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IDE DISCUSSION PAPER No. 437

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December 2013

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Keywords: Free trade agreement, rules of origin, FTA utilization
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New Measures of FTA Liberalization Level

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Abstract: This paper proposes new measures of the liberalization level of free trade agreements (FTAs). Our measures take three issues into account. First, in order to identify the differences in FTA liberalization level over time, we compute the annual liberalization level rather than the level during the whole period. Second, our measure includes information on tariff margins, i.e. the difference between FTA rates and most favoured nation rates. Third, the restrictiveness of rules of origin (RoOs) is also taken into account in order to penalize the liberalization level of products with more restrictive RoOs. In this paper, we compute such measures of FTA liberalization level for three FTAs in Thailand.

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1. Introduction

While the number of free trade agreements (FTAs) has experienced an explosive increase since the 1990s, it becomes important to achieve a sufficiently high liberalization level of FTAs. As of January 2013, notification of around 500 FTAs, counting goods and services separately, has been provided to the World Trade Organization (WTO). In the North American FTA (NAFTA), the U.S. and Mexico completed the elimination of tariff rates for *all products* in regard to each other. On the

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[§] This research was conducted as part of a project of the Japan External Trade Organization "Comprehensive Analysis on Consequence of Trade and Investment Liberalization in East Asia". We are grateful to Fukunari Kimura, Kohei Shiino, and Seiya Sukegawa for their helpful comments. The opinions expressed in this paper are those of the author and do not represent the views of any of the institutions with which we are affiliated.

other hand, almost all other existing FTAs allow member countries not to reduce tariff rates for a limited number of products. For example, Japan has around 10% of all products (tariff line-level) in which tariff rates have never been eliminated in any of its FTAs. Also, in the case of the Chile-European Union (EU) FTA, the EU has not liberalized almost 10% of all products against Chile. In general, moreover, the liberalization level is lower in the case of FTAs based on the Enabling Clause than that of FTAs under GATT Article XXIV.

Several measures have been used for the evaluation of FTA liberalization levels. A typical measure is the share of "liberalized" products within all products. Even in this measure, there are some variations. The first is whether to calculate such a share in trade value-basis or product number-basis. However, since highly-protected products usually have low trade values, a high share of liberalized products may be obtained on a value-basis, even if protected products are not liberalized at all. Thus, a number-basis measure might be preferable. The second is the calculation level, i.e. harmonized system (HS) six-digit level (for which codes are common across countries) or tariff-line level. The third is what "liberalized" stands for. In FTAs, the tariff rates for some products are reduced, but not necessarily to zero, i.e. incomplete elimination. Obviously, the liberalization level when incomplete elimination is included in a definition of "liberalized" becomes higher.

In addition to these variations, three more issues are potentially important. First, FTAs usually reduce tariff rates *gradually*. This means both that tariff reduction for some products starts some years after an agreement comes into force, and that tariff rates for some products are not immediately eliminated but are subsequently lowered to zero. Thus, the FTA liberalization level becomes different during the years after its entry into force. Also, FTAs with relatively long tariff elimination periods (e.g. 15 or 20 years) in which some products start tariff reduction/elimination from the latter phase of said period may not be effective, at least during the early phase. The second issue is Most Favoured Nation rates (MFN rates). If liberalized products are significantly biased to those already with zero or low MFN rates, liberalization levels might be considered insufficient, since such FTAs will not yield much of a trade creation effect. The third is the rules of origin (RoOs). RoOs include change-in-tariff classification (CTC) rules, real value-added content (RVC) rules, and technical requirement/specific process (TECH) rules. It is well known that compliance with both CTC and RVC is rather restrictive, particularly compared with co-equal types, i.e. the compliance with *either* CTC *or* RVC. It is doubtful as to whether "liberalized" products with prohibitively restrictive RoOs can be classified as preferential products.

The purpose of this paper is to propose new measures of FTA liberalization level. Our measures take the above three issues into account. Specifically, in order to identify the differences in FTA liberalization level over time, we compute the annual liberalization level rather than the level during the whole period. Also, our measure includes information on tariff margins, i.e. the difference between FTA rates and MFN rates. The restrictiveness of RoOs is also taken into account in order to penalize the liberalization level of products with more restrictive RoOs. In this paper, we compute such measures of FTA liberalization level in Thailand for three ASEAN+1 FTAs, i.e. ASEAN-China FTA (ACFTA), ASEAN-Korea FTA (AKFTA), and ASEAN-JAPAN FTA (AJCEP). ACFTA, AKFTA, and AJCEP came into force in 2004, 2010, and 2008, respectively. Obviously, these measures are useful to judge which FTA truly has the higher liberalization level.

The crucial difficulty lies in the quantification of each type of RoOs' restrictiveness. Two methods have been proposed. One is the synthetic RoOs restrictive index, which was proposed by Estevadeordal (2000). He assigned a score to each type of RoOs, ranging from one to seven for NAFTA. Estevadeordal and Suominen (2004) developed this further. Cadot et al. (2006) regress this index on FTA utilization rates. The other method, which we employ in this paper, is to estimate the tariff-equivalent compliance costs of each type of RoOs. Carrere and de Melo (2006) is an important study in this method. They regress tariff margin and RoOs type dummy variables for NAFTA utilization rates and estimate those costs by dividing each of the coefficients for the RoOs dummy variables by the coefficient for tariff margin. This paper regresses FTA utilization rates in Thai imports, obtains the estimates of tariff-equivalent compliance costs of RoOs, and then calculates our measures of FTA liberalization level in Thailand for some ASEAN+1 FTAs.

