reduction, certain regimes grant additional duty privileges to firms. The exemption of excise tax exists for goods imported under bonded warehouse and duty drawback for raw materials imported for the production of export. The free zones allow imported to be free of the tariff, excise tax, and value-added tax.

[4] https://www.jetro.go.jp/world/search/compare.html

generates positive profits. In the DD regime, however, we suppose that firms export their products to a foreign country and do not sell them in the domestic market.[5]

3.1. Setup of the Model

There are two countries where products are consumed, a home country (country h) and a foreign country (country x). There are also other countries that supply inputs used for final products. Consumers in each country have the same preferences, and they consume a homogenous good and S products whose goods in each product category are differentiated. The utility function in country $j\ (=h,x)$ is given by

$$U_j = c_{j0}^{\beta_0} \prod_{s=1}^{S} C_{js}^{\beta_s}, \tag{1}$$

where $\beta_0 + \sum_{s=1}^{S} \beta_s = 1$ and c_{j0} is the consumption of the homogeneous good. C_{js} is the total consumption of a differentiated product s in country j, which is given by

$$C_{js} = \left[\int_{i \in \mathrm{I}_{js}} c_{js}(i)^{\frac{\sigma_s - 1}{\sigma_s}} di \right]^{\frac{\sigma_s}{\sigma_s - 1}}, \tag{2}$$

where $c_{js}(i)$ is the consumption of variety i and I_{js} is the set of the available varieties in country j of product s. $\sigma_s \in (1, +\infty)$ is the elasticity of the substitution between any two pairs of variety within the product group s.

By maximizing consumers' utility subject to their budget constraints, the demand for variety i of product s in country j is given by:

$$c_{js}(i) = \frac{p_{js}(i)^{-\sigma_s}}{P_{js}^{1-\sigma_s}} \beta_s E_j \tag{3}$$

where $p_{js}(i)$ is the consumer price of the variety i that the producing firm charges and P_{js} is the consumer-price index for product s in country j.

The homogenous good is produced only with labor, and we assume that one unit of output requires one unit of labor. It is produced in both countries h and x and freely traded without any trade costs between the countries. By choosing the homogenous good

[5] In our study data, the share of inputs imported by the DD regime out of total imports accounted for 75% in the firms that mainly use the DD regime before RTA formations. The share increased to 98% after the RTA formations. This evidence indicates that firms that choose the DD regime do not use multiple tariff regimes depending on the sales destination of their outputs. Namely, such DD regime-users are less likely to sell their outputs to both the foreign and domestic markets by importing inputs under the DD regime for the former market and those under the MFN/RTA regime for the latter market. They export the majority of their outputs to foreign countries. Nevertheless, notice that the main results remain unchanged even if we consider the situation where those firms also sell their products to the domestic market.

as numeraire and setting the price of the good being equal to one, the wage rates become $w_x = w_h = 1$.

Each variety i of product s is produced only by a single firm in the home country using labor and intermediate inputs. The firm which produces variety i is called firm i. Variety i of product s is produced with a standard Cobb-Douglas function, which is given by

$$y_s(i) = \varphi_s(i) l_s(i)^{1-\alpha} M_s(i)^{\alpha}, \tag{4}$$

where $\varphi_s(i)$ is the productivity parameter, $l_s(i)$ is a labor input, $M_s(i)$ is a CES composite of intermediate inputs, and $\alpha \in (0,1)$ is the output elasticity of $M_s(i)$. It is defined as

$$M_s(i) = \left[\int_{k \in K_s} m_{ks}(i)^{\frac{\nu_s - 1}{\nu_s}} \, dk \right]^{\frac{\nu_s}{\nu_s - 1}}, \tag{5}$$

where $m_{ks}(i)$ is an input used in the production of variety i of product s, and $\nu_s \in (1, +\infty)$ is the elasticity of substitution between inputs. K_s is the set of available inputs used for producing each variety of product s. Each firm purchases these inputs from suppliers located in many foreign countries, including country x. Thus, $M_s(i)$ corresponds to the total imports of inputs.[6]

We assume each firm produces a single variety taking the prices of inputs as given. By solving the cost-minimization problem of each firm, the demand for each input k per unit of the final-good output is given by

$$m_{ks}(i) = \gamma \left(\frac{Z_s(i)^{\nu_s - (1-\alpha)}}{\varphi_s(i)} \right) z_{ks}(i)^{-\nu_s}, \tag{6}$$

where $z_{ks}(i)$ is the price of each input that firm i faces, $Z_s(i)$ is the price index of inputs used for the production of variety i, and $\gamma \equiv \{\alpha/(1-\alpha)\}^{1-\alpha}$ is a positive parameter. The price index of inputs is calculated as

$$Z_s(i) = \left[\int_{k \in K_s} z_{ks}(i)^{1-\nu_s} \, dk \right]^{\frac{1}{1-\nu_s}}. \tag{7}$$

The unit cost to produce each variety of product k in country j becomes $\Gamma Z_s(i)^{\alpha}/\varphi_s(i)$, where $\Gamma \equiv \gamma(1 + \gamma^{1/(\alpha-1)})$ is the positive parameter. By substituting (6) and (7) into (5), the total import of inputs becomes

$$M_s(i) = \frac{\gamma}{\varphi_s(i) Z_s(i)^{1-\alpha}}, \tag{8}$$

which is decreasing in the price index of imported inputs.

A final-good firm, which produces variety i of product s, maximizes the profit and set the free on-board price, $\tilde{p}_s(i)$, which is given by

$$\tilde{p}_s(i) = \left(\frac{\sigma_s}{\sigma_s - 1} \right) \Gamma \frac{Z_s(i)^{\alpha}}{\varphi_s(i)}. \tag{9}$$

[6] The model does not include domestic inputs because including them complicates the model without changing the main results.

Thus, a firm with higher productivity charges a lower price. The price also becomes lower as the price index of inputs becomes lower. The equilibrium consumer price is given by $p_{js}(i) = T_{js}\tilde{p}_s(i)$, where the parameter $T_{js} \geq 1$ is one plus the ad-valorem tariff rate imposed by country j on imports of product s. If the variety is sold in the domestic market ($j = h$), we set $T_{hs} = 1$.

3.2. The Input Costs in Each Regime

In analyzing a firm's choice of a tariff regime in input procurements, it is enough to focus on one product among differentiated-product sectors. Hence, we omit the subscript s in the following analysis. The price of input k, $z_k(i)$, and the price index of inputs, $Z(i)$, depend on the regime that firm i chooses. Let $\tilde{z}_k$ be the fundamental price of imported input k, which should reflect the technology of producing input k and other locational factors (such as wages and transport costs) of the foreign country where the supplier of input k operates. Henceforth, superscripts M, D, and R are attached to variables in the MFN regime, the DD regime, and the RTA regime, respectively. Each firm chooses one regime from three regimes.

The tariff-inclusive prices of imported inputs are as follows. First, if firm i chooses the MFN regime, the input price is given by $z_k^M(i) = \tau_k^M \tilde{z}_k$, where $\tau_k^M \geq 1$ is one plus the MFN tariff rate on input k imposed by the home country. For foreign inputs with zero MFN tariffs, $\tau_k^M = 1$ holds. By using $z_k^M(i)$, the price index of inputs is calculated, and it is denoted by Z^M. Second, if firm i chooses the DD regime, he/she is free from input tariffs, and we have $z_k^D(i) = \tilde{z}_k$. Accordingly, the price index of inputs is denoted by Z^D.

Last, suppose that the home country and a country (other than the home country) forms an RTA. If a firm chooses the RTA regime, we have

$$z_k^R(i) = \begin{cases} \tau_k^R \theta_k \tilde{z}_k & \text{for the inputs from partner countries of RTAs} \\ \tau_k^M \tilde{z}_k & \text{for the inputs from other countries} \end{cases} \quad (10)$$

where $\tau_k^R \in [1, \tau_k^M)$ is the one plus the preferential tariff rate of RTA imposed on input k imported from a partner country of RTAs. Besides that, $\theta_k \geq 1$ is the cost of adjusting the procurement sources of input production to meet RoO for input k. The adjustment cost is incurred to the producers of inputs, and it is passed through to input prices. To make formations of RTAs meaningful, we restrict our attention to the case where $z_k^M(i) > z_k^R(i)$ holds for the inputs imported from partner countries. The inequality is satisfied if $1 > \mu_k \theta_k$ holds, where $\mu_k \equiv \tau_k^R / \tau_k^M$ ($\mu_k \in (0,1)$) is the tariff ratio that captures how RTAs reduce the input tariff on input k. The assumption excludes the case where firms never choose the RTA regime. The corresponding price index of inputs in the RTA regime is denoted by Z^R.

3.3. Pre-RTA Regime Choices

We consider each firm's export decisions before the formation of an RTA and the choice between the MFN regime and the DD regime in input procurements. Because firms that choose the DD regime do not sell their products domestically, the DD regime is chosen only if the firms export their varieties to country x.

In the MFN regime, a firm's profit from exporting to country x becomes

$$\pi_x^M(i) = \left[\left(\frac{\sigma}{\sigma-1}\right)\Gamma\frac{T_x(Z^M)^\alpha}{\varphi(i)P_x}\right]^{1-\sigma}\frac{\beta E_x}{\sigma} - f_x, \tag{11}$$

where f_x is the fixed cost of exports. By setting $A = \sigma^{-\sigma}(\sigma-1)^{\sigma-1}\Gamma^{1-\sigma}$ and $B_j = [T_j(Z^M)^\alpha]^{1-\sigma}{P_j}^{\sigma-1}\beta E_j$, the export profit is rewritten as

$$\pi_x^M(i) = AB_x\varphi(i)^{\sigma-1} - f_x. \tag{12}$$

In this profit function, B_j captures the baseline profitability of selling a variety in country j. B_j is increasing in the market size of country j, which is represented by βE_j, and in the consumer price index, P_j. It is decreasing in the input-costs evaluated at the MFN tariff on the imported inputs, Z^M, and in the tariff on the final product, T_x. Firm i exports its product if and only if $\pi_x^M(i) \geq 0$ holds. By solving $\pi_x^M(i) = 0$ with respect to $\varphi(i)$, the cutoff level of productivity is calculated as $\underline{\varphi}_x^M \equiv [f_x/AB_x]^{1/(\sigma-1)}$. Firms with $\varphi(i) \geq \underline{\varphi}_x^M$ export their varieties in the MFN regime. Moreover, MFN tariffs are also applied to inputs used for their domestic sales. The profit in the domestic market is given by

$$\pi_h^M(i) = AB_h\varphi(i)^{\sigma-1}. \tag{13}$$

To make our analysis as simple as possible, we assume away the fixed cost of domestic production, which implies that firms that produce final goods always serve the domestic market. The total profit in the MFN regime is given by $\Pi^M(i) = \max[\pi_x^M(i), 0] + \pi_h^M(i)$.

In the DD regime, a firm earns profits only from exporting. Its profit from exporting to country x becomes

$$\begin{aligned}\pi_x^D(i) &= \left[\left(\frac{\sigma}{\sigma-1}\right)\Gamma\frac{T_x(Z^D)^\alpha}{\varphi(i)P_x}\right]^{1-\sigma}\frac{\beta E_x}{\sigma} - (f_x + f_D) \\ &= AB_x\left[\frac{\varphi(i)}{(\rho^D)^\alpha}\right]^{\sigma-1} - (f_x + f_D),\end{aligned} \tag{14}$$

where f_D is the fixed cost of getting the duty drawbacks of imported inputs from the domestic government. As is explained in Section 2, the fixed cost reflects the cost of submitting the evidence of compliance to the government. Besides that, $\rho^D \equiv Z^D/Z^M$ represents the input-cost ratio that captures the degree of the reduction in the input costs in the DD regime relative to those in the MFN regime. In so far as the tariffs on imported inputs are positive at least for some inputs, $\rho^D < 1$ holds. As the MFN rates of input tariffs are higher, ρ^D becomes lower. In the DD regime, a firm exports its product if and only if $\pi_x^D(i) \geq 0$ holds, and the cutoff level of productivity becomes $\underline{\varphi}_x^D \equiv (\rho^D)^\alpha[(f_x + f_D)/$

$AB_x]^{1/(\sigma-1)}$. Firms with $\varphi(i) \geq \underline{\varphi}_x^D$ export their varieties in the DD regime. The profit in the DD regime becomes $\Pi^D(i) = \max[\pi_x^D(i), 0]$.

A firm's export decision and the choice of regime depend on its productivity. Figure 1 depicts the net profits of a firm in each market as a function of its productivity index, $\varphi(i)^{\sigma-1}$. The slope of $\pi_x^D(i)$ is steeper than that of $\pi_x^M(i)$ because firms are free from input tariffs in the DD regime, though they must incur additional fixed costs in exporting. The profit in the domestic market is always positive, but the export profit in the MFN regime and the profit in the DD regime are positive only for firms with high productivity.

=== Figure 1 ===

By comparing $\Pi^D(i)$ and $\Pi^M(i)$ given that both $\pi_x^M(i)$ and $\pi_x^D(i)$ are positive, we have

$$\Pi^D(i) - \Pi^M(i) = H^{DM} A \varphi(i)^{\sigma-1} - f_D, \tag{15}$$

where $H^{DM} \equiv B_x\{(\rho^D)^{\alpha(1-\sigma)} - 1\} - B_h$. Because $\rho^D < 1$ and $\sigma > 1$, we have $(\rho^D)^{\alpha(1-\sigma)} > 1$. We focus on the case where $B_h/B_x < (\rho^D)^{\alpha(1-\sigma)} - 1$ is satisfied such that $H^{DM} > 0$ holds. This ensures that firms with high productivity choose the DD regime over the MFN regime. Specifically, the cutoff level of the productivity, above which an exporting firm prefers the DD regime to the MFN regime, becomes $\tilde{\varphi}_x^{D>M} \equiv [f_D/(H^{DM}A)]^{1/(\sigma-1)}$.

To consider several switching scenarios after the formation of an RTA, we restrict our attention to the case where some exporters choose the MFN regime over the DD regime in the pre-RTA situation. Specifically, we focus on the case where $\Pi^D(i) < \Pi^M(i)$ holds at $\varphi(i) = \underline{\varphi}_x^M$.[7] We have the following proposition.

Proposition 1. *Suppose that the home country does not form any RTAs with input-sourced countries. If $\tilde{\varphi}_x^{D>M} > \underline{\varphi}_x^M$ holds, then firms with $\varphi(i) \geq \tilde{\varphi}_x^{D>M}$ choose the DD regime and export their outputs, firms with $\varphi(i) \in [\underline{\varphi}_x^M, \tilde{\varphi}_x^{D>M})$ choose the MFN regime and sell their outputs in both the home country and the foreign country, and firms with $\varphi(i) < \underline{\varphi}_x^M$ choose the MFN regime and only sell their outputs in the home country.*

[7] This requires that $B_h/B_x > (\rho^D)^{\alpha(1-\sigma)} - 1 - f_D/f_x$ is satisfied. If $B_h/B_x \leq (\rho^D)^{\alpha(1-\sigma)} - 1 - f_D/f_x$ holds, the profit under the DD regime always dominates the profit under the MFN regime and all exporters use the duty-drawback system whenever firms export their products.

Figure 2 depicts the total profits in the two regimes and shows how firms with different productivity choose different regimes.[8] We can confirm that firms with high productivity can cover the fixed cost of using the DD regime and choose that regime.

