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Exchange Rate and Utilization of Free Trade Agreements: Focus on rules of origin[§]

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Abstract: This paper investigates how exchange