This paper is the first to measure such sophisticated liberalization level in *goods*. Some research has evaluated the liberalization level in the *whole* FTA. For example, Feng and Genna (2003) report the average of scores among several categories such as "trade in goods and services", "the degree of capital mobility", "the degree of labour mobility", and so on. Each category has a score of 0 through 5 with higher scores translating to higher liberalization levels in each category. Horn et al. (2010) and the World Trade Organization (2011) count the number of provisions that are inside and outside the current mandate of the World Trade Organization (WTO). These scores and numbers are useful in evaluating the overall liberalization level of FTAs. In contrast, our liberalization measure will contribute to uncovering the depth of trade liberalization in goods.

The rest of this paper is organized as follows. The next section formalizes our measures of FTA liberalization level. Section 3 estimates tariff-equivalent compliance costs of RoOs in addition to providing some basic information on ASEAN+1 FTAs. Section 4 reports the results of our measures of FTA liberalization level in Thailand for some ASEAN+1 FTAs. In Section 5, we conduct some robustness checks. Last, Section 6 concludes this paper.

2. New Measures of FTA Liberalization Level

This section formalizes our multiple measures of FTA liberalization level. All measures lie in the unit interval [0, 1].

First, a well-used measure is the following.

$$\mathrm{LIB}_1 = \frac{\sum_{i\in\Omega} \mathbf{1}\left(t_i^{\mathrm{MFN}} > t_i^{\mathrm{FTA}} \text{ or } t_i^{\mathrm{MFN}} = 0\right)}{\sum_{i\in\Omega} \mathbf{1}(i \in \Omega)}.$$

1(x) is the indicator function, which is 1 if the expression x holds, and is 0 if x is false. Subscript *i* indicates HS code. Ω is a set of all (tariff-line) HS codes. t_i^{MFN} and t_i^{FTA} are MFN and FTA tariff rates, respectively. For products placed in the exclusion list (i.e. FTA ineligible products), we set that $t_i^{\mathrm{MFN}} = t_i^{\mathrm{FTA}}$. We omit time script for brevity. This measure is a product number-basis share of liberalized products in all products. The liberalized products include those in which tariff rates are reduced but not necessarily to zero. The products with zero MFN rates are also included in the numerator. This is simple and makes it easy to understand the extent of FTA liberalization.

Second, as mentioned in the introductory section, the above measure does not take into account at all how much FTAs contribute to reducing tariff rates. In the second measure, we include "tariff reduction rates", which is defined as $(t_i^{\mathrm{FTA}} - t_i^{\mathrm{MFN}})/\ t_i^{\mathrm{MFN}}$. The liberalization measure is as follows.

$$\mathrm{LIB}_2 = \frac{-\sum_{i\in\Omega} \mathrm{u}_i}{\sum_{i\in\Omega} \mathbf{1}(i \in \Omega)}, \text{where } \mathrm{u}_i \equiv \begin{cases} \left(\dfrac{t_i^{\mathrm{FTA}} - t_i^{\mathrm{MFN}}}{t_i^{\mathrm{MFN}}}\right) & \text{if } t_i^{\mathrm{MFN}} \neq 0 \\ -1 & \text{if } t_i^{\mathrm{MFN}} = 0 \end{cases}.$$

In this measure, u_i becomes closer to −1 if the difference between FTA rates and MFN rates in product *i* is larger. It becomes −1 in the case of products with zero MFN rates. This measure indicates how much an FTA (and WTO) reduces tariff rates.

Third, we furthermore take the restrictiveness of RoOs into account. The measure is:

$$\mathrm{LIB}_3 = \frac{-\sum_{i\in\Omega} \mathrm{v}_i}{\sum_{i\in\Omega} \mathbf{1}(i \in \Omega)}, \text{where } \mathrm{v}_i$$
$$\equiv \begin{cases} \left(\dfrac{t_i^{\mathrm{FTA}} - t_i^{\mathrm{MFN}}}{t_i^{\mathrm{MFN}}}\right) & \text{if } t_i^{\mathrm{MFN}} \neq 0 \text{ and } t_i^{\mathrm{MFN}} - t_i^{\mathrm{FTA}} \geq \mathrm{ROO}_i \\ 0 & \text{if } t_i^{\mathrm{MFN}} \neq 0 \text{ and } t_i^{\mathrm{MFN}} - t_i^{\mathrm{FTA}} < \mathrm{ROO}_i \\ -1 & \text{if } t_i^{\mathrm{MFN}} = 0 \end{cases},$$

where ROO is the RoOs compliance costs, of which details are defined in the next section. While in the second measure we sum up tariff reduction rates in all products with positive MFN rates, the third measure does not sum up those for products in which the tariff margin is smaller than the RoOs compliance costs. This measure indicates how much an FTA *substantially* reduces tariff rates.