=== Figure 2 ===

3.4. Post-RTA Regime Choices

Let us investigate how the formation of RTAs with input-sourced countries affects firms' decisions to export and their choices of a regime in input procurements. If the partner countries of RTAs include country x, the tariff on the final good also decreases from T_x to T'_x. We denote $\lambda_x \equiv T'_x/T_x$ ($\in (0,1]$) as the tariff ratio that captures how an RTA reduces output tariffs. If country x is not included, $\lambda_x = 1$ holds.[9]

If a firm chooses the RTA regime, the RTA tariff rates are applied to foreign inputs imported from the partner countries of RTAs, and the MFN tariff rates are applied to inputs imported from other countries. Therefore, we have $Z^M > Z^R > Z^D$ and the inputs costs in the RTA regime are somewhere between the inputs in the DD regime and those in the MFN regime. A firm's profit from exporting to country i becomes

$$\pi_x^R(i) = AB_x\left[\frac{\varphi(i)}{\lambda_x(\rho^R)^\alpha}\right]^{\sigma-1} - f_x, \tag{16}$$

where $\rho^R \equiv Z^R/Z^M$ is the input-cost ratio of the RTA regime relative to the MFN regime. It satisfies $\rho^D < \rho^R < 1$. Besides that, we assume $\rho^R > \mu_k^R\theta_k$ for any input k imported from a partner country in the RTA regime. This assumption ensures that choosing the RTA regime over the MFN regime always increases the demand for input k.[10]

An important property of the RTA regime is that imported inputs to which the RTA tariffs are applied are also used in the final-good production for domestic sales. Therefore, a firm's profit from domestic sales becomes

$$\pi_h^R(i) = AB_h\left[\frac{\varphi(i)}{(\rho^R)^\alpha}\right]^{\sigma-1}. \tag{17}$$

The total profit in the RTA regime is given by $\Pi^R(i) = \max[\pi_x^R(i), 0] + \pi_h^R(i)$.

Figure 3 shows how the profits in the RTA regime increases compared to those in the MFN regime. Because firms face lower input tariffs without incurring the additional fixed cost, the profit in the RTA regime always dominates that in the MFN regime in each market.

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[8] The different choices of regimes require $(\rho^D)^{\alpha(1-\sigma)} - 1 - f_D/f_x < B_h/B_x < (\rho^D)^{\alpha(1-\sigma)} - 1$.

[9] In utilizing the output tariffs of RTAs, exporting firms must comply with RoO. In that case, we suppose that the fixed cost and the marginal cost of meeting RoO are reflected in the level of f_x and T'_x, respectively.

[10] This inequality is reversed if inputs imported from RTA partners other than input k experience larger decline in prices and a so-called "within RTA substitution effect" dominates the substitution effect between RTA-made inputs and non-RTA-made inputs. Considering this case substantially complicates the analysis without changing the basic insights of our analysis.

=== Figure 3 ===

In the RTA regime, a firm exports its variety if $\pi_x^R(i) > 0$ holds and firms with $\varphi(i) \geq \underline{\varphi}_x^R \equiv (\rho^R)^{\alpha}(f_x/AB_x)^{1/(\sigma-1)} = (\rho^R)^{\alpha}\underline{\varphi}_x^M$ export their varieties. Note that $\underline{\varphi}_x^R < \underline{\varphi}_x^M$ always holds because $(\rho^R)^{\alpha} < 1$. Intuitively, because the RTA regime reduces the input costs and increases the profitability of exports, less productive firms become able to earn positive profits from exporting compared to the MFN regime.

Figure 4 compares the total profit of each regime. We can easily confirm that $\Pi^R(i) > \Pi^M(i)$ holds if evaluated at the same level of productivity, and firms always prefer the RTA regime to the MFN regime. However, firms may still prefer the DD regime to the RTA regime because the former realizes the higher degree of the input-cost reductions, though firms must incur the additional fixed cost.

=== Figure 4 ===

By comparing $\Pi_k^D(i)$ with $\Pi_k^R(i)$ given that exports profits are positive in both regimes, we have

$$\Pi^D(i) - \Pi^R(i) = H^{DR}A\varphi(i)^{\sigma-1} - f_D, \tag{18}$$

where $H^{DR} \equiv (\rho^R)^{\alpha(1-\sigma)}\left[B_x\{(\rho^R/\rho^D)^{\alpha(\sigma-1)} - \lambda_x^{1-\sigma}\} - B_h\right]$. By (18), $\Pi^D(i) \geq \Pi^R(i)$ is possible only if $(\rho^R/\rho^D)^{\alpha(\sigma-1)} - \lambda_x^{1-\sigma} > B_h/B_x$ holds. Firms are able to increase their profits from domestic sales by choosing the RTA regime, but cannot do that by choosing the DD regime. Therefore, the total profit in the DD regime can dominate that in the RTA regime only if the higher rate of an increase in the profit gains in the DD regime, $(\rho^R/\rho^D)^{\alpha(\sigma-1)} - \lambda_x^{1-\sigma}$, dominates the relative fundamental profitability of the domestic market to the foreign market, B_h/B_x. Suppose that this inequality holds, then a firm that engages in exporting prefers the DD regime to the RTA regime when $\varphi(i) \geq \tilde{\varphi}_x^{D>R} \equiv [f_D/(H^{DR}A)]^{1/(\sigma-1)}$ holds.

As in the pre-RTA situation, each firm's export decision and choice of the regime depend on its productivity, as the following proposition suggests.

Proposition 2. *Suppose that the home country forms RTAs with some of the input-sourced countries. If* $\tilde{\varphi}_x^{D>R} > \underline{\varphi}_x^R$ *holds, then firms with* $\varphi(i) \geq \tilde{\varphi}_x^{D>R}$ *choose the DD regime, firms with* $\varphi(i) \in [\underline{\varphi}_x^R, \tilde{\varphi}_x^{D>R})$ *choose the RTA regime and sells their outputs in both the home country and the foreign country, and firms with* $\varphi(i) < \underline{\varphi}_x^R$ *choose the RTA regime and sell their outputs only in the home country.*

Thus, if $\tilde{\varphi}_x^{D>R} > \underline{\varphi}_x^R$ holds, some exporters with relatively high productivity choose the DD regime, and other exporters with relatively low productivity choose the RTA regime.[11]

3.5. RTA Formation and Regime Switches

Let us now examine how an RTA formation affects firms' behaviors. As Figure 4 shows, some firms change their export decisions and choices of the regime. We can calculate that

$$\tilde{\varphi}_x^{D>R} - \tilde{\varphi}_x^{D>M} = \left[\frac{f_D}{AH^{DM}H^{DR}}\right]^{\frac{1}{\sigma-1}}\left[(H^{DM})^{\frac{1}{\sigma-1}} - (H^{DR})^{\frac{1}{\sigma-1}}\right] > 0 \tag{19}$$

holds because we have $H^{DM} - H^{DR} = B_x\{\lambda_x^{1-\sigma}(\rho^R)^{\alpha(1-\sigma)} - 1\} + B_h\{(\rho^R)^{\alpha(1-\sigma)} - 1\} > 0$. This implies that firms whose productivity satisfies $\tilde{\varphi}_x^{D>M} \leq \varphi(i) < \tilde{\varphi}_x^{D>R}$ switch from the DD regime to the RTA regime. These firms' unit costs of final-good production increase because $Z^R > Z^D$, but they can save the fixed cost of using duty drawbacks.

Exporting firms, whose productivity falls into $\underline{\varphi}_x^D \leq \varphi(i) < \tilde{\varphi}_x^{D>M}$ and choose the MFN regime before an RTA formation, switch to input procurements using RTA tariffs. Besides that, because $\underline{\varphi}_x^R < \underline{\varphi}_x^M$ holds, firms with $\underline{\varphi}_x^R \leq \varphi(i) < \underline{\varphi}_x^M$ start exporting by choosing the RTA regime. Firms with $\varphi(i) < \underline{\varphi}_x^R$ also switch to the RTA regime, even though they are still non-exporters. Proposition 3 summarizes these switches when exporting firms with different productivities choose a different regime with respect to their input procurements.

Proposition 3. *Given that* $\tilde{\varphi}_x^{D>R} > \underline{\varphi}_x^R$ *holds, RTAs make: (i) exporting firms with* $\varphi(i) \in [\tilde{\varphi}_x^{D>M}, \tilde{\varphi}_x^{D>R})$ *to switch from the DD regime to the RTA regime; (ii) exporting firms with* $\varphi(i) \in [\underline{\varphi}_x^M, \tilde{\varphi}_x^{D>M})$ *to switch from the MFN regime to the RTA regime, (iii) firms with* $\varphi(i) \in [\underline{\varphi}_x^R, \underline{\varphi}_x^M)$ *to switch from the MFN regime to the RTA regime and start exporting, and (iv) firms with* $\varphi(i) < \underline{\varphi}_x^R$ *to switch from the MFN regime to the RTA regime, but they still do not export. Exporting firms with* $\varphi(i) \geq \tilde{\varphi}_x^{D>R}$ *continue to choose the DD regime.*

[11] For $\tilde{\varphi}_x^{D>R} > \underline{\varphi}_x^R$ to hold, $(\rho^R/\rho^D)^{\alpha(\sigma-1)} - \lambda_x^{1-\sigma} - (f_D/f_x) < B_h/B_x < (\rho^R/\rho^D)^{\alpha(\sigma-1)} - \lambda_x^{1-\sigma}$ must be satisfied. If $B_h/B_x \leq (\rho^R/\rho^D)^{\alpha(\sigma-1)} - \lambda_x^{1-\sigma} - (f_D/f_x)$ holds, exporting firms always chooses the DD regime while the non-exporting firms choose the RTA regime. If $B_h/B_x > (\rho^R/\rho^D)^{\alpha(\sigma-1)} - \lambda_x^{1-\sigma}$ holds, all firms choose the RTA regime and firms with $\varphi(i) \geq \underline{\varphi}_x^R$ export their outputs.

Thus, among firms that initially choose the DD regime, those with relatively low productivity shift to the RTA regime, while those with high productivity remain the DD regime.

3.6. Trade Effects of RTA Formation

Now we investigate the trade effects of RTA formation for firms that switch to the RTA regime. Suppose for simplicity that country h and country x import many varieties from many foreign countries in each product category, so that RTA formations and resulting changes in firms' choices do not affect the level of the consumer-price index, P_x and P_h.[12] Proposition 3 suggests that an RTA formation changes firms' choices of the regime if $\varphi(i) < \tilde{\varphi}_x^{D>R}$ holds. Firms with $\varphi(i) \geq \tilde{\varphi}_x^{D>R}$ continue to select the DD regime.

3.6.1 The Effect on Input Trade

We examine how RTAs with input-sourced countries change each firm's import values of inputs. First, we consider the imports for the switched firms from the DD regime to the RTA regime ($\varphi(i) \in [\tilde{\varphi}_x^{D>M}, \tilde{\varphi}_x^{D>R})$). They always export their products to country x. Let $\Delta Im_k^{DR}(i)$ be the switched firm's change in the import value of input k. We have

$$\Delta Im_k^{DR}(i) = \Delta zm_k^{DR}(i)c_x^R + \tilde{z}_k m_k^D(i)\Delta c_x^{DR}(i) + \theta_k \tilde{z}_k m_k^R(i)c_h^R(i), \tag{20}$$

where $\Delta zm_k^{DR}(i) \equiv \tilde{z}_k\{\theta_k m_k^R(i) - m_k^D(i)\}$ is the change in each firm's import values of inputs per unit of its output and $\Delta c_x^{DR}(i) \equiv c_x^R(i) - c_x^D(i)$ is the changes in the volume of exports. Since the switched firms start selling in the domestic market, the third term captures the imports of inputs used for domestic sales. We set $\theta_k = 1$ if input k is imported from non-RTA countries. The change in each switched firm's total imports of inputs is given by

$$\Delta Import^{DR}(i) = \int_{k\in K} \Delta Im_k^{DR}(i)dk. \tag{21}$$

In (20), we can confirm that both $\Delta zm_k^{DR}(i)$ and $\Delta c_x^{DR}(i)$ have ambiguous signs. The detailed calculations are given in Appendix A of Online Appendix. Therefore, the RTA formation can either increase or decrease $\Delta Import^{DR}(i)$.

The intuitive explanation is as follows. The switch from the DD regime to the RTA regime increases the price of input k because firms that were enjoying duty drawbacks now face the RTA tariff, τ_k^R, and the cost of meeting RoO incurred to input suppliers is reflected in the input price. The increase in the input price directly decreases the demand for the input. However, the switch also increases the price index of inputs, which increases the demand for input k due to a substitution effect. Therefore, the sign of $\Delta zm_k^{DR}(i)$ is ambiguous. With

[12] If firms' export status and their choice of regime affect the consumer-price index, trade effects of RTA formation will become more complicated. Specifically, even if an RTA formation decreases the input costs of firms, some firms may not increase their exports when the RTA decreases the consume-price index. Other than that, the assumption does not qualitatively affect the results of our model.

regard to $\Delta c_x^{DR}(i)$, the increase in the input cost reduces exports of the final good. However, a reduction of tariff on the final good promotes exports. Therefore, the sign of $\Delta c_x^{DR}(i)$ is also ambiguous if country x is included as an RTA partner. If country x is excluded from RTAs, $\Delta c_x^{DR}(i) < 0$ always holds. Since the third-term of (20) is always positive, $\Delta Im_k^{DR}(i)$ is more likely to be positive if firms the market size of the domestic country is sufficiently large such that newly initiated domestic sales increase the imports of inputs.

We can calculate that

$$\Delta Im_k^{DR}(i) \gtreqless 0 \quad \Leftrightarrow \quad \frac{T_x B_h}{B_x} \gtreqless \frac{1 + \left(\frac{\rho^R}{\rho^D}\right)^{\alpha\sigma} - \frac{1}{\lambda_x^\sigma}}{\left(\frac{\rho^R}{\rho^D}\right)^{\nu-(1-\alpha)} (\tau_k^R)^{-\nu} (\theta_k)^{1-\nu}} - 1. \tag{24}$$

See Appendix A of Online Appendix for the detailed calculation. Hence, the switched firms are more likely to increase the imports of inputs as B_h/B_x, is larger, τ_k^R and θ_K are higher, T_x, is higher, and the preference margin of the output, $1/\lambda_x$, is smaller.

Second, we consider the imports for the switched firms from the MFN regime to the RTA regime ($\varphi(i) < \tilde{\varphi}_x^{D>M}$). We denote $\Delta Im_k^{MR}(i)$ as the change in the import value of input k. We have

$$\Delta Im_k^{MR}(i) \equiv \begin{cases} \Delta zm_k^{MR}(i) \sum_{j=h,x} c_j^R(i) + \tilde{z}_k m_k^M(i) \sum_{j=h,x} \Delta c_j^{MR}(i) & \text{for} \quad \varphi(i) \in \left[\underline{\varphi}_x^M, \tilde{\varphi}_x^{D>M}\right) \\ \Delta zm_k^{MR}(i) c_h^R(i) + \tilde{z}_k m_k^M(i) \Delta c_h^{MR}(i) + \theta_k \tilde{z}_k m_k^R(i) c_x^R & \text{for} \quad \varphi(i) \in \left[\underline{\varphi}_x^R, \underline{\varphi}_x^M\right) \\ \Delta zm_k^{MR}(i) c_h^R(i) + \tilde{z}_k m_k^M(i) \Delta c_h^{MR}(i) & \text{for} \quad \varphi(i) < \underline{\varphi}_x^R \end{cases}, \tag{22}$$

where $\Delta zm_k^{MR}(i) \equiv \tilde{z}_k\{\theta_k m_k^R(i) - m_k^M(i)\}$ is a change in each firm's import values of inputs per unit of its output and $\Delta c_j^{MR}(i) \equiv c_j^R(i) - c_j^M(i)$ is the change in the total volume of sales of the final good in country $j \in \{h, x\}$. We set $\theta_k = 1$ if input k is imported from non-RTA countries. The change in each switched firm's total imports of inputs is given by

$$\Delta Import^{MR}(i) = \int_{k \in K} \Delta Im_k^{MR}(i) dk. \tag{23}$$

We can confirm that $\Delta zm_k^{MR}(i) > 0$ holds (See Appendix A) for inputs imported from RTA countries because input-tariff reductions of RTAs increase the demands for those inputs. Besides that, $\Delta c_h^{MR}(i) > 0$ and $\Delta c_x^{MR}(i) > 0$ always hold, implying that each switched firm increases the amount of sales in each market it serves. Therefore, we always have $\Delta Im_k^{MR}(i) > 0$ for inputs imported from RTA countries. For inputs imported from non-RTA countries, we have $\Delta zm_k^{MR}(i) < 0$. This is because lower prices of RTA inputs decrease demands for non-RTA inputs. If this negative effect outweighs the positive effect of increased sales, the switched firms decrease the imports of non-RTA inputs. The following proposition summarizes the trade effects on inputs for switched firms.