Fourth, we take smoothly into account tariff margin and RoOs restrictiveness. The measure is given by

$$\mathrm{LIB}_4 = \frac{-\sum_{i\in\Omega} \mathrm{w}_i}{\sum_{i\in\Omega} \mathbf{1}(i \in \Omega)}, \text{where } \mathrm{w}_i$$
$$\equiv \begin{cases} \left(\dfrac{t_i^{\mathrm{FTA}} - t_i^{\mathrm{MFN}}}{t_i^{\mathrm{MFN}}}\right) \times f\left(t_i^{\mathrm{MFN}} - t_i^{\mathrm{FTA}} - \mathrm{ROO}_i\right) & \text{if } t_i^{\mathrm{MFN}} \neq 0 \\ -1 & \text{if } t_i^{\mathrm{MFN}} = 0 \end{cases}.$$

$$f(\cdot) \text{ is a function such that } \begin{cases} \lim_{x\to+\infty} f(x) = 1 \\ f'(x) > 0 \\ \lim_{x\to-\infty} f(x) = 0 \end{cases}.$$

In the third measure, for products with positive MFN rates, we sum up exactly the tariff reduction rates if the tariff margin is greater than the RoOs compliance costs, and do not include them at all otherwise. The fourth measure modifies this all-or-nothing treatment. Specifically, we discount the tariff reduction rates by using a function *f*. This function takes a value closer to zero if the RoOs compliance costs are greater, while it takes a value closer to one if the tariff margin is greater. For such a function, we employ the logistic function, i.e. $f(x) = e^x / (1 + e^x)$.

The comparability of these measures is as follows. Other things being equal, each measure is comparable across years and across exporters. We cannot compare the liberalization level across measures. Also, we should be careful in comparing each measure across importers due to the following two facts. One is that MFN rates differ between importers.[1] However, the above measures focus on "tariff reduction rates", not

[1] Thus, as long as focusing on a single importing country, it does not matter qualitatively whether or not to include products with zero MFN rates in the computation of FTA liberalization measures.

on the tariff margin (i.e. not percent points). Furthermore, we score products with zero MFN rates to the (absolutely) highest value, 1. Thus, differences in MFN rates might not be a serious issue. The other is that the fineness of tariff-line codes is different between importers. This issue is critical because we cannot predict even the direction of biases according to the fineness of tariff-line codes.

3. Quantification of RoOs' Restrictiveness

This section quantifies the RoOs' restrictiveness. To do that, we follow the method proposed in Carrere and de Melo (2006). Specifically, focusing on one importer, we estimate the following simple equation for the determinants of FTA utilization.[2]

$$\text{Utilization}_{ip} = \alpha\, \text{Margin}_{ip} + \mathbf{D}_{ip}\, \boldsymbol{\beta} + \varepsilon_{ip}.$$

Utilization_{ip} is the FTA utilization rates in importing product p from country i and is defined as the share of preferential imports of product p from country i in total imports of product p from country i. Margin_{ic} is the preference tariff margin in importing product p from country i. $\mathbf{D}_{ip}$ is a vector of dummy variables indicating a type of RoOs against product p in importing from country i. As a result, Carrere and de Melo (2006) demonstrated that the RoOs compliance costs can be computed as $\mathbf{D}_{ip}\, \boldsymbol{\beta}/\alpha$.

We estimate this model for Thai imports from China and Korea in 2011 by employing the fractional logit estimation technique proposed by Papke and Wooldridge (1996), because our dependent variable lies in the unit interval, i.e. [0, 1].[3] The sample products are restricted to those with positive tariff margins. The reason for the use of import-side data on FTA utilization is that export-side data on FTA utilization is usually available at HS six-digit level. In the case of analysis at HS six-digit level, we are forced to aggregate *arbitrary* tariff margins from tariff-line level to HS six-digit level. Then,

[2] There are several papers analyzing the determinants on the FTA utilization. Bureau et al. (2007) examine utilization of the Generalized System of Preferences (GSP) granted by the European Union (EU) and the United States (US) to developing countries in the agri-goods sector, while Cadot et al. (2006) focus on the trade of the EU and the US with their preferential trading partners. Francois et al. (2006) and Manchin (2006) examine the preferential trade relations of the EU and non-least-developed African, Caribbean, and Pacific (ACP) countries under the Cotonou Agreement, while Hakobyan (2010) examines US GSP utilization by 143 GSP-eligible countries. Keck and Lendle (2012) analyze utilization of both unilateral and bilateral preferences by not only the EU and US but also Australia and Canada. These studies consistently found that FTA utilization is higher in the products with larger tariff margins and less restrictive RoOs.

[3] The fractional logit model ensures that, unlike the ordinary least square method (OLS), the predicted values of the dependent variable are in the unit interval. Also, unlike the log-odds ratio model and the beta regression model, it can naturally define dependent variables for the boundary values 0 and 1. It imposes less restrictive assumptions than the Tobit model (requiring the normality and homoskedasticity of the dependent variables). For more details, see Ramalho et al. (2011).

although we have the FTA utilization data for all FTAs by Thailand in hand, we restrict analysis to FTA partners in which only a single FTA scheme is available, i.e. China and Korea.[4] Namely, our sample FTA schemes are ACFTA and AKFTA, which are FTAs based on the Enabling Clause and GATT Article XXIV, respectively.

Our data sources are as follows. Data on FTA utilization in Thailand is obtained from the Bureau of Trade Preference Development, Department of Foreign Trade, Ministry of Commerce, Kingdom of Thailand. We obtain data on total imports in Thailand from the World Trade Atlas. We extract the information on RoOs from the legal texts of each FTA. The data on MFN rates are from the WITS TRAINS database. We obtain the data on the scheduled FTA rates in Thailand from Thailand Customs.

Before reporting our estimation results on this model, we take a brief look at FTAs in our sample countries. Specifically, here we focus on ACFTA and AKFTA in addition to AJCEP. Figure 1 shows the simple average tariff margin in Thailand for these three ASEAN+1 FTAs. We aggregate the tariff-line level difference between scheduled FTA rates in each year and MFN rates in 2011. As of 2011, Thailand already liberalizes products with large margins in the cases of ACFTA and AKFTA. The average margin is near 9%. On the other hand, in the case of AJCEP, the tariff margin rises from a small magnitude in 2011 (around 6%) to almost the same magnitude as the cases of ACFTA and AKFTA. In sum, compared with ACFTA and AKFTA, AJCEP reduces tariff rates at a slow pace.

=== Figure 1 ===

Table 1 lists RoOs in Thailand for the three ASEAN+1 FTAs in 2011 at a tariff-line level. CS, CH, and CC are the RoOs criteria of “Change in Subheading,” “Change in Heading,” and “Change in Chapter,” respectively. WO indicates the “Wholly obtained” criterion. In the case of ACFTA, most of the preferential products follow its general rule, RVC. The same is true for AKFTA, CH/RVC. On the other hand, AJCEP sets many product-specific rules. A relatively large number can be found not only in its general rule, CH/RVC, but also in CC. Roughly speaking, restrictiveness is expected to increase in the order of CS, CH, and CC because, for example, CC always

[4] For example, Thailand has both bilateral and multilateral FTA schemes with Australia, India, Japan, and New Zealand. In this case, firms’ decisions on FTA use will be qualitatively different. Specifically, firms will choose their tariff scheme among MFN rates, bilateral FTA rates, and multilateral FTA rates rather than simply between MFN rates and FTA rates. Since our aim for estimation is simply to estimate the RoOs compliance costs, we do not include such complicated cases in our analysis.

meets CH and CS. Furthermore, when these are combined by AND, restrictiveness increases, and declines when combined with OR. Thus, we may say that less restrictive RoOs are set in AKFTA.

=== Table 1 ===

Table 2 shows FTA utilization rates in Thai imports from China, Japan, and Korea under ASEAN+1 FTA schemes. “Total”, “Ineligible”, and “Under FTA” indicate total imports, imports of eligible products under all tariff schemes, and imports of eligible products under FTA scheme, respectively. Columns (IV) and (V) report “Total” divided by “Ineligible” and “Under FTA”, respectively. The rates in column (V) are usually called “FTA utilization rates”. As mentioned above, Thailand has both bilateral and multilateral FTAs with Japan, so that FTA utilization rates are rather low in the case of AJCEP (1%). Indeed, most of the preferential imports from Japan are known to be under Japan-Thailand bilateral FTA. ACFTA and AKFTA have relatively high utilization rates, which are 61% and 35% respectively. However, imports under ACFTA and AKFTA schemes occupy only 32% and 18% of total imports from China and Korea, respectively.

=== Table 2 ===

The estimation results of our fractional logit model are presented in Table 3. For estimation, in order to increase the number of observations with each type of RoOs, we replace “RVC/WO” and “RVC/TECH” with “RVC” and “CH/RVC/TECH” with “CH/RVC”. The coefficient for Margin is estimated to be significantly positive, indicating that, consistent with expectations, products with larger tariff margins are likely to be imported under FTA schemes. Except for “CH&RVC”, all RoOs dummy variables have negative coefficients. However, the estimated order of restrictiveness is not necessarily consistent with our expectation. As mentioned above, it is consistent with our expectation that “CH” has absolutely (and abnormally) larger coefficients than “CH/RVC”. However, we have the opposite orders of restrictiveness between “CC” and “CH”, among “CC/RVC”, “CH/RVC”, and “CS/RVC”, and among “CC”, “CC/RVC”, and “CC&RVC”. The opposite order can be also found between “CH” and “CH&RVC”. The insignificantly positive coefficient for “CH&RVC” and too small coefficient for “RVC” are not consistent with our expectations.

=== Table 3 ===

4. Liberalization Level

This section computes the liberalization level in Thailand for ACFTA and AKFTA. For reference, we also compute that for AJCEP. The results for 2011 are reported in Table 4. The first two measures LIB_1 and LIB_2 can be computed without using the above estimation results. LIB_1 indicates that Thailand liberalizes 91% of all products in all three FTAs. The second measure, which takes the magnitude of general tariff reduction into account, shows the interesting difference among the three FTAs. The highest level is found in ACFTA (0.903), followed by AKFTA (0.880) and AJCEP (0.746). This order can be easily understood by the differences in the magnitude of tariff margin confirmed in Figure 1. Compared with the case of AJCEP, Thailand liberalizes products with large margins in the cases of ACFTA and AKFTA. This fact leads to the differences in LIB_2 across three FTAs.

=== Table 4 ===

Next, we compute the third and fourth measures of liberalization level, which require our estimation results on the RoOs compliance costs. As mentioned in the previous section, our estimation results on the order of RoOs' restrictiveness are not necessarily consistent with general expectations. Nevertheless, in order to show the performance of our liberalization measures, it will be useful to compute liberalization levels even using such estimation results. Next, we set the coefficient for "CH&RVC" to zero in order to avoid the negative RoOs compliance costs. Moreover, for computation in the case of AJCEP, we replace some RoOs in AJCEP which are not included in the estimation sample. Specifically, we replace "CC&TECH" and "CC/TECH" with "CC" and "CH&TECH", "CH/TECH", and "CS" with "CH".

The results for the third and fourth measures of liberalization level are also reported in Table 4. In each FTA, those two measures show the almost same level. The indifference between these two measures is caused at least partly by our use of logistic function. For example, the difference between those measures is affected by the curvature of function. In this paper, as a first step, we keep the use of standard logistic function in computing the fourth measure. These measures indicate that the liberalization level in ACFTA is higher than that in AKFTA and AJCEP. This is because most of the products liberalized in ACFTA have much lower RoOs compliance costs.