Proposition 4. *The firms that switched from the DD regime to the RTA regime are more likely to increase the imports of inputs from RTA countries as the relative market size of the domestic country*

is larger, the RTA-tariff rate on input and the adjustment costs for meeting RoO are lower, the tariff on output is higher, or the preference margin on output is smaller. Otherwise, they decrease those imports. Firms that switched from the MFN regime to the RTA regime always increase the imports of inputs from RTA countries.

For the imports of inputs from non-RTA countries, both types of switched firms either increase or decrease them.

3.6.2 The Effect on Output Trade

Our next question is how RTAs with input-sourced countries affect the switched firms' exports of their varieties to country x. Let $\Delta Export^{RD}(i) \equiv \tilde{p}^R(i)c_x^R(i) - \tilde{p}^D(i)c_x^D(i)$ be the change in export value of variety i for firms that switched from the DD regime to the RTA regime. We have

$$\Delta Export^{DR}(i) = \frac{AB_x}{\sigma T_x}\left[\frac{\varphi(i)}{(\rho^R)^{\alpha}}\right]^{\sigma-1}\left[\frac{1}{\lambda_x^{\sigma}} - \left(\frac{\rho^R}{\rho^D}\right)^{\alpha(\sigma-1)}\right]. \tag{25}$$

As does $\Delta c_x^{DR}(i)$, whether the switched firms increase or decrease their exports depends on the relative magnitude of the preference margin on the output, which is captured by $1/\lambda_x^{\sigma}$, and that of the increase in the input cost, which is captured by $(\rho^R/\rho^D)^{\alpha(\sigma-1)}$. If the former effect dominates the latter, $\Delta Export^{DR}(i) > 0$ holds, and vice versa. In particular, if country x is not a member of RTAs ($\lambda_x = 1$), $\Delta Export^{DR}(i) < 0$ holds.

Because the switch from the DD regime to the RTA regime increases the switched firms' input costs, their export values may decrease.[13] Instead, the switch increases their revenues from the domestic market because it starts domestic sales. If country x is not a member of RTAs, firms with high productivity that remain the DD regime do not change their export values. Then, firms with medium-high productivity that switch from the DD regime to the RTA regime decrease exports and increase domestic sales. This implies that RTA formations that liberalize input trade may *prevent*, rather than promote, exports of firms with medium-high productivity.

For medium-low and low productive firms that switched from the MFN regime to the RTA regime, $\Delta Export^{MR}(i)$ is the switched firm's change in the export value. We have

[13] If the consumer-price index changes, the consumer-price index in the RTA regime can be larger than that in the DD regime when the degree of price increases of other firms that shifted from the DD regime to the RTA regime is large. In this case, the switched firm's export value decreases when the negative effect from the increased input costs dominates the positive effect from the increased consumer-price index. At least, a switched firm who experienced the largest cost-increase compared with other switched firms decreases its export value.

$$\Delta Export^{MR}(i) \equiv \begin{cases} \tilde{p}^R(i)c_x^R(i) - \tilde{p}^M(i)c_x^M(i) & \text{for} \quad \varphi(i) \in \left[\underline{\varphi}_x^M, \tilde{\varphi}_x^{D>M}\right) \\ \tilde{p}^R(i)c_x^R(i) & \text{for} \quad \varphi(i) \in \left[\underline{\varphi}_x^R, \underline{\varphi}_x^M\right) \\ 0 & \text{for} \quad \varphi(i) < \underline{\varphi}_x^R \end{cases}. \tag{26}$$

For firms that start exporting, the export values naturally increase. For firms that initially export their varieties, we have

$$\tilde{p}^R(i)c_x^R(i) - \tilde{p}^M(i)c_x^M(i) = \frac{AB_x}{\sigma T_x}\left[\frac{\varphi(i)}{(\rho^R)^\alpha}\right]^{\sigma-1}\left[\frac{1}{\lambda_x^\sigma} - (\rho^R)^{\alpha(\sigma-1)}\right] > 0 \tag{27}$$

because $\rho^R < 1$. Thus, firms that switched from the MFN regime to the RTA regime always increase the export values of their outputs if they export after the RTA formation.

Contrary to the firms switched from the DD regime, RTA formations with a part of input-sourced countries always promote exports of the final-good firms that chose the MFN regime before the RTA formations and switched to the RTA regime. These firms, however, are less productive than the firms that initially chose the DD regime. The following proposition summarizes the trade effect on outputs for the switched firms.

Proposition 5. *If the tariff reduction of the output is large enough to satisfy* $1/\lambda_x^\sigma > (\rho^R/\rho^D)^{\alpha(\sigma-1)}$, *firms that switched from the DD regime to the RTA regime increase exports. Otherwise, they decrease exports. Firms that switched from the MFN regime to the RTA regime always increase exports as long as they export after the RTA formations.*

4. Empirical Framework

This section explains our empirical framework on how the firms that switch from the drawback regime to the RTA regime change their imports. We first discuss the methodological framework and then present the data sources and issues.

4.1. Propensity Score Matching

As theoretically demonstrated in the previous section, there are various types of importers according to the tariff regimes in pre- and post-RTA periods. The tariff regimes they use are not randomly assigned but are chosen based on their profit comparison. Depending on the firms' characteristics, the chosen regime is different. In other words, since the firm characteristics are different across the tariff regimes, the simple comparison of imports across the firm types includes not only the impacts of switching tariff regimes but also the differences in ex-ante firm characteristics. One approach to address this endogeneity is to use instruments for the switching status. However, across all firm types, there are not only the selection on whether or not to switch from the drawback regime to the RTA regime but also the selection on the choice between the MFN regime and the RTA

regime and the selection on whether or not to keep using the MFN regime. We need to take into consideration all these selection mechanisms. As usual, however, it is tough to find many and plausible instruments. Thus, to address the selection bias above, we employ the PSM method.

The goal of this paper is to evaluate the causal effect of switching from the drawback regime to the RTA regime on imports. Specifically, our indicator variable for this switching is $Switch_{fcp} \in \{0,1\}$, which takes the value of one if firm *f* switches from the drawback regime to the RTA when importing product *p* from country *c* and the value of zero otherwise. The average effect of switching on imports (*y*), that is, the average treatment effect on the treated (ATT), is defined as:

$$\text{ATT} \equiv \text{E}\left(y_{fcp}^{1} - y_{fcp}^{0} | Switch_{fcp} = 1\right) = \text{E}\left(y_{fcp}^{1} | Switch_{fcp} = 1\right) - \text{E}\left(y_{fcp}^{0} | Switch_{fcp} = 1\right),$$

where y^{1}_{fcp} and y^{0}_{fcp} are the imports of firm *f* for cases when switching and not switching, respectively.

We cannot observe the last term, namely, the imports that would be obtained if a switching firm had not switched the tariff regime. Thus, we replace the last term with the observable performance of non-switchers, namely, $\text{E}\left(y_{fcp}^{0} | Switch_{fcp} = 0\right)$:

$$\begin{aligned}\text{ATT} = \text{E}\left(y_{fcp}^{1} | Switch_{fcp} = 1\right) - \text{E}\left(y_{fcp}^{0} | Switch_{fcp} = 0\right) \\ + \left\{\text{E}\left(y_{fcp}^{0} | Switch_{fcp} = 0\right) - \text{E}\left(y_{fcp}^{0} | Switch_{fcp} = 1\right)\right\}.\end{aligned}$$

We can obtain a consistent estimator of the ATT only if the bracketed term is equal to zero. However, as theoretically demonstrated in the previous section, switching firms and non-switching firms are different in terms of productivity and thereby imports. Thus, the bracketed term does not equal to zero, and the estimates suffer from sample selection bias.

We follow the solution advocated by Rosenbaum and Rubin (1983). We first assume the following:

$$y_{fcp}^{0} \perp Switch_{fcp} | \text{Prob}\left(Switch_{fcp} = 1 | \mathbf{X}_{fcp}\right).$$

$\perp$ represents mathematical independence. $\text{Prob}\left(Switch_{fcp} = 1 | \mathbf{X}_{fcp}\right)$ is called a "propensity score" and indicates the probability of switching conditional on a vector of observable variables $\mathbf{X}_{fcp}$. This assumption implies that if the probability of switching explained by a vector of observable variables $\mathbf{X}_{fcp}$ is the same between a switching firm and a non-switching firm, imports obtained when not switching are also the same between those two firms. Another assumption is:

$$\text{Prob}\left(Switch_{fcp} = 1 | \mathbf{X}_{fcp}\right) < 1.$$

This assumption guarantees that firms with identical characteristics (i.e., $\mathbf{X}_{fcp}$) can be observed in both switchers and non-switchers. With these two assumptions, the bracketed term in the above equation is equal to zero when the propensity score is common.

After computing the propensity scores of switching, we employ the one-to-one nearest neighbor matching method as the matching algorithm. The switching status is identified at a pair-level, i.e., *fcp*. For simplicity, we denote this triple script by a single script *i*. I_0 and I_1 represent sets of non-switching firms and switching firms, respectively. We define the following:

$$P_i \equiv \text{Prob}(Switch_i = 1|\,\mathbf{X}_i).$$

Then, the pairs matched with firm i belong to the following set:

$$A_i = \left\{ j \in I_0 | P_j = \underset{j}{\text{argmin}} \,||P_i - P_j|| \right\}, i \in I_1 \,.$$

When the above first assumption holds between pairs $i \in I_1$ and $j \in A_i$, the following becomes a consistent estimator of switching:

$$\text{ATT}^{PSM} = \sum\nolimits_{i \in I_1} \left(y_i^1 - y_j^0\right).$$

Last, to control for the remaining selection bias that results from unobservable temporary time-invariant factors such as common macro effects, we combine the matching method with a difference-in-differences (DID) approach along the lines of Heckman et al. (1998). We add time script t to the outcome variable, i.e., y. Then, instead of the above first assumption, we assume that:

$$(y_{it}^0 - y_{it-1}^0) \perp Switch_i | \text{Prob}\left(Switch_i = 1|\,\mathbf{X}_{fcp}\right).$$

Then, the above ATT estimator is replaced by:

$$\text{ATT}^{PSM-DID} = \sum\nolimits_{i \in I_1} \left\{ (y_{it}^1 - y_{it-1}^1) - \left(y_{jt}^0 - y_{jt-1}^0\right) \right\}.$$

We compute this estimator.

The propensity of switching is estimated by using the logit model. Based on the data availability, a vector of $\mathbf{X}_{fcp}$ includes the following elements.

$$\mathbf{X}_{fcp} = \left\{ \ln Total\ exports_f \,, Margin_{cp}, FE_{cs} \right\}$$

$Total\ exports_f$ is firm f's total exports evaluated at time t−1, while $Margin_{cp}$ represents the difference between MFN tariff rates and RTA tariff rates (preference margin) when importing product p from country c at time t. FE_{cs} includes country-sector fixed effects. The theoretical analysis in the previous section demonstrates that the less productive drawback users switch to the RTA regime. Unfortunately, we do not have detailed information on firm characteristics such as productivity or employment. By expecting that total exports are positively correlated with productivity, we use firms' total exports instead of productivity. The preference margin does not have direct impacts on the choice between the drawback and RTA regimes. It affects this choice indirectly by increasing the cutoff level of productivity, $\tilde{\varphi}_x^{D>R}$. As Proposition 3 suggests, a higher $\tilde{\varphi}_x^{D>R}$ increases the likelihood of the switch from the DD regime to the RTA regime.

We also extend the vector $\mathbf{X}_{fcp}$ in the later estimation. For example, total exports are decomposed into the average exports at a country-product-level and the number of country-product pairs. We also use the following three variables, which are defined at a firm-level. The first is the share of exports to RTA member countries out of total exports at time t−1. While our import data can identify the tariff regime used, such information is not available in the export data. Therefore, by using this share, we control for the possibility of claiming the RTA regime and enjoying tariff reduction in exports. However, note that exports to RTA member countries do not necessarily follow the RTA regime because its utilization incurs

some costs. The second is the share of imports from RTA members out of total imports at time $t-1$. This share is expected to control for the significance of the choice of switching in each firm. Besides, we introduce a dummy variable on foreign-owned firms because they may behave differently from indigenous firms. Last, we also control for fixed effects of firms' location, which is identified at a province-level.

4.2. Data Issues

Our primary data are the export and import data obtained from Customs in Thailand. Those data cover all commodity exports and imports in Thailand at a transaction level. Specifically, those include customs clearing date, HS eight-digit code, exporting/importing country, firm identification code, values, and quantities. In the import data, the information on the tariff regime is also available. We aggregate the import data according to firms, countries, HS eight-digit code, tariff regimes, and years. Thus, product p is defined at an HS eight-digit level. We categorize the tariff regime into four types, including the MFN regime, the RTA regime, the duty drawback regime, and the other regime. Although we name it "duty drawback regime," it includes the five regimes as introduced in Section 2; bonded warehouses, free zones, investment promotion, duty drawback for raw materials imported for the production of exports, and duty drawback for re-exportation. We use the abbreviation of DD for duty drawback.

We employ trade data in 2007 and 2011. Ideally, two years should be chosen based on the availability of RTAs (i.e., pre- and post-RTA periods). However, the data in 2007 is the oldest data that we have. Indeed, Thailand already had RTAs with some countries (e.g., ASEAN countries) in 2007. Nevertheless, since few firms used RTA regimes in 2007 as shown below, we believe that the choice of the year 2007 works well. On the other hand, the year 2011 is chosen to assure the longest interval under the consistent HS version, i.e., HS 2007. While the outcome variable is the log-difference between imports in 2007 and 2011, the independent variables in the logit model are evaluated in 2007, except for preference margin evaluated in 2011. The data on tariffs are obtained from the Customs of Thailand. We introduce country-sector fixed effects. The sector is defined at a two-digit level of ISIC Revision 3. To convert HS eight-digit codes to two-digit codes of ISIC, we use the correspondence table between HS six-digit codes and four-digit codes of ISIC Revision 3 compiled by the World Integrated Trade Solution[14]. We also use business data compiled by the Department of Business Development in Thailand, which include the basic information of firms. With these data, we create the dummy variable of foreign-owned firms and identify firms' locations (i.e., province).

As of 2011, four bilateral RTAs and six plurilateral RTAs are available in Thailand. The bilateral RTAs came into force with Australia in 2005, India in 2004, Japan in 2007, and New

[14] https://wits.worldbank.org/product_concordance.html

Zealand in 2005.[15] Among plurilateral RTAs, ASEAN Trade in Goods Agreement (ATIGA) was introduced in 2010 by revising the ASEAN Free Trade Area (AFTA) that became effective among the 10 ASEAN countries (Brunei, Cambodia, Indonesia, Malaysia, Myanmar, Laos, the Philippines, Singapore, Thailand, and Vietnam) in the 1990s. Also, Thailand, together with the other ASEAN members, has concluded five plurilateral RTAs, called ASEAN+1 RTAs; ASEAN–Australia–New Zealand Free Trade Agreement (AANZFTA) in 2010, ASEAN–China FTA (ACFTA) in 2005, ASEAN–India FTA (AIFTA) in 2010, ASEAN–Japan Comprehensive Economic Partnership (AJCEP) in 2009, and ASEAN–Korea FTA (AKFTA) in 2010. Thus, we define the following 15 countries as RTA partner countries: the nine ASEAN countries, Australia, China, India, Japan, Korea, and New Zealand.

There are four noteworthy points. First, we restrict study firms to those that have positive exports in both 2007 and 2011 because non-exporters do not have the option to use the DD regime. Second, as found above, multiple RTAs are overlapped in many country-pairs. For example, when trading with ASEAN countries, firms in Thailand can choose an RTA regime among six RTAs (i.e., ATIGA and five ASEAN+1 RTAs). The preference margin is computed by using the lowest available RTA tariff rates at a country-HS eight-digit level. Third, we define the tariff regime with the largest imports as the main tariff regime in each country-product-year pair. We restrict study firm-country-product observations only to those where the main tariff regimes are the duty drawback regime in 2007 and either the duty drawback or RTA regime in 2011. Then, our treatment variable, *Switch*, takes the value of one if the main regime is the RTA in 2011. Fourth, our analysis focuses on the imports of manufacturing products (15-37 in ISIC Revision 3) from these RTA partner countries. Furthermore, the study country-product pairs are restricted to those eligible for any RTAs, i.e., those with a positive preference margin. Last, when we merge the trade data with the business data, a considerable number of firms are dropped partly because we have the business data only for manufacturing firms. Thus, we estimate both the models with and without variables that are obtained from the business data.