RoOs in such products in ACFTA are “RVC”, of which the absolute magnitude of a coefficient is estimated to be rather small. On the other hand, since the major RoOs in AKFTA and AJCEP are “CH/RVC”, of which the absolute magnitude of a coefficient is estimated to be (unexpectedly) larger, the two liberalization measures are low in the cases of AKFTA and AJCEP.

We also compute these measures over time. Figure 2 depicts the changes in LIB_1. It rises significantly in 2016 in the case of AKFTA, and in 2017 in the case of AJCEP. As a result, in 2018, near 99% of all products have preferential rates (or zero MFN rates) in the cases of AKFTA and AJCEP. The time-series changes in LIB_2 are shown in Figure 3. As shown in Table 4, AJCEP had the lowest LIB_2 in 2011. However, it has risen significantly since 2011. The liberalization level in AJCEP becomes higher than that in ACFTA in 2017 and that in AKFTA in 2018. This is consistent with the finding in Figure 1 showing that AJCEP reduces tariff rates at a slow pace compared with ACFTA and AKFTA. In contrast to the remarkable changes over time in these two figures, Figures 4 and 5 show the stable transition of LIB_3 and LIB_4, respectively. Over time, both LIB_3 and LIB_4 do not change significantly. This stability would imply that the products liberalized in the latter period have higher RoOs compliance costs. For example, in AKFTA and AJCEP, most of such products have “CH/RVC”, for which the RoOs compliance costs are estimated to relatively high in this paper.

=== Figures 2-5 ===

5. Robustness

In this section, we conduct some robustness checks on the estimation results. First, we include dummy variables on the Section in tariff classification in order to provide a control for the role of industrial characteristics in complying with RoOs. The results are reported in column (I) in Table 5 and are quantitatively unchanged with those in Table 3. Namely, the estimated order of restrictiveness among some types of RoOs is again not necessarily consistent with our expectation. However, the coefficient for “CH&RVC” turns out to be negative, though insignificant.

=== Table 5 ===

Second, as in recent studies on FTA utilization, we provide a control for the magnitude of trade. As theoretically demonstrated in Demidova and Krishna (2008),

even if the tariff margin is trivial, the more productive firms are more likely to use FTA schemes in exporting because such firms have larger outputs and thus obtain larger gains from the use of FTA schemes. Following Hakobyan (2013), we introduce total imports of a concerned product from China or Korea. Furthermore, in order to avoid the simultaneity problem between this variable and a dependent variable (especially its denominator), one year lagged imports are used (Lagged Imports).[5] The results are reported in column (II) in Table 5. Consistent with our expectations, the coefficient for Lagged Imports is estimated to be significantly positive. Although the absolute magnitude of the coefficient for "CC&RVC" turns out to be a little larger than that for "CC", there are still many combinations in which the order of restrictiveness is not consistent with general expectations.

Third, as pointed out in the Hakobyan (2013), the coefficient for the magnitude of trade, i.e. Lagged Imports, might suffer from endogeneity biases because unobserved shocks have an influence on both trade values and the dependent variable (particularly its denominator). Thus, we use the instrumental variable (IV) method. Following Hakobyan (2013), we use total imports of a concerned product *i* from the rest of the world (ROW) as an instrument variable, for which data is also obtained from the World Trade Atlas. The results are reported in column (III) in Table 5. Although the coefficient for the tariff margin is again significantly positive, the results for RoOs are not good at all. In particular, some types have positively significant coefficients. Moreover, "Lagged Imports" has an insignificant coefficient and wrong sign.

Last, our estimates may suffer from sample selection biases because we restrict our sample only to observations with positive imports, due to the nature of the denominator of our dependent variable. Using the total imports of a concerned product *i* from the rest of the world (i.e. ROW) as an excluded variable, we estimate the Heckman sample selection model.[6] The results are reported in column (II) in Table 5 and are similar to those in column (III), i.e. those by IV technique. The coefficients for tariff margin and lagged imports are significantly positive. Although all RoOs dummy variables except for "CH&RVC" have negative coefficients, the results in RoOs are not good at all.

Based on these estimates, we again compute measures of liberalization levels.

[5] The data on Lagged Imports are obtained from World Trade Atlas.

[6] Our aim here is different from Manchin (2006), which employs the Heckman estimation technique in order to include zero utilization rates into estimation sample. Namely, while ours is to tackle zero issues for the denominator of utilization rates, Manchin (2006) uses the Heckman to tackle zero issues for the numerator of utilization rates. Also, we naturally include zero utilization rates because we do not take a log of utilization rates as in the previous studies except for Manchin (2006).

Since the first and second measures do not need such estimates for computation, we only report the third and fourth measures in 2011, which are provided in Table 6. Although the level of these measures differs by estimation technique, the order is consistent with that in Table 4. Namely, the liberalization level in ACFTA is higher than that in AKFTA and AJCEP. Furthermore, except for the case of controlling sector dummy variables, the level in AKFTA is a bit higher than that in AJCEP. The higher levels in the cases of Heckman and IV are due to the fact that, as reported above, most of the coefficients for RoOs dummy variables are transformed to zero in order to avoid negative RoOs compliance costs or have trivial magnitude. Thus the tariff reduction rates in most of the preferential products are counted without being significantly penalized.