Before reporting our estimation results, we take an overview of the import "size" according to the main tariff regimes, which is shown in Table 1. It reports the number of import transactions defined at a firm-country-product-level and the share of each import value out of total imports in 2011. Here we do not include the observations in which no imports are recorded in either 2007 or 2011. In terms of the number, the largest number can be found in the type where the main regime was the MFN regime in both 2007 and 2011, followed by the type where it was the DD regime in both the two years. On the other hand, the ranking becomes opposite in terms of the share; the type where it was the DD regime in both 2007 and 2011 shows the highest share. Both these figures indicate the significant role of the DD regime in the imports in Thailand. The type where the major regime switched

[15] We do not include the RTA with Peru here because it entered into force in 31 December 2011.

from the DD regime to the RTA regime, which is our treatment group in the PSM analysis, accounts for 7%. Last, as mentioned above, few firms used the RTA regime in 2007. The type where the main regime was the RTA regime in 2007 accounts for less than 1%.

=== Table 1 ===

5. Empirical Results

This section reports our estimation results. After some basic analyses, we report the results of our analyses with the PSM method. We also conduct some robustness checks. Then, we report the results of the effects on exports and of the effects of switching from the MFN regime to the RTA regime.

5.1. Basic Analyses

Before the analysis by the PSM, we conduct two basic analyses. First, Figure 5 depicts the distribution of the log-difference between firm-country-product-level imports in 2007 and 2011. The distribution is shown for switchers and non-switchers separately. In both types, the major tariff regime was the DD in 2007 but either the DD or the RTA in 2011. Although both cases hit a peak at around a small positive number, the distribution for switchers looks positively dominant against that for non-switchers. This relation implies that switchers seem to have higher import growth than non-switchers.

=== Figure 5 ===

Second, we simply regress the log-difference above on dummy variables indicating the combination of the major tariff regime between 2007 and 2011. In this regression, we include all importers, including those in which the main regime was not the DD in 2007. The results by the ordinary least squares (OLS) method are reported in Table 2. We may control for country fixed effects or/and HS eight-digit-level fixed effects. The base category is the one where the major regime was the DD in both 2007 and 2011. The standard errors are clustered at a firm-level. The results show that switchers from the DD to the RTA have positively significant coefficients, indicating that the switchers have a higher import growth rate than non-switchers, as is consistent with the finding in Figure 4. Other noteworthy results are that, compared with the non-switchers, the relatively high growth rate is found in the firms that changed from the RTA or the MFN to the DD while the firms that changed from the DD or the RTA to the MFN have the relatively low growth rate.

=== Table 2 ===

5.2. Baseline Results of the PSM

We begin with the analyses by the PSM. Hereafter, we restrict the study observations to those in which the main regime was the DD in 2007 and either the DD or the RTA in 2011. Then, the treatment variable, *Switch*, takes the value of one if the main regime in 2011 was the RTA. The upper panel in Table 3 reports the estimation results for the propensity scores. The standard errors are clustered at a firm-level. Column (I) shows the result with the basic variables, including total exports, preference margin, and country-industry fixed effects. The coefficient for total exports is significantly negative, while the preference margin has an insignificant coefficient. Namely, the DD importers with the relatively small total exports switch to the RTA regime. This result is consistent with our theoretical prediction if total exports are positively associated with firms' productivity. The insignificant result in the preference margin is perhaps because it plays only an indirect role in the choice between the DD and RTA regimes as mentioned in Section 4.1. As shown in column (II), this result does not change even when adding the dummy variable on foreign companies and province fixed effects. The coefficient for a foreign dummy is insignificant. Notice that the number of observations remarkably decreased due to linking the trade data with the business data.[16]

=== Table 3 ===

Based on the predicted propensity scores, we match between switchers and non-switchers. Before discussing the results of the impacts of switching, we show the performance of our matching. The standardized difference and variance ratio of each covariate are reported in Table 4. Column numbers in this table correspond to those in Table 3. Compared with the case of the raw observations, the standardized difference among the matched observations should be smaller in an absolute term. Similarly, the variance ratio in the matched sample should be close to the value of one. Columns (I) and (II) in Table 4 indicate that matching is successfully done in terms of standardized differences but not necessarily successful in terms of variance ratios. The distribution of a log of total exports is presented in panel (a) in Figure 6. Compared with the raw observations, the matched observations show a similar distribution between switchers and non-switchers.

=== Table 4 & Figure 6 ===

[16] To avoid such a decrease of the number of observations, Brandt and Morrow (2017) did not link trade data with manufacturing survey. For completeness, we show the results in both kinds of study observations.

The results in the outcome variable are reported in the lower panel of Table 3. We use standard errors based on the innovation of Abadie and Imbens (2016).[17] Their method takes into account the fact that propensity scores are estimated rather than known when calculating standard errors. Both columns (I) and (II) show the positively significant impacts on imports, indicating that switching to the RTA increases imports by 34-40%. In our theoretical analysis in Section 3, we demonstrated that switching firms could either increase or decrease their imports. Our empirical analyses show the effect of switching on imports is positive on average. To investigate the source of this increase, we examine the impacts on the import quantity and price by replacing the outcome variable in the PSM. The results are presented below those for imports. Both the import quantity and price show positive effects, but only the effect on import quantity is significant. Thus, the increase of imports comes mainly from the increase of import quantity.

Next, we try other specifications in the logit model. In columns (III) and (IV), we decompose total exports to the average exports and the number of country-product pairs. The logit results show that both variables have positive coefficients, but only the results in the average exports are significant. The DD importers with the smaller average exports tend to switch to the RTA regime. In columns (V) and (VI), we introduce two variables of shares, that is, the shares of exports to and imports from RTA member countries to the specification used in columns (III) and (IV). These two variables have not robust results. Only column (V) shows the significantly positive coefficient for the share of the imports, while the significantly positive coefficient for the share of the exports is found only in column (VI). The balancing tests based on these logit results are reported in the corresponding columns in Table 4. The distribution of a log of average exports is presented in panel (b) in Figure 6. Similar to the case of total exports, compared with the raw observations, the matched observations show a similar distribution between switchers and non-switchers. Also, in all these estimations, the results of the impacts on imports are qualitatively unchanged. Switching significantly increases imports, especially import quantity.

5.3. Robustness Checks

We conduct four kinds of robustness checks on the results above. First, so far, we only restrict the study products to manufacturing products. For more consistency with our theoretical setting, we further restrict only to intermediate products, e.g., parts. Finished products are defined as items categorized into 112, 122, 41, 51, 52, 61, 62, or 63 in the Broad Economic Categories (BEC) classification while the rest are intermediate products. The results for imports of parts are reported in Table 5.[18] The logit results are similar to those in Table 3. Both total exports and the average exports have significantly negative coefficients. On the other hand, the results in the outcome variables are not robust. Some specifications

[17] To this end, we use "teffects" command in Stata.

[18] The balancing tests in the analyses below are presented in Appendix B.

show the insignificant impacts on not only import prices but also imports and import quantity. Thus, these results indicate that switching from the DD regime to the RTA regime does not necessarily increase imports.

=== Table 5 ===

The second and third checks are to estimate for subsamples. As the second check, we exclude import observations from Japan. Japan has been a top investing country in Thailand and has had a close economic relationship with Thailand. Thus, the trade between Japan and Thailand may follow different economic mechanisms, such as intra-firm trade. The third check is to exclude outliers in terms of import growth. Specifically, we drop observations with the top 3% or the bottom 3% of import growth. The results in these two checks are shown in Table 6. We only report the results of the model with the full variables. The results for all manufacturing products and parts are separately presented. The results for both the logit model and the impacts are similar to those in Table 3. Namely, switching significantly increases imports and import quantity.

=== Table 6 ===

The last robustness check is to examine the effect of switching on imports at a firm-level. So far, we have estimated the model defined at a firm-country-product-level. Suppose that a firm switches the tariff regime in one product but not in another product. In this case, the change in imports in the former product may also affect the imports in the latter product if these products are interrelated. To incorporate such effects, we estimate the propensity of switching at a firm-level and examine the effects on firm-level imports. The major tariff regime is also defined at a firm-level. In this categorization of the major regime, we use the sum of imports of the RTA eligible products from RTA member countries. Then, we focus on the firms in which the imports under the DD regime are larger than those under the RTA regime in 2007. The switching is to have the larger imports under the RTA regime than under the DD regime in 2011. The results are shown in columns (I)-(IV) in Table 7. The logit estimation results indicate the weak result in total exports while the average exports have significantly negative coefficients. The impacts on total imports are reported in the lower panel and again show the positive effects. Specifically, the results indicate that switching increases imports from RTA member countries by around 30%.

=== Table 7 ===

5.4. Impacts on Exports

In this subsection, we examine the impacts of switching on firms' exports. Since those exports are defined at a firm-level, matching is carried out by using the same model used in columns (VI) and (V) in Table 7. The impacts on firms' total exports are shown in the lower panel in columns (V) and (VI) in Table 7. The results indicate the insignificant effects of switching on total exports. We also examine the impacts on the exports only to RTA member countries because the RTA formation decreases not only input tariffs when importing but also output tariffs when exporting to the member countries. However, notice that firms do not necessarily use RTA tariffs even when exporting to RTA member countries because of the existence of their utilization costs.[19] The results are reported in columns (VII) and (VIII) but again show the insignificant results.

In Section 3, we theoretically demonstrate that there are two opposing effects on exports. The positive effect is based on the utilization of RTA tariffs in exporting, i.e., the use of lower tariffs, while the negative effect comes from the rise of input costs because of the compliance of RoO. The former effect works only in exporting to RTA partner countries and utilizing RTA tariffs. Also, we found the positive effect of switching on import prices in many specifications, but such an effect was insignificant. Our results on the impacts on exports, especially exports to RTA member countries, indicate that the exports did not increase as greatly as offsetting the (insignificant) rise of input costs. Nevertheless, we found the significant increase of imports, especially import quantities. These results imply that increased inputs are used to produce goods for the domestic market. Indeed, as found in Figure 7, the share of domestic sales out of total sales is higher in switching firms.[20] In sum, the switching firms increase their imports from RTA partner countries to produce their goods for the domestic market rather than to expand their exports.

=== Figure 7 ===

5.5. Switching from the MFN Regime to the RTA Regime

Last, we examine the impacts of switching from the MFN regime to the RTA regime on imports in order to cover the whole picture on firms who switch to the RTA regime. To do that, we restrict study firm-country-product observations only to those where the main tariff regimes are the MFN regime in 2007 and either the MFN or RTA regime in 2011. Then, our treatment variable, *Switch*, takes the value of one if the main regime is the RTA regime in 2011. We use the same variables in estimating the propensity of this type of switching as in the case of switching from the DD regime. As found in Table 1, in terms of imports, firms switching from the MFN regime to the RTA regime account for 16%, which is more than

[19] Note that the information on the tariff regime used in exporting is not available.

[20] This figure depicts the distribution of domestic sales shares in 2010. The domestic sales are computed by subtracting total exports from total sales. The data on total sales are obtained from the business data. Notice that we have those data only for 2010.

twice as large as those switching from the DD regime to the RTA regime. Thus, the impacts in the former type of switchers may have potentially larger impacts on national imports.

The results are presented in columns "All" and "Parts" in Table 8. In column "Parts," we restrict the study observations only to intermediate products. The logit estimation results indicate that the coefficients for the average exports are positive, which is opposite to the case of switching from the DD, though significant only in the case of parts. This result is consistent with our theoretical result that among MFN users, the more productive importers switch to the RTA regime. Another noteworthy result is that the coefficients for preference margin are significantly positive, indicating that MFN users are more likely to switch to the RTA regime when the difference between MFN tariffs and RTA tariffs is larger. This result is natural because the difference between MFN tariffs and RTA tariffs has a direct effect on the choice between MFN and RTA regimes, unlike the choice between DD and RTA regimes. The results in the other variables are similar to those in switching from the DD regime. The higher share of imports from RTA members is associated with the higher propensity of switching from the MFN regime to the RTA regime. Foreign-owned firms tend to keep using the MFN regime.

=== Table 8 ===

The impacts on imports are reported in the lower panel and show positive effects. Specifically, the results indicate much larger coefficients than those in switching from the DD regime. Switching from the MFN regime to the RTA regime increases imports from RTA member countries by 74-110%. While the impacts on the import quantity are significantly positive with the almost same magnitude as those on imports, the import prices receive negative and insignificant effects (except for column (III)). Thus, as in the case of switching from the DD regime, most of the increase of imports come from the increase of import quantities. The negative (but insignificant) impacts on import prices are not consistent with our expectation because this measure is tariff-exclusive import prices. In the theoretical model, the fundamental price of imported input is assumed to be constant. If each input is provided by a monopolistically competitive firm and the price-cost margin is not constant, however, RTA use can decrease import prices by decreasing the price-cost margin, as is indicated by Hayakawa et al. (2019). This also indicates that the adjustment costs to meet RoO are not significant.

We also examine the impacts of this switching at a firm-level. The results are shown in column "Firm-level." The study observations are restricted to those in which the imports under the MFN regime are larger than those under the RTA regime in 2007. Then, the treatment variable, *Switch*, takes the value of one if the imports under the RTA regime are larger than those under the MFN regime in 2011. As in the case of firm-country-product-level analyses, the impacts on imports are estimated to be significantly positive. Switching from the MFN regime to the RTA regime increases the imports from RTA partners by 53-

68%. In this firm-level analysis, we also examine the impacts on total exports. However, those impacts are insignificantly estimated as in the case of switching from the DD regime to the RTA regime. This insignificant result is not consistent with our theoretical prediction. We have supposed that the price index of outputs is constant. However, if lower export prices decrease the price index in the destination countries, it intensifies competition, and some exporters may decrease their exports.

6. Concluding Remarks

This study examined theoretically and empirically how the entry of RTAs into force changes firms' imports and exports under the presence of duty drawback regimes. We theoretically demonstrated that firms who switch from the duty drawback regime to the RTA regime can either increase or decrease their imports from RTA member countries because the use of RTA regimes does not provide additional benefit in terms of duty exemption but import prices may rise due to the compliance of RoO. In the detailed firm-level trade data in Thailand, we found that firms' switch from the duty drawback regime to the RTA regime increases their imports from RTA member countries by around 30%. The switch from the MFN regime to the RTA regime increases the imports by around 90%. However, it is also revealed that those firms switching to the RTA regime are medium-sized firms in terms of total exports. The large-sized firms keep using the duty drawback regime in their importing even after the entry of RTAs into force. Therefore, the impacts of RTAs on trade might not be so large at a national level. Indeed, in Thailand, the share of imports by such two kinds of switching firms is only 23% even in the post-RTA period.

We also found that the increase of imported inputs by firms who switch from the duty drawback to the RTA regime is to sell their goods for the domestic market rather than to expand their exports. This result implies that the presence of domestic firms rises in the domestic market of the downstream or finished goods. Thus, the competition in the domestic market becomes tough, resulting in dampening the exports of finished goods from RTA member countries. Namely, RTAs may increase the trade in materials or inputs but not that in finished goods. Indeed, when we estimate the gravity equation with RTA dummy variables for the worldwide trade, we found the significantly positive trade creation effects for trade in materials but did not for trade in finished goods (see Table B5 in Appendix B). In sum, under the presence of duty drawback regimes, the magnitude of trade creation effects by RTAs will be different according to production stages.

References

Afesorgbor, Sylvanus Kwaku, 2017, Revisiting the Effect of Regional Integration on African Trade: Evidence from Meta-analysis and Gravity Model, *Journal of International Trade & Economic Development*, 26: 133–153.

Abadie, Alberto and Guido W. Imbens, 2016, Matching on the Estimated Propensity Score, *Econometrica*, 84: 781-807.

Baier, Scott L. and Jeffrey H. Bergstrand, 2007, Do Free Trade Agreements Actually Increase Members' International Trade?, *Journal of International Economics*, 71(1): 72–95.

Bombarda, Pamela and Elisa Gamberoni, 2013, Firm Heterogeneity, Rules of Origin, and Rules of Cumulation, *International Economic Review*, 54(1): 307–328.

Brandt, Loren and Peter M Morrow, 2017, Tariffs and the Organization of Trade in China, *Journal of International Economics*, 104: 85-103.

Bureau, Jean-Christophe, Raja Chakir, Jacques Gallezot, 2007, The Utilisation of Trade Preferences for Developing Countries in the Agri-food Sector, *Journal of Agricultural Economics*, 58(2), 175–198.

Cadot, Olivier, Jaime de Melo, and Marcelo Olarreaga, 2003, The Protectionist Bias of Duty Drawbacks: Evidence from Mercosur, *Journal of International Economics*, 59: 161-182.

Cherkashin, Ivan, Svetlana Demidova, Hiau Looi Kee, and Kala Krishna, 2015, Firm Heterogeneity and Costly Trade: A New Estimation Strategy and Policy Experiments, *Journal of International Economics*, 96(1): 18–36.

Cipollina, Maria and Luca Salvatici, 2010, "Reciprocal Trade Agreements in Gravity Models: A Meta-Analysis, *Review of International Economics*, 18(1): 63–80.

Demidova, Svetlana and Kala Krishna, 2008, Firm Heterogeneity and Firm Behavior with Conditional Policies, *Economics Letters*, 98(2): 122–128.

Egger, Hartmut and Peter Egger, 2005, The Determinants of EU Processing Trade, *The World Economy*, 28(2): 147-168.

Francois, Joseph F and Bernard Hoekman, and Miriam Manchin, 2006, Preference Erosion and Multilateral Trade Liberalization, *World Bank Economic Review*, 20(2), 197–216.

Hakobyan, Shushanik, 2015, Accounting for Underutilization of Trade Preference Programs: U.S. Generalized System of Preferences, *Canadian Journal of Economics*, 48(2), 408–436.

Hamada, Koichi, 1974, An Economic Analysis of the Duty-free Zone, *Journal of International Economics*, 4: 225-241.

Hayakawa, Kazunobu, 2015, Impacts of FTA Utilization on Firm Performance, *B.E. Journal of Economic Analysis and Policy*, 15(3): 1325-1352.

Hayakawa, Kazunobu, Han-Sung Kim, and Taiyo Yoshimi, 2017, Exchange Rate and Utilization of Free Trade Agreements: Focus on Rules of Origin, *Journal of International Money and Finance*, 75, 93-108.

Hayakawa, Kazunobu, Shujiro Urata, and Taiyo Yoshimi, 2019, Choosing between Multiple Regional Trade Agreements: Evidence from Japan's Imports, *Review of International Economics*, 27(2): 578-593.

Hayakawa, K., Nattawut Laksanapanyakul, Hiroshi Mukunoki, and Shujiro Urata, 2019, Impact of Free Trade Agreement Use on Import Prices, *World Bank Economic Review*, 33(3): 643–660.

Helpman, Elhanan, Marc J. Melitz, and Stephen R. Yeaple, 2004, Export Versus FDI with Heterogeneous Firms, *American Economic Review*, 94(1): 300–316.

Ianchovichina, Elena, 2004, Trade Policy Analysis in the Presence of Duty Drawbacks, *Journal of Policy Modelling*, 26: 353-371.

Ianchovichina, Elena, 2007, Are Duty Drawbacks on Exports Worth the Hassle?, *Canadian Journal of Economics*, 40(3): 881-913.

Kohl, Tristan, 2014, Do We Really Know That Trade Agreements Increase Trade?, *Review of World Economics*, 150: 443–469.

Mah, Jai, 2007, The Effect of Duty Drawback on Export Promotion: The Case of Korea, *Journal of Asian Economics*, 18: 967-973.

Melitz, Marc J., 2003, The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, *Econometrica*, 71(6): 1695–1725.

Manchin, Miriam, 2006, Preference Utilisation and Tariff Reduction in EU Imports from ACP Countries, *The World Economy*, 29(9), 1243–1266.

Panagariya, Arvind, 1992, Input Tariffs, Duty Drawbacks, and Tariff Reforms, *Journal of International Economics*, 32: 131-147.

Sargent, John and Linda Matthews, 2001, Combining Export Processing Zones and Regional Free Trade Agreements: Lessons from the Mexican Experience, *World Development*, 29(10): 1739-1752.

WTO, 2003, Export Financing and Duty Drawbacks, WT/TF/COH/15, World Trade Organization.

Table 1. The Number of Import Observations and the Share of Imports out of Total Imports in 2011 according to the Major Tariff Regime in 2007 and 2011

		2011			
2007		DD	MFN	RTA	Other
DD	Number	14,717	3,432	974	163
	Import share in 2011 (%)	28	3	7	1
MFN	Number	2,644	56,382	11,831	1,297
	Import share in 2011 (%)	4	23	16	6
RTA	Number	7	65	512	0
	Import share in 2011 (%)	0.1	0.05	0.63	0
Other	Number	65	1,906	4,057	107
	Import share in 2011 (%)	0.5	2	9	0.4

Source: Customs, Kingdom of Thailand

Note:

Table 2. Simple OLS Estimation

Base: 2007 = DD & 2011 = DD	(I)	(II)	(III)
1 if 2007 = DD & 2011 = RTA	0.286***	0.239***	0.213**
	[0.075]	[0.078]	[0.086]
1 if 2007 = DD & 2011 = MFN	-1.029***	-1.074***	-1.051***
	[0.081]	[0.080]	[0.083]
1 if 2007 = DD & 2011 = Other	-0.276	-0.285	-0.134
	[0.308]	[0.293]	[0.298]
1 if 2007 = RTA & 2011 = DD	1.816***	1.812***	2.098***
	[0.458]	[0.455]	[0.500]
1 if 2007 = RTA & 2011 = RTA	0.596***	0.641***	0.713***
	[0.169]	[0.169]	[0.192]
1 if 2007 = RTA & 2011 = MFN	-0.713**	-0.696**	-0.720**
	[0.321]	[0.334]	[0.344]
1 if 2007 = MFN & 2011 = DD	1.451***	1.407***	1.380***
	[0.079]	[0.081]	[0.081]
1 if 2007 = MFN & 2011 = RTA	0.616***	0.636***	0.645***
	[0.045]	[0.045]	[0.048]
1 if 2007 = MFN & 2011 = MFN	0.078**	0.069*	0.069*
	[0.035]	[0.037]	[0.039]
1 if 2007 = MFN & 2011 = Other	0.323***	0.409***	0.383***
	[0.081]	[0.113]	[0.112]
1 if 2007 = Other & 2011 = DD	0.511*	0.473	0.568
	[0.278]	[0.305]	[0.396]
1 if 2007 = Other & 2011 = RTA	0.301***	0.310***	0.282***
	[0.051]	[0.061]	[0.074]
1 if 2007 = Other & 2011 = MFN	-0.261**	-0.411***	-0.339***
	[0.116]	[0.096]	[0.104]
1 if 2007 = Other & 2011 = Other	0.420**	0.587***	0.621***
	[0.194]	[0.209]	[0.238]
Country FE		X	
HS FE		X	
Country-HS FE			X
R-squared	0.026	0.0696	0.1153
Number of obs.	98,159	97,472	93,097

Notes: We estimate the model by the OLS method. The dependent variable is a log-difference between imports in 2007 and 2011 at a firm-country-product-level. The independent variables include various dummy variables indicating the combination of the major tariff regime between 2007 and 2011. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. The square brackets denote standard errors clustered by firms. We may control for country fixed effects or/and HS eight-digit-level fixed effects.

Table 3. Effects of Switching on Imports of All Products

	(I)	(II)	(III)	(IV)	(V)	(VI)
Logit results						
ln Total exports	-0.145***	-0.158***				
	[0.030]	[0.052]				
ln Average exports			-0.189***	-0.181***	-0.195***	-0.183***
			[0.044]	[0.065]	[0.044]	[0.064]
ln # of country-product pairs			-0.084	-0.125	-0.066	-0.07
			[0.067]	[0.092]	[0.071]	[0.102]
Share of exports to RTA members					0.01	0.745**
					[0.238]	[0.348]
Share of imports from RTA members					0.499*	-0.019
					[0.293]	[0.383]
Margin	-0.175	1.738	-0.182	1.74	-0.102	1.665
	[0.720]	[1.269]	[0.719]	[1.262]	[0.697]	[1.265]
Foreign dummy		-0.279		-0.282		-0.384
		[0.220]		[0.222]		[0.234]
Province FE		X		X		X
Country-ISIC 2-digit FE	X	X	X	X	X	X
Pseudo R2	0.2021	0.2429	0.203	0.2432	0.2047	0.2484
Log pseudolikelihood	-2876.6	-1609.4	-2873.6	-1608.9	-2867.4	-1597.8
Impacts						
ln Imports	0.344***	0.401***	0.307***	0.455***	0.277***	0.464***
	[0.093]	[0.129]	[0.094]	[0.138]	[0.101]	[0.144]
ln Quantity	0.222*	0.325**	0.213*	0.303*	0.265**	0.373**
	[0.116]	[0.148]	[0.117]	[0.167]	[0.127]	[0.169]
ln Price	0.122	0.076	0.094	0.153	0.012	0.091
	[0.077]	[0.093]	[0.070]	[0.105]	[0.078]	[0.094]
Number of obs.	13,834	7,484	13,834	7,484	13,834	7,484
Treated obs.	1,006	615	1,006	615	1,006	615
Control obs. (Raw)	12,828	6,869	12,828	6,869	12,828	6,869

Notes: This table reports the results of the PSM. The study observations are restricted to those in which the main regime was the DD in 2007 and either the DD or the RTA in 2011. Then, the treatment variable, *Switch*, takes the value of one if the main regime in 2011 was the RTA. The upper panel reports the estimation results for the propensity scores. The standard errors are clustered at a firm-level. The results in the outcome variable are reported in the lower panel. The standard errors are the Abadie-Imbens robust ones. ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 4. Balancing Test for Matched Firms in Table 3

		(I)	(II)	(III)	(IV)	(V)	(VI)
ln Total exports							
Raw	S.D.	-0.500	-0.472				
	Var R	1.020	1.469				
Matched	S.D.	0.024	0.101				
	Var R	0.811	0.681				
ln Average exports							
Raw	S.D.			-0.459	-0.411	-0.459	-0.411
	Var R			1.022	1.440	1.022	1.440
Matched	S.D.			-0.009	-0.002	-0.023	-0.016
	Var R			0.908	0.734	0.959	0.791
ln # of country-product pairs							
Raw	S.D.			-0.372	-0.376	-0.372	-0.376
	Var R			1.177	1.365	1.177	1.365
Matched	S.D.			0.089	-0.059	0.045	0.018
	Var R			1.091	0.920	0.975	0.881
Share of exports to RTA members							
Raw	S.D.					-0.131	0.048
	Var R					0.942	0.907
Matched	S.D.					-0.134	-0.133
	Var R					0.924	0.988
Share of imports from RTA members							
Raw	S.D.					-0.128	-0.176
	Var R					0.926	1.049
Matched	S.D.					0.035	-0.095
	Var R					0.811	0.869
Margin							
Raw	S.D.	0.193	0.290	0.193	0.290	0.193	0.290
	Var R	1.587	2.208	1.587	2.208	1.587	2.208
Matched	S.D.	-0.031	0.051	0.072	-0.006	0.063	0.043
	Var R	0.557	1.142	1.420	0.954	1.447	1.236
Foreign dummy							
Raw	S.D.		-0.425		-0.425		-0.425
	Var R		2.006		2.006		2.006
Matched	S.D.		0.011		0.025		0.025
	Var R		0.989		0.976		0.976

Notes: This table reports the balancing tests for the matching conducted in Table 3. We show the standardized differences (S.D.) and variance ratio (Var R) of each covariate. Column numbers correspond to those in Table 3.

Table 5. Effects of Switching on Imports of Parts

	(I)	(II)	(III)	(IV)	(V)	(VI)
Logit results						
ln Total exports	-0.147***	-0.131***				
	[0.030]	[0.049]				
ln Average exports			-0.185***	-0.131**	-0.187***	-0.133**
			[0.046]	[0.065]	[0.046]	[0.065]
ln # of country-product pairs			-0.097	-0.131	-0.083	-0.078
			[0.065]	[0.091]	[0.068]	[0.098]
Share of exports to RTA members					0.082	0.788**
					[0.255]	[0.374]
Share of imports from RTA members					0.284	-0.1
					[0.308]	[0.401]
Margin	0.151	2.454	0.158	2.454	0.175	2.275
	[0.752]	[1.559]	[0.747]	[1.562]	[0.741]	[1.570]
Foreign dummy		-0.322		-0.322		-0.425*
		[0.234]		[0.236]		[0.246]
Province FE		X		X		X
Country-ISIC 2-digit FE	X	X	X	X	X	X
Pseudo R2	0.1887	0.2276	0.1893	0.2276	0.1901	0.2333
Log pseudolikelihood	-2276.0	-1268.2	-2274.3	-1268.2	-2272.1	-1258.8
Impacts						
ln Imports	0.317***	0.324	0.329***	0.324	0.117	0.438**
	[0.109]	[0.214]	[0.101]	[0.213]	[0.109]	[0.183]
ln Quantity	0.306**	0.179	0.337***	0.218	0.208	0.456**
	[0.127]	[0.225]	[0.121]	[0.223]	[0.136]	[0.203]
ln Price	0.011	0.144	-0.008	0.106	-0.091	-0.019
	[0.079]	[0.120]	[0.073]	[0.119]	[0.090]	[0.106]
Number of obs.	9,312	5,138	9,312	5,138	9,312	5,138
Treated obs.	833	501	833	501	833	501
Control obs. (Raw)	8,479	4,637	8,479	4,637	8,479	4,637

Notes: This table reports the results of the PSM. The study observations are restricted to those in which the main regime was the DD in 2007 and either the DD or the RTA in 2011. Then, the treatment variable, *Switch*, takes the value of one if the main regime in 2011 was the RTA. The upper panel reports the estimation results for the propensity scores. The standard errors are clustered at a firm-level. The results in the outcome variable are reported in the lower panel. The standard errors are the Abadie-Imbens robust ones. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In this table, we restrict the study products only to intermediate products.