=== Table 6 ===

6. Concluding Remarks

In this paper, we have proposed new measures of the FTA liberalization level. Our measures take three issues into account. First, in order to identify the differences in FTA liberalization level over time, we compute the annual liberalization level rather than the level during the whole period. Second, our measure includes information on the tariff margin, i.e. the difference between FTA rates and MFN rates. Third, the restrictiveness of RoOs is also taken into account in order to penalize the liberalization level of products with more restrictive RoOs. The RoOs restrictiveness is quantified by estimating the equation on determinants of FTA utilization rates. In this paper, we computed such measures of FTA liberalization level for three FTAs, including ACFTA, AKFTA, and AJCEP, in Thailand. One remaining important challenge is to obtain more precise estimates of the RoOs compliance costs, which play a crucial role in computing our measures. To do that, for example, it will be helpful to use FTA utilization data from as many countries as possible.

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Table 1. RoOs in Thailand for ASEAN+1 FTAs

	ACFTA	AJCEP	AKFTA
CC	1	1,170	4
CC&RVC			13
CC&TECH		487	
CC/RVC	21	136	665
CC/TECH		53	
CH		243	15
CH&RVC			5
CH&TECH		86	
CH/RVC	127	3,381	4,699
CH/RVC/TECH			21
CH/TECH		185	
CS		17	
CS/RVC		55	93
RVC	5,323	415	256
RVC/TECH	461		
RVC/WO			12
WO	22	5	615
Total	5,955	6,233	6,398

Source: Authors' classification based on legal texts on each FTA

Table 2. FTA Utilization in Thailand in 2011

	Total (I)	In Eligible (II)	Under FTA (III)	(IV) = (III)/(I)	(V) = (III)/(II)
ACFTA	617,733	321,348	194,817	32%	61%
AJCEP	725,302	286,301	1,769	0.2%	1%
AKFTA	171,939	89,227	31,634	18%	35%

Sources: World Trade Atlas; Bureau of Trade Preference Development, Department of Foreign Trade, Ministry of Commerce, Kingdom of Thailand.

Note: "Total", "In Eligible", and "Under FTA" indicate total imports, total imports in only products eligible to each FTA, and imports under FTA schemes, respectively.

Table 3. Estimation Results: Fractional-logit Model

	Coef.	Robust S.E.	P>z
Margin	0.019	0.003	0.000
CC	-1.167	1.334	0.382
CC&RVC	-0.524	1.003	0.602
CC/RVC	-1.819	0.146	0.000
CH	-13.397	0.799	0.000
CH&RVC	0.678	0.986	0.492
CH/RVC	-1.863	0.055	0.000
CS/RVC	-2.779	0.437	0.000
RVC	-0.309	0.040	0.000
WO	-3.005	0.413	0.000
Log pseudolikelihood		-3,797	
Number of Obs.		7,398	

Table 4. FTA Liberalization in Thailand for 2011

	ACFTA	AKFTA	AJCEP
LIB1	0.916	0.914	0.908
LIB2	0.903	0.880	0.746
LIB3	0.401	0.208	0.200
LIB4	0.401	0.209	0.200

Source: Authors' calculation

Table 5. Robustness Checks

	(I) Fractional	(II) Fractional	(III) IV	(IV) Heckman
Margin	0.006**	0.027***	0.004***	0.004***
	[0.003]	[0.003]	[0.001]	[0.001]
CC	-1.365	-1.945*	0.247	-0.060
	[1.207]	[1.143]	[0.294]	[0.202]
CC&RVC	-0.760	-1.947**	0.409	-0.072
	[1.084]	[0.822]	[0.255]	[0.204]
CC/RVC	-2.204***	-2.984***	0.129***	-0.249***
	[0.244]	[0.160]	[0.033]	[0.042]
CH	-14.147***	-16.136***	-0.108	-0.531***
	[0.745]	[0.929]	[0.083]	[0.103]
CH&RVC	-0.138	-1.151	0.686***	0.142
	[1.009]	[0.926]	[0.209]	[0.245]
CH/RVC	-1.960***	-3.292***	0.136***	-0.274***
	[0.204]	[0.107]	[0.026]	[0.031]
CS/RVC	-2.436***	-4.344***	0.053	-0.358***
	[0.479]	[0.440]	[0.040]	[0.030]
RVC	-0.385*	-1.953***	0.451***	-0.089
	[0.197]	[0.111]	[0.033]	[0.072]
WO	-3.741***	-3.960***	0.004	-0.279***
	[0.505]	[0.425]	[0.032]	[0.038]
Lagged Imports		0.131***	-0.001	0.029***
		[0.007]	[0.002]	[0.002]
ROW			0.700***	0.029***
			[0.020]	[0.002]
Section Dummy	YES	NO	NO	NO
Log pseudolikelihood	-3,615	-3,624		-8914
Chi2 for Wald test (Rho = 0)				7.48
Number of Obs.	7,398	7,398	7,929	11,694