Table 6. Effects of Switching on Imports: Robustness Checks

	Excluding imports from Japan				Excluding outliers			
	All		Parts		All		Parts	
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Logit results								
ln Average exports	-0.224***	-0.253***	-0.221***	-0.193***	-0.195***	-0.188***	-0.186***	-0.134**
	[0.049]	[0.070]	[0.052]	[0.073]	[0.045]	[0.065]	[0.047]	[0.065]
ln # of country-product pairs	-0.089	-0.156*	-0.115*	-0.163*	-0.066	-0.065	-0.086	-0.074
	[0.067]	[0.089]	[0.066]	[0.098]	[0.071]	[0.103]	[0.067]	[0.099]
Share of exports to RTA members	-0.011	0.607*	0.095	0.671*	-0.003	0.746**	0.077	0.818**
	[0.236]	[0.332]	[0.257]	[0.373]	[0.238]	[0.350]	[0.258]	[0.382]
Share of imports from RTA members	0.747**	-0.002	0.580*	-0.066	0.527*	0.055	0.309	-0.043
	[0.301]	[0.398]	[0.320]	[0.430]	[0.294]	[0.386]	[0.308]	[0.403]
Margin	-0.105	1.916	0.106	2.255	-0.002	1.786	0.069	1.919
	[0.741]	[1.339]	[0.874]	[1.745]	[0.703]	[1.289]	[0.733]	[1.593]
Foreign dummy		-0.388		-0.406		-0.357		-0.417*
		[0.252]		[0.272]		[0.234]		[0.247]
Province FE		X		X		X		X
Country-ISIC 2-digit FE	X	X	X	X	X	X	X	X
Pseudo R2	0.1874	0.2508	0.1823	0.241	0.2018	0.2426	0.1881	0.2296
Log pseudolikelihood	-2146.6	-1130.6	-1680.7	-881.7	-2727.9	-1512.0	-2151.7	-1186.5
Impacts								
ln Imports	0.241**	0.528***	0.366***	0.347**	0.304***	0.437***	0.208**	0.347**
	[0.103]	[0.134]	[0.138]	[0.175]	[0.080]	[0.109]	[0.089]	[0.159]
ln Quantity	0.212*	0.607***	0.417***	0.236	0.215**	0.334**	0.278**	0.401**
	[0.124]	[0.151]	[0.157]	[0.203]	[0.103]	[0.143]	[0.117]	[0.183]
ln Price	0.029	-0.079	-0.052	0.11	0.089	0.103	-0.07	-0.054
	[0.079]	[0.097]	[0.085]	[0.118]	[0.075]	[0.104]	[0.080]	[0.107]
Number of obs.	7,782	4,090	5,469	2,913	12,678	6,850	8,531	4,713
Treated obs.	830	495	681	398	967	584	798	465
Control obs. (Raw)	6,952	3,595	4,788	2,515	11,711	6,266	7,733	4,248

Notes: This table reports the results of the PSM. The study observations are restricted to those in which the main regime was the DD in 2007 and either the DD or the RTA in 2011. Then, the treatment variable, *Switch*, takes the value of one if the main regime in 2011 was the RTA. The upper panel reports the estimation results for the propensity scores. The standard errors are clustered at a firm-level. The results in the outcome variable are reported in the lower panel. The standard errors are the Abadie-Imbens robust ones. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. This table reports the results when excluding import observations from Japan or outliers in terms of import growth. In the latter, we drop observations with top 3% or bottom 3% of import growth.

Table 7. Effects of Switching on Imports and Exports: Firm-level Analyses

	(I)	(II)	(III)	(VI)	(V)	(VI)	(VII)	(VIII)
Logit results								
ln Total exports	-0.024	-0.051*						
	[0.018]	[0.028]						
ln Average exports			-0.091***	-0.114***	-0.080***	-0.093**	-0.089***	-0.084**
			[0.026]	[0.039]	[0.028]	[0.043]	[0.027]	[0.042]
ln # of country-product pairs			0.090**	0.058	0.128***	0.114*	0.151***	0.130**
			[0.037]	[0.057]	[0.039]	[0.060]	[0.040]	[0.063]
Share of exports to RTA members	-0.285**	-0.072	-0.249*	-0.034	-0.18	0.123	-0.023	0.16
	[0.133]	[0.206]	[0.136]	[0.211]	[0.137]	[0.214]	[0.152]	[0.237]
Share of imports from RTA members	0.394**	0.164	0.432***	0.209	0.474***	0.265	0.242	0.124
	[0.160]	[0.240]	[0.162]	[0.241]	[0.159]	[0.238]	[0.170]	[0.255]
Foreign dummy		-0.18		-0.203		-0.162		-0.111
		[0.156]		[0.157]		[0.158]		[0.166]
Province FE		X		X		X		X
ISIC 2-digit FE	X	X	X	X	X	X	X	X
Pseudo R2	0.0717	0.1223	0.0755	0.1254	0.077	0.1198	0.0852	0.1302
Log pseudolikelihood	-1548.5	-744.1	-1542.0	-741.5	-1502.9	-720.8	-1411.3	-674.9
Impacts								
ln Imports from RTA members	0.382***	0.300**	0.305***	0.294**				
	[0.095]	[0.124]	[0.093]	[0.115]				
ln Total exports	0.002	-0.011	-0.038	-0.033	0.058	0.094		
	[0.115]	[0.129]	[0.121]	[0.145]	[0.103]	[0.152]		
ln Exports to RTA members							0.086	0.099
							[0.098]	[0.124]
Number of obs.	2,758	1,354	2,758	1,354	2,726	1,325	2,606	1,250
Treated obs.	808	432	808	432	776	409	727	390
Control obs. (Raw)	1,950	922	1,950	922	1,950	916	1,879	860

Notes: This table reports the results of the PSM at the firm-level. The study observations are restricted to those in which imports under the DD regime are larger than those under the RTA regime in 2007. Then, the treatment variable, *Switch*, takes the value of one if firms have the larger imports under the RTA regime than under the DD regime in 2011. The upper panel reports the estimation results for the propensity scores. The standard errors are clustered at a firm-level. The results in the outcome variable are reported in the lower panel. The standard errors are the Abadie-Imbens robust ones. ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 8. Effects of Switching from the MFN Regime to the RTA Regime

	All		Parts		Firm-level	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Logit results						
ln Average exports	0.026	0.021	0.031	0.045	0.01	0.02
	[0.020]	[0.032]	[0.019]	[0.034]	[0.015]	[0.031]
ln # of country-product pairs	-0.213***	-0.084	-0.200***	-0.091*	-0.035	0.017
	[0.028]	[0.053]	[0.030]	[0.054]	[0.024]	[0.047]
Share of exports to RTA members	-0.065	0.076	0.018	0.02	-0.173**	-0.061
	[0.112]	[0.181]	[0.106]	[0.192]	[0.079]	[0.158]
Share of imports from RTA members	1.053***	0.748***	0.800***	0.525**	0.647***	0.279
	[0.136]	[0.233]	[0.130]	[0.243]	[0.090]	[0.172]
Margin	2.532***	2.251***	3.199***	4.283***		
	[0.378]	[0.757]	[0.581]	[1.015]		
Foreign dummy		-0.666***		-0.629***		-0.477***
		[0.150]		[0.146]		[0.122]
Province FE		X		X		X
Country-ISIC 2-digit FE	X	X	X	X	X	X
Pseudo R2	0.2276	0.2298	0.2252	0.2324	0.0711	0.0929
Log pseudolikelihood	-14800.2	-3723.9	-8583.7	-2434.0	-3243.0	-970.3
Impacts						
Imports	0.746***	1.046***	0.654***	1.038***	0.677***	0.526***
	[0.052]	[0.098]	[0.063]	[0.144]	[0.076]	[0.191]
Quantity	0.741***	1.105***	0.757***	1.090***		
	[0.060]	[0.126]	[0.075]	[0.177]		
Price	0.006	-0.058	-0.103	-0.052		
	[0.039]	[0.082]	[0.051]	[0.113]		
Exports					0.077	0.012

Notes: This table reports the results of the PSM. In columns "All" and "Parts," the study observations are defined at a firm-country-product-level. They are restricted to those in which the main regime was the MFN in 2007 and either the MFN or the RTA in 2011. Then, the treatment variable, *Switch*, takes the value of one if the main regime in 2011 was the RTA. On the other hand, the study observations are defined at a firm-level in column "Firm-level." They are restricted to those in which the imports under the MFN regime are larger than those under the RTA regime in 2007. Then, the treatment variable, *Switch*, takes the value of one if the imports under the RTA regime are larger than those under the MFN regime in 2011. The upper panel reports the estimation results for the propensity scores. The standard errors are clustered at a firm-level. The results in the outcome variable are reported in the lower panel. The standard errors are the Abadie-Imbens robust ones. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In column "Parts," we restrict the study products only to intermediate products.