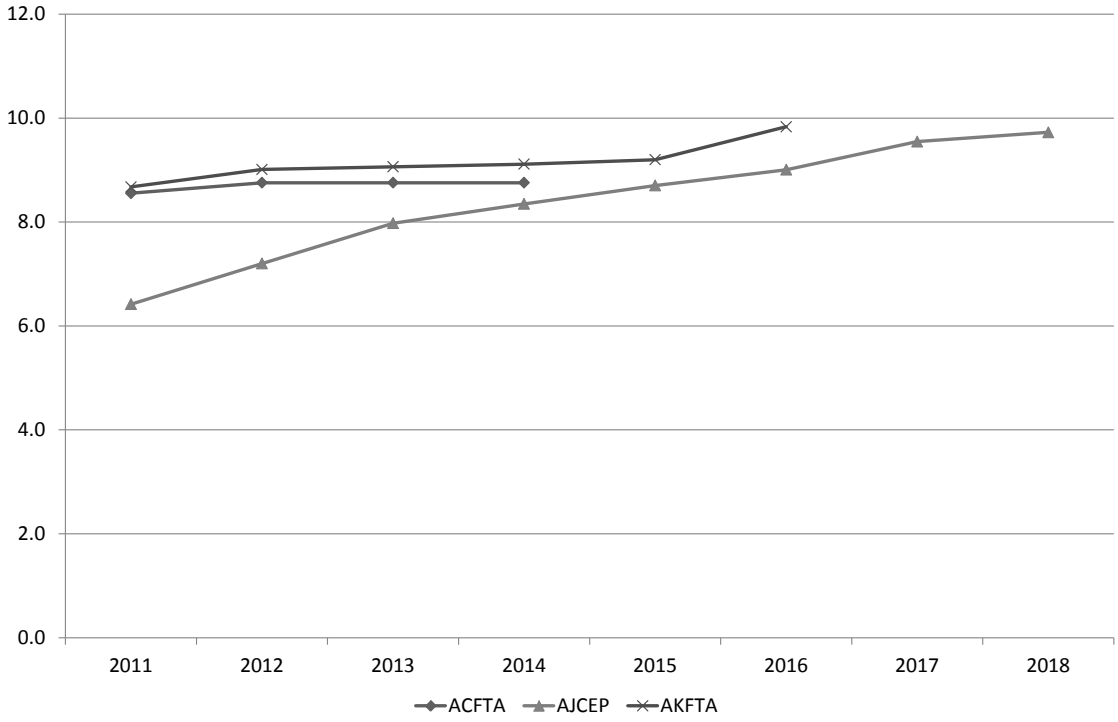
Notes: The parentheses are robust standard errors. ***, **, and * show 1%, 5%, and 10% significance, respectively. We report coefficients for only an excluded variable and an instrument, i.e. imports from rest of the world (ROW), in the cases of selection equation in Heckman and the first-stage regression equation in IV, respectively.

Table 6. FTA Liberalization in Thailand for 2011: Robustness Checks

	ACFTA	AJCEP	AKFTA
(I) Controlling Sector Dummy			
LIB3	0.516	0.230	0.207
LIB4	0.512	0.229	0.207
(II) Controlling Lagged Imports			
LIB3	0.198	0.197	0.197
LIB4	0.198	0.197	0.197
(III) IV Method			
LIB3	0.903	0.689	0.880
LIB4	0.867	0.658	0.844
(IV) Heckman Method			
LIB3	0.903	0.740	0.880
LIB4	0.902	0.708	0.846

Source: Authors' calculation based on the results reported in Table 5.