Figure 1: Profit in Each Country before the Formation of RTAs

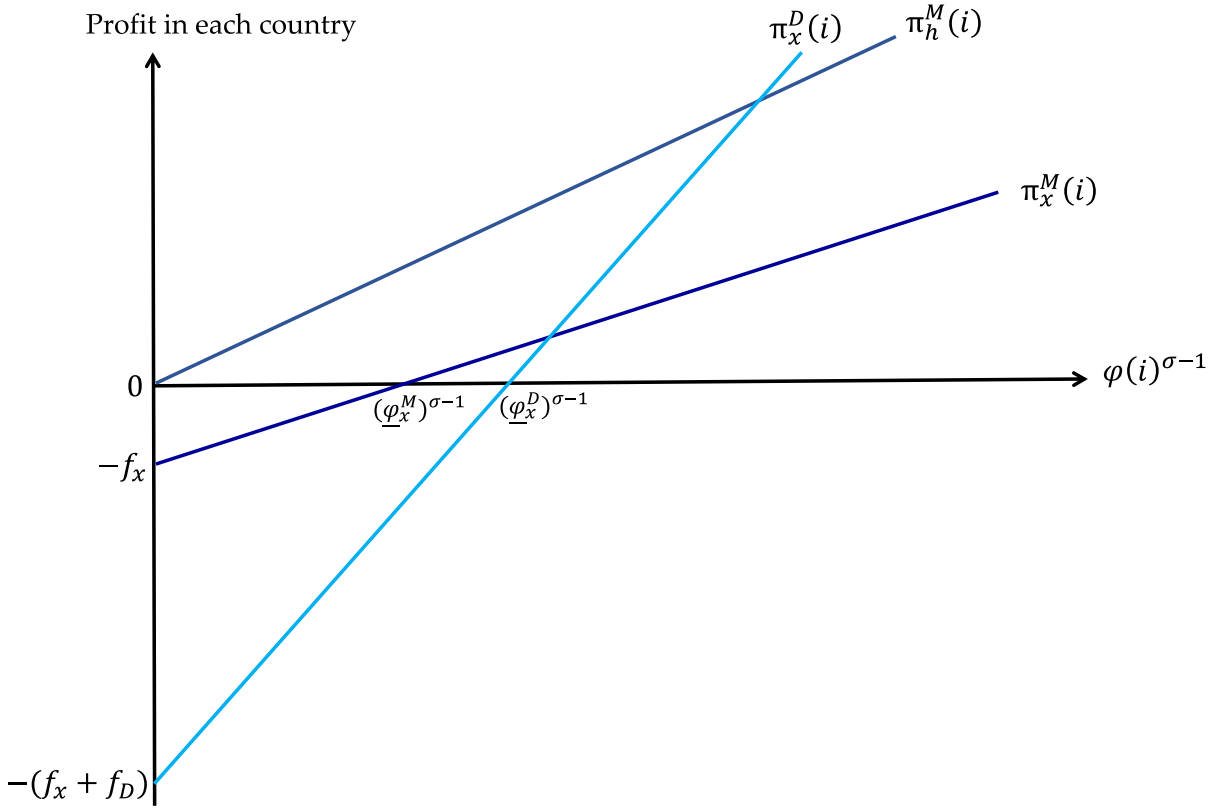


Figure 2: Total Profit before the Formation of RTA

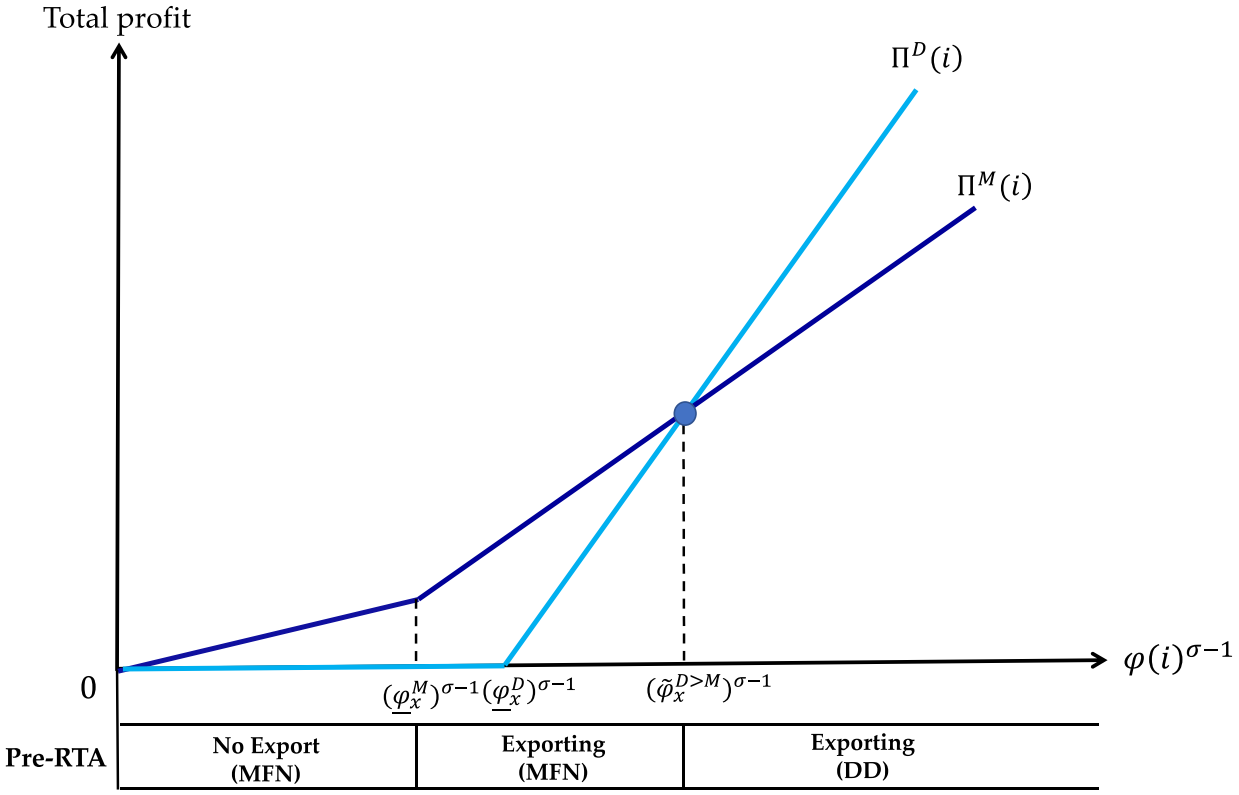


Figure 3: Profit in Each Market in the RTA Regime

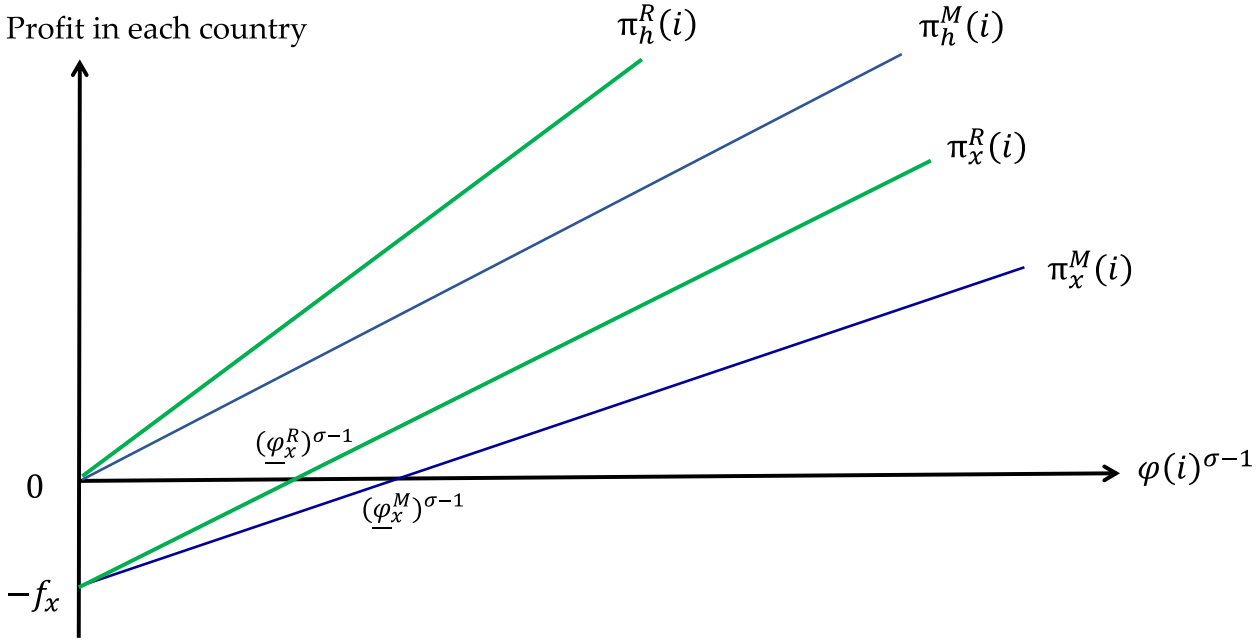


Figure 4: Total Profit after the Formation of RTA

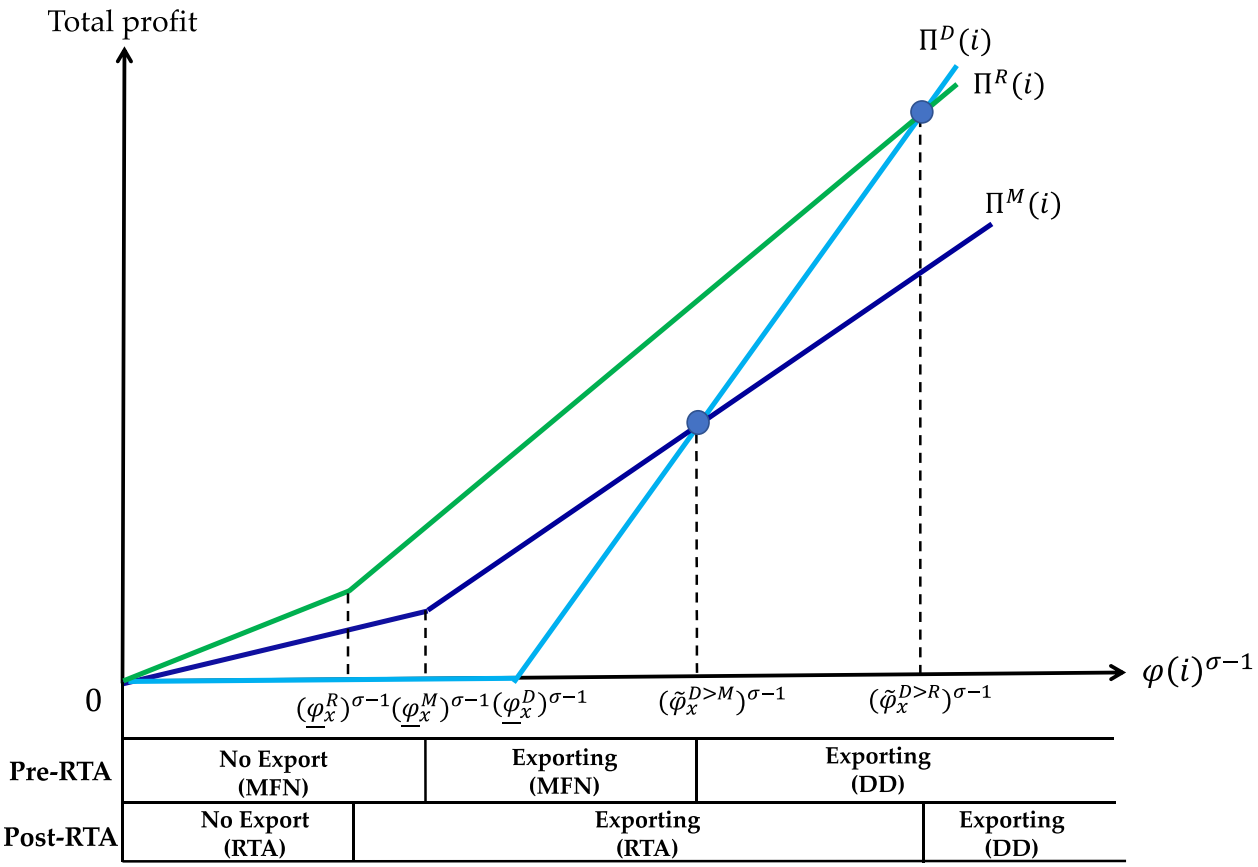
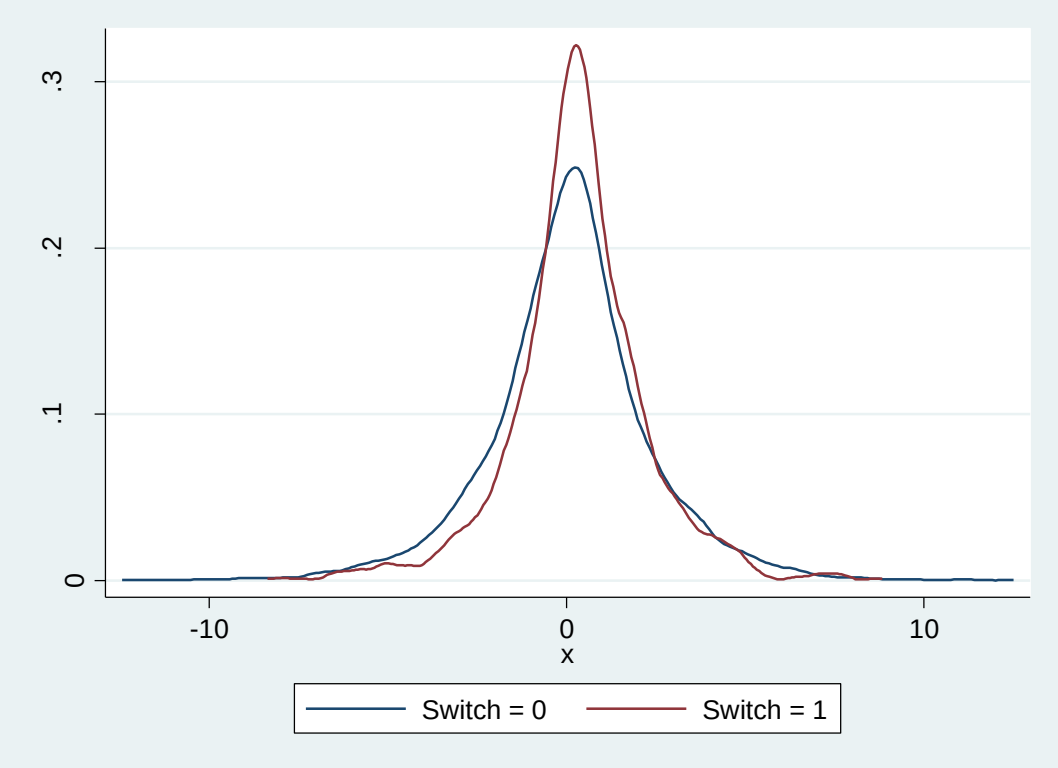


Figure 5. The Distribution of Import Growth Rates

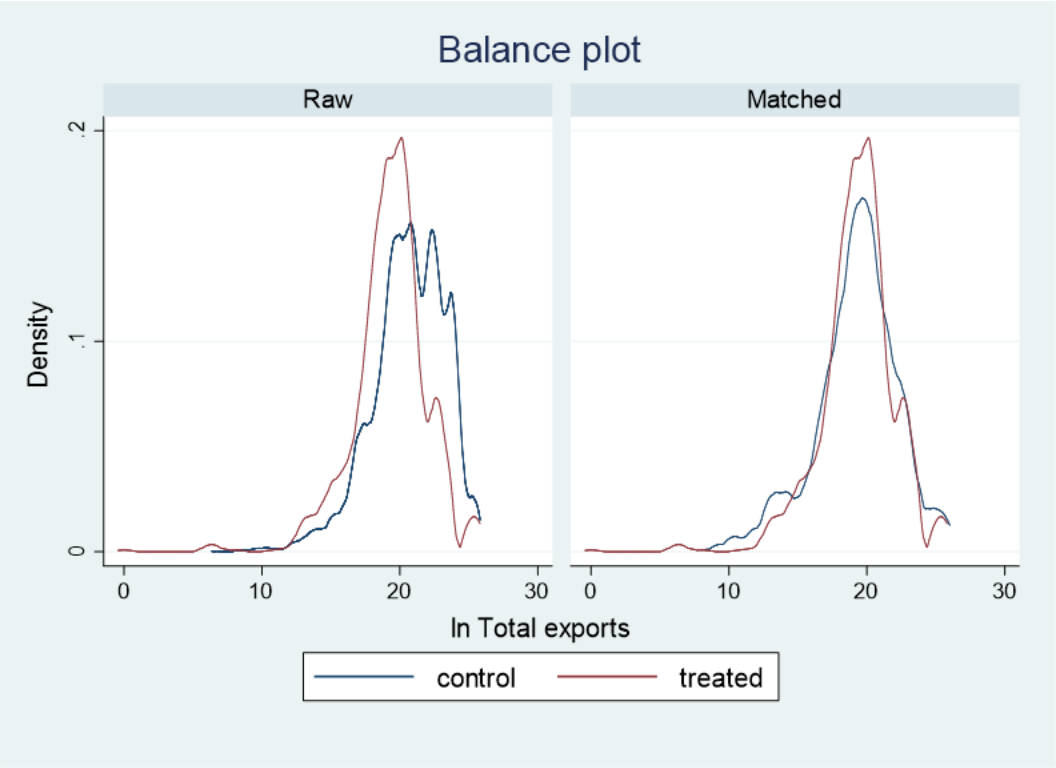


Source: Authors' compilation

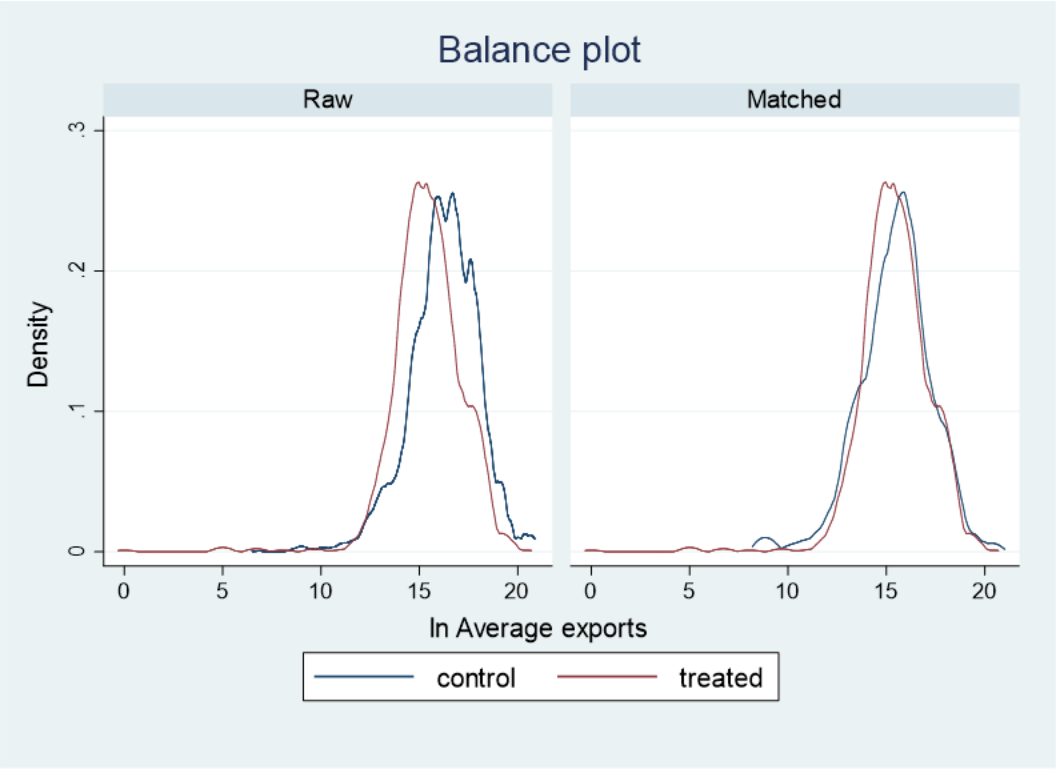
Notes: The study observations are restricted to those in which the main regime was the DD in 2007 and either the DD or the RTA in 2011. *Switch* takes the value of one if the main regime in 2011 was the RTA.

Figure 6. Balance Plots

(a) Total exports: Column (I) in Table 3

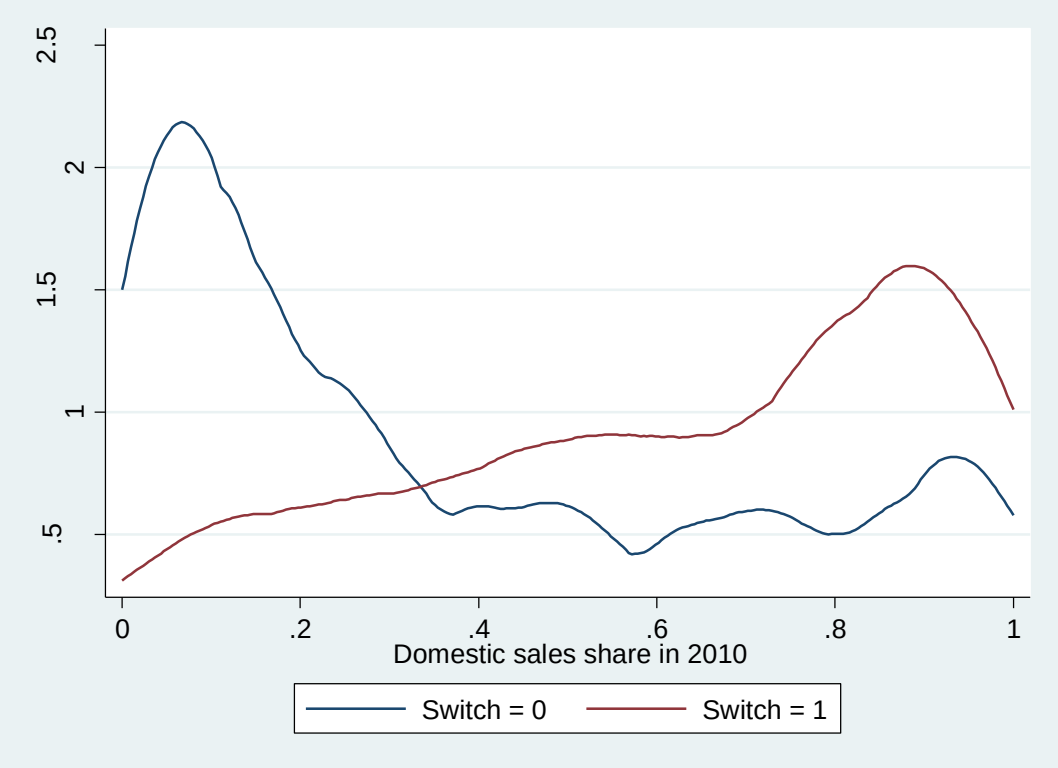


(b) Average exports: Column (III) in Table 3



Source: Authors' compilation.

Figure 7. The Distribution of Domestic Sales Shares



Source: Authors' compilation.

Online Appendix for "Trade Creation Effect of Regional Trade Agreements in the Presence of Duty Drawbacks"

Kazunobu HAYAKAWA[#]
Development Studies Center, Institute of Developing Economies, Japan

Nuttawut LAKSANAPANYAKUL
Science and Technology Development Program, Thailand Development Research Institute, Thailand

Hiroshi MUKUNOKI
Faculty of Economics, Gakushuin University, Japan

Appendix A. The Derivation of Trade Effects of RTA Formation

With regard to the sign of $\Delta zm_k^{DR}(i)$, we have

$$\Delta zm_k^{DR}(i) = \tilde{z}_k m_k^D(i)\left[\left(\frac{\rho^R}{\rho^D}\right)^{v-(1-\alpha)} (\tau_k^R)^{-v}(\theta_k)^{1-v} - 1\right].$$

A switch from the DD regime to the RTA regime increase the trade price of input k from $\tilde{z}_k$ to $\theta_k\tilde{z}_k$. This direct effect increases the import value of input k. An increase in the price of the input from $\tilde{z}_k$ to $\theta_k\tau_k^R\tilde{z}_k$ reduces the demand for input k. Since the latter effect dominates the former, a higher $\theta_k\tau_k^R$ reduces $\Delta zm_k^{DR}(i)$. Besides that, the import price of input k^* that is imported from a non-partner country also increases from $\tilde{z}_{k^*}$ to $\tau_{k^*}^M\tilde{z}_{k^*}\,\tilde{z}_{k^*}$, because firms no longer use the duty-drawback system. The latter effect increases the demand for input k and it is reflected in the increase in the price index of inputs, ρ^R/ρ^D.[21] Therefore, we have

$$\Delta zm_k^{DR}(i) \gtreqless 0 \quad \Leftrightarrow \left(\frac{\rho^R}{\rho^D}\right)^{v-(1-\alpha)} \gtreqless (\tau_k^R)^v(\theta_k)^{v-1}.$$

With regard to $\Delta c_x^{DR}(i)$, we have

$$\Delta c_x^{DR}(i) = \lambda_x^{-\sigma}\left(\frac{1}{\rho^R}\right)^{\alpha\sigma} c_x^M(i) - \left(\frac{1}{\rho^D}\right)^{\alpha\sigma} c_x^M(i) = \frac{c_x^M(i)}{(\rho^R)^{\alpha\sigma}}\left[\frac{1}{\lambda_x^\sigma} - \left(\frac{\rho^R}{\rho^D}\right)^{\alpha\sigma}\right],$$

and

$$\Delta c_x^{DR}(i) \gtreqless 0 \quad \Leftrightarrow \frac{1}{\lambda_x^\sigma} \gtreqless \left(\frac{\rho^R}{\rho^D}\right)^{\alpha\sigma}.$$

[#] Corresponding author: Kazunobu Hayakawa; Address: Wakaba 3-2-2, Mihama-ku, Chiba-shi, Chiba, 261-8545, Japan. Tel: 81-43-299-9500; Fax: 81-43-299-9724; E-mail: kazunobu_hayakawa@ide-gsm.org.

[21] Furthermore, if other inputs imported from RTA-partner countries experience larger increase in input prices, they increase ρ^R/ρ^D and the price index of inputs is more likely to dominate the increase in the input price of k.

Although the tariff reduction on the final good promotes exports, the increase in the input cost by the switch from the DD to the RTA discourages them. The former effect is captured by $1/\lambda_x^{\sigma}$, while the latter effect is captured by $(\rho^R/\rho^D)^{\alpha\sigma}$. If $\lambda_x = 1$, $\Delta c_x^{DR}(i) < 0$ always holds. By substituting $\Delta zm_k^{DR}(i)$ and $\Delta c_x^{DR}(i)$ into (20), we have

$$\Delta Im_k^{DR}(i) = \tilde{z}_k m_k^D(i) c_x^R \left[\left(\frac{\rho^R}{\rho^D}\right)^{v-(1-\alpha)} (\tau_k^R)^{-v} (\theta_k)^{1-v} \left(1 + \frac{T_x B_h}{B_x}\right) - 1 + \frac{1}{\lambda_x^{\sigma}} - \left(\frac{\rho^R}{\rho^D}\right)^{\alpha\sigma} \right]$$

and

$$\Delta Im_k^{DR}(i) \gtreqless 0 \quad \Leftrightarrow \quad \frac{T_x B_h}{B_x} \gtreqless \frac{1 + (\rho^R/\rho^D)^{\alpha\sigma} - \lambda_x^{-\sigma}}{(\rho^R/\rho^D)^{v-(1-\alpha)} \ (\tau_k^R)^{-v} (\theta_k)^{1-v}} - 1.$$

As for firms that switched from the MFN regime to the RTA regime, $\Delta zm_k^{MR}(i)$ for those imported from RTA countries is given by

$$\Delta zm_k^{MR}(i) = \tilde{z}_k m_k^D(i) (\tau_k^R)^{-v} \left(\frac{\rho^R}{\rho^D}\right)^{v-(1-\alpha)} \left[(\theta_k)^{1-v} - \left(\frac{1}{\rho^R}\right)^{v-(1-\alpha)} (\mu_k)^v \right]$$

$$> \tilde{z}_k m_k^D(i) (\tau_k^R)^{-v} \left(\frac{\rho^R}{\rho^D}\right)^{v-(1-\alpha)} (\theta_k)^{1-v} \left[1 - \frac{(\mu_k)^{1-\alpha}}{(\theta_k)^{\alpha}} \right] > 0.$$

The first inequality is due to $\rho_R > \mu_k \theta_k$, under which the cost-decrease of input k imported from a partner country, $\mu_k \theta_k$, dominates the overall cost-decrease of inputs, ρ_R. See Section 3.4 for details. The second inequality is due to $\theta_k > 1 \; and \; \mu_k < 1$.

If input k is imported from the non-RTA countries, the changes in the value of inputs per-unit of output become

$$\Delta zm_k^{MR}(i) = \tilde{z}_k m_k^D(i) (\tau_k^M)^{-v} \left(\frac{\rho^R}{\rho^D}\right)^{v-(1-\alpha)} \left[1 - \left(\frac{1}{\rho^R}\right)^{v-(1-\alpha)} \right] < 0.$$

With regard to $\Delta c_x^{MR}(i)$ and $\Delta c_h^{MR}(i)$, we have

$$\Delta c_x^{MR}(i) = c_x^M(i) \left[\frac{1}{\lambda_x^{\sigma}} \left(\frac{1}{\rho^R}\right)^{\alpha\sigma} - 1 \right] > 0 \text{ and } \Delta c_h^{MR}(i) = c_h^M(i) \left[\left(\frac{1}{\rho^R}\right)^{\alpha\sigma} - 1 \right] > 0.$$

Therefore, if input k is imported from an RTA country, the switch from the MFN regime to the RTA regime always increases the firms' imports of that input. If input k is imported from a non-RTA country, the shift increases imports only when the positive output effects dominate the negative unit-value effect.

Appendix B. Other Tables

Table B1. Balancing Test for Matched Firms in Table 5

		(I)	(II)	(III)	(IV)	(V)	(VI)
ln Total exports							
Raw	S.D.	-0.449	-0.396				
	Var R	1.045	1.448				
Matched	S.D.	0.063	-0.040				
	Var R	0.758	0.881				
ln Average exports							
Raw	S.D.			-0.393	-0.315	-0.393	-0.315
	Var R			1.085	1.417	1.085	1.417
Matched	S.D.			0.063	-0.046	0.014	0.025
	Var R			0.919	0.942	0.869	0.731
ln # of country-product pairs							
Raw	S.D.			-0.353	-0.346	-0.353	-0.346
	Var R			1.141	1.391	1.141	1.391
Matched	S.D.			0.101	-0.028	0.058	0.047
	Var R			1.014	0.903	0.841	0.919
Share of exports to RTA members							
Raw	S.D.					-0.068	0.112
	Var R					0.901	0.863
Matched	S.D.					-0.087	-0.145
	Var R					0.880	1.000
Share of imports from RTA members							
Raw	S.D.					-0.104	-0.139
	Var R					0.933	1.023
Matched	S.D.					-0.042	-0.137
	Var R					0.826	1.012
Margin							
Raw	S.D.	1.052	0.234	0.134	0.234	0.134	0.234
	Var R	0.134	2.276	1.052	2.276	1.052	2.276
Matched	S.D.	1.132	-0.032	0.028	-0.033	0.043	-0.004
	Var R	0.047	0.893	0.357	0.924	0.366	1.080
Foreign dummy							
Raw	S.D.		-0.401		-0.401		-0.401
	Var R		1.829		1.829		1.829
Matched	S.D.		-0.018		-0.018		0.061
	Var R		1.017		1.017		0.949

Notes: This table reports the balancing tests for the matching conducted in Table 5. We show the standardized differences (S.D.) and variance ratio (Var R) of each covariate. Column numbers correspond to those in Table 5.

Table B2. Balancing Test for Matched Firms in Table 6

		Excluding imports from Japan				Excluding outliers			
		All		Parts		All		Parts	
		(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
ln Average exports									
Raw	S.D.	-0.444	-0.471	-0.398	-0.375	-0.451	-0.402	-0.388	-0.309
	Var R	1.045	1.527	1.160	1.560	1.047	1.449	1.119	1.429
Matched	S.D.	-0.026	-0.002	-0.023	0.119	-0.040	-0.086	0.030	0.215
	Var R	0.912	0.752	0.766	0.561	0.931	1.001	0.921	0.587
ln # of country-product pairs									
Raw	S.D.	-0.453	-0.540	-0.445	-0.507	-0.363	-0.364	-0.353	-0.341
	Var R	0.966	1.126	0.942	1.138	1.188	1.369	1.151	1.397
Matched	S.D.	0.012	0.164	0.026	0.176	0.070	-0.100	0.059	0.157
	Var R	0.949	0.744	0.921	0.792	0.948	1.035	0.932	0.808
Share of exports to RTA members									
Raw	S.D.	0.127	0.296	0.177	0.352	-0.143	0.028	-0.075	0.098
	Var R	0.892	0.919	0.869	0.889	0.945	0.912	0.904	0.868
Matched	S.D.	-0.018	-0.132	-0.115	-0.109	-0.095	-0.062	-0.083	-0.223
	Var R	0.858	0.918	0.864	0.904	0.879	0.983	0.900	1.026
Share of imports from RTA members									
Raw	S.D.	0.115	0.016	0.120	0.038	-0.139	-0.191	-0.118	-0.152
	Var R	0.789	0.955	0.807	0.950	0.932	1.060	0.942	1.028
Matched	S.D.	0.042	-0.102	-0.064	-0.029	0.014	-0.054	0.014	-0.120
	Var R	0.797	0.856	0.898	0.841	0.811	0.906	0.807	0.878
Margin									
Raw	S.D.	0.151	0.256	0.152	0.256	0.174	0.274	0.104	0.203
	Var R	1.505	1.997	1.153	2.357	1.516	2.193	0.942	2.167
Matched	S.D.	-0.019	0.152	-0.013	0.095	0.012	-0.094	0.165	0.165
	Var R	0.525	1.420	0.195	1.442	1.181	0.781	1.557	1.511
Foreign dummy									
Raw	S.D.		-0.367		-0.336		-0.411		-0.394
	Var R		1.614		1.493		1.930		1.784
Matched	S.D.		0.009		-0.027		-0.135		-0.005
	Var R		0.993		1.022		1.169		1.004

Notes: This table reports the balancing tests for the matching conducted in Table 6. We show the standardized differences (S.D.) and variance ratio (Var R) of each covariate. Column numbers correspond to those in Table 6.

Table B3. Balancing Test for Matched Firms in Table 7

		(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
ln Total exports									
Raw	S.D.	0.009	-0.066						
	Var R	0.915	1.038						
Matched	S.D.	-0.004	-0.066						
	Var R	0.976	1.197						
ln Average exports									
Raw	S.D.			-0.039	-0.096	-0.018	-0.055	-0.020	-0.042
	Var R			0.902	1.020	0.912	0.964	0.929	0.898
Matched	S.D.			-0.025	-0.039	0.040	-0.003	0.042	0.072
	Var R			0.928	0.921	0.900	0.997	0.973	0.959
ln # of country-product pairs									
Raw	S.D.			0.071	0.006	0.114	0.080	0.131	0.092
	Var R			1.015	1.075	1.006	1.069	0.957	0.924
Matched	S.D.			0.007	0.038	0.031	-0.022	-0.012	0.085
	Var R			1.047	1.179	1.120	1.064	1.036	1.054
Share of exports to RTA members									
Raw	S.D.	-0.075	-0.068	-0.075	-0.068	-0.051	-0.041	-0.053	-0.049
	Var R	0.853	0.843	0.853	0.843	0.841	0.814	0.828	0.817
Matched	S.D.	0.036	0.109	0.023	0.058	-0.054	0.100	-0.085	-0.003
	Var R	0.804	0.836	0.874	0.846	0.878	0.799	0.921	0.836
Share of imports from RTA members									
Raw	S.D.	0.010	-0.072	0.010	-0.072	0.032	-0.046	-0.040	-0.087
	Var R	0.762	0.792	0.762	0.792	0.738	0.755	0.785	0.792
Matched	S.D.	-0.013	-0.094	0.049	-0.070	-0.045	-0.094	-0.061	0.013
	Var R	0.796	0.749	0.762	0.760	0.818	0.756	0.842	0.735
Foreign dummy									
Raw	S.D.		-0.220		-0.220		-0.188		-0.172
	Var R		1.230		1.230		1.174		1.202
Matched	S.D.		-0.054		-0.064		0.081		-0.056
	Var R		1.041		1.049		0.957		1.053

Notes: This table reports the balancing tests for the matching conducted in Table 7. We show the standardized differences (S.D.) and variance ratio (Var R) of each covariate. Column numbers correspond to those in Table 7.

Table B4. Balancing Test for Matched Firms in Table 8

		(I)	(II)	(III)	(IV)	(V)	(VI)
ln Average exports							
Raw	S.D.	-0.260	-0.273	-0.204	-0.190	0.071	0.066
	Var R	0.809	0.994	0.852	0.991	0.888	0.820
Matched	S.D.	-0.025	-0.003	-0.020	-0.051	0.000	-0.037
	Var R	0.930	0.958	1.042	0.939	0.957	1.176
ln # of country-product pairs							
Raw	S.D.	-0.506	-0.329	-0.470	-0.309	-0.009	0.013
	Var R	0.885	1.117	0.921	1.034	1.021	1.108
Matched	S.D.	0.003	-0.035	0.018	-0.041	-0.019	0.000
	Var R	0.966	1.087	1.003	1.001	0.982	1.097
Share of exports to RTA members							
Raw	S.D.	-0.138	-0.226	-0.098	-0.225	-0.041	-0.068
	Var R	1.207	1.133	1.167	1.149	0.971	0.997
Matched	S.D.	0.020	0.092	-0.007	-0.093	0.001	0.057
	Var R	0.936	0.927	0.951	1.022	0.965	0.911
Share of imports from RTA members							
Raw	S.D.	0.022	-0.185	-0.029	-0.196	0.213	0.020
	Var R	0.811	0.942	0.839	0.964	0.749	0.841
Matched	S.D.	0.021	0.002	0.027	0.032	-0.018	0.064
	Var R	0.877	0.973	0.876	0.938	0.852	0.906
Margin							
Raw	S.D.	0.346	0.274	0.200	0.233		
	Var R	1.703	1.697	1.659	1.910		
Matched	S.D.	-0.023	0.041	-0.030	0.026		
	Var R	0.912	1.002	0.912	0.997		
Foreign dummy							
Raw	S.D.		-0.625		-0.575		-0.306
	Var R		1.923		1.898		1.012
Matched	S.D.		0.053		0.017		0.038
	Var R		0.985		0.993		1.012

Notes: This table reports the balancing tests for the matching conducted in Table 8. We show the standardized differences (S.D.) and variance ratio (Var R) of each covariate. Column numbers correspond to those in Table 8.

Table B5. Gravity Results by the Pseudo-Poisson Maximum Likelihood

	(I) Material	(II) Finish	(III) Material	(IV) Finish
RTA	0.081**	-0.011		
	[0.038]	[0.049]		
CU			0.150***	0.024
			[0.051]	[0.059]
FTA			0.065*	-0.049
			[0.036]	[0.045]
PSA			0.025	0.271***
			[0.070]	[0.060]
Number of observations	551,547	556,189	551,547	556,189
Log pseudolikelihood	-4.E+09	-2.E+09	-4.E+09	-2.E+09
Pseudo R-squared	0.9903	0.9928	0.9903	0.9928

Notes: This table reports the estimation results of the gravity equations for the trade among 222 countries during 1995-2017. The standard errors are clustered by country pairs. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. We employ the BACI database available in the CEPII. The RTA dummy variable is drawn from Egger and Larch (2008) and its 2020 update by using RTA information available on the World Trade Organization website (Egger, Peter and Larch, Mario, 2008, Interdependent Preferential Trade Agreement Memberships: An Empirical Analysis, *Journal of International Economics*, 76(2): 384-399). CU, FTA, and PSA take a value of one for trade among the members of Customs Union, Free Trade Agreement, and Partial Scope Agreement, respectively. RTA takes a value of if any of these dummy variables takes a value of one. Finished products (*Finish*) are defined as items categorized into 112, 122, 41, 51, 52, 61, 62, or 63 in the Broad Economic Categories (BEC) classification while the rest are intermediate products (*Material*). We also control for exporter-year fixed effects, importer-year fixed effects, and country pair fixed effects.