Figure 1. Average Tariff Margin in Thailand for ASEAN+1 FTAs



Sources: WITS TRAINS; Thailand Customs

Figure 2. Time-series Changes in LIB_1

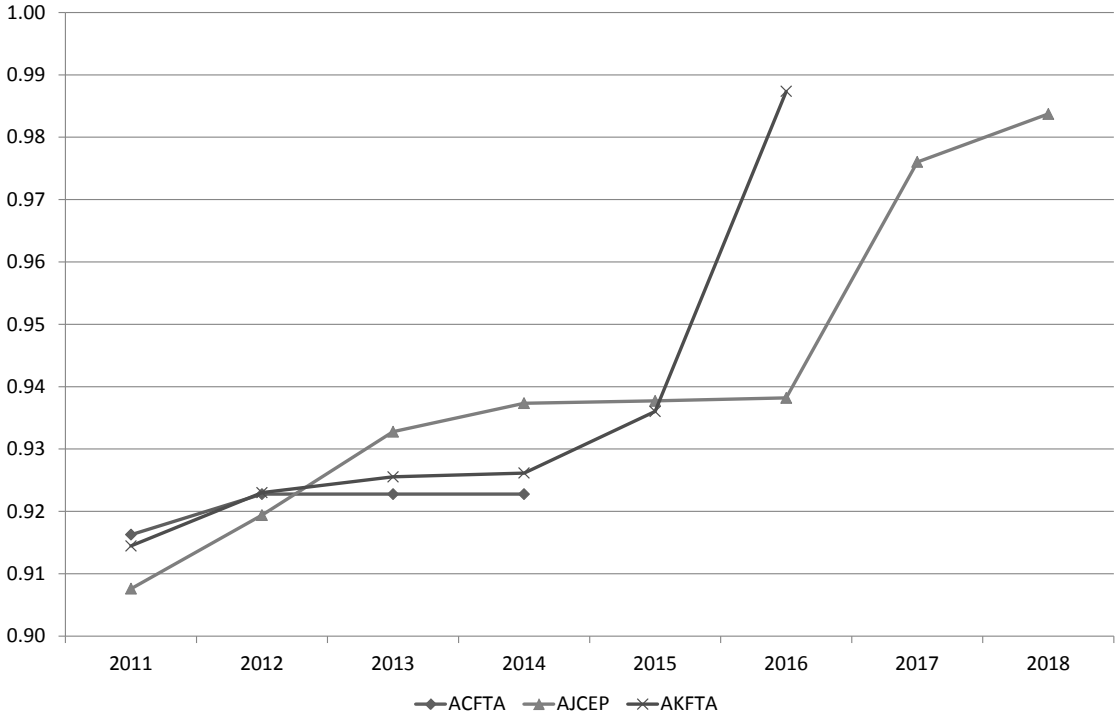


Figure 3. Time-series Changes in LIB_2

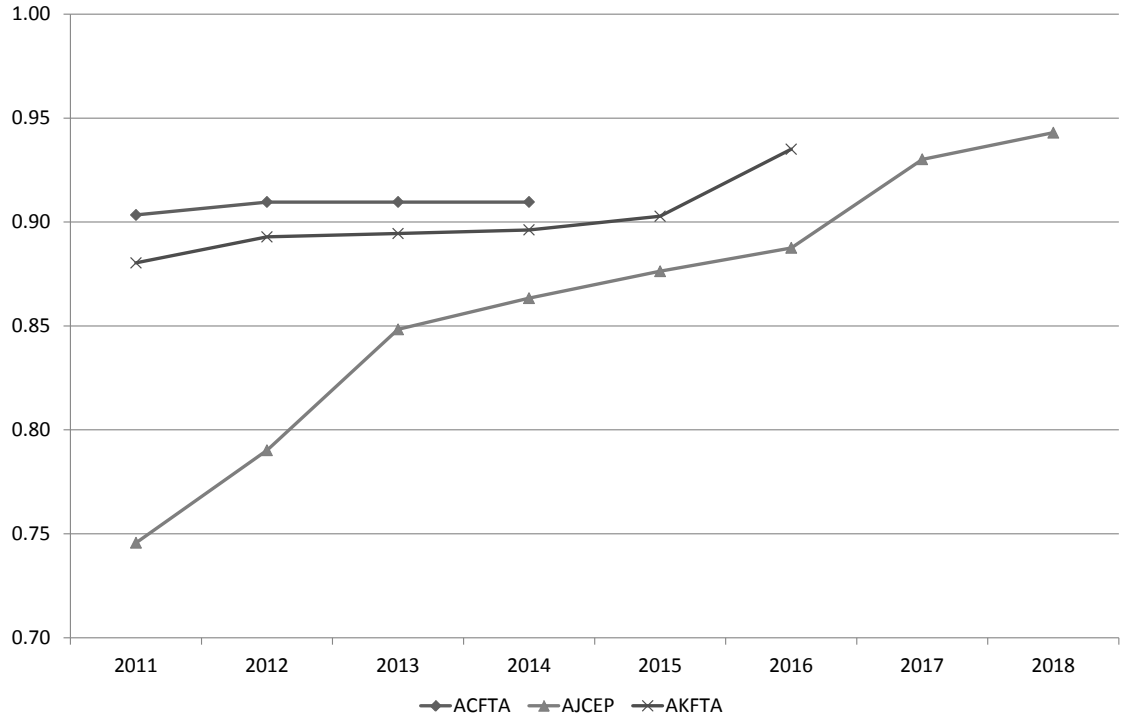


Figure 4. Time-series Changes in LIB_3

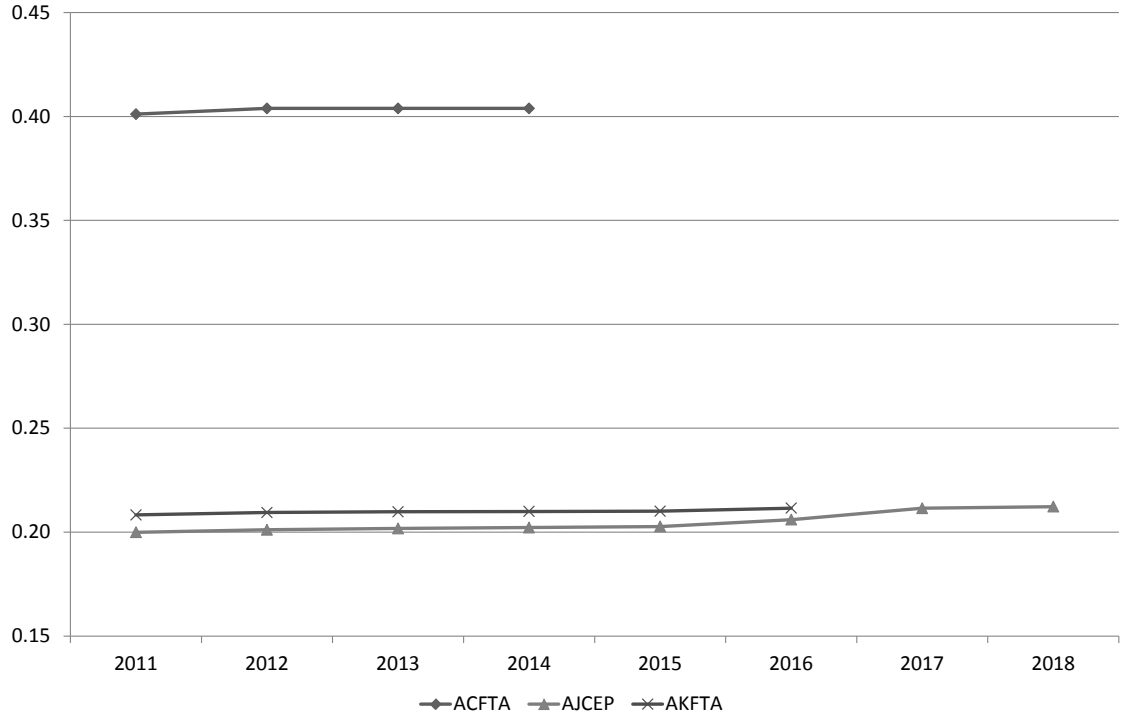


Figure 5. Time-series Changes in LIB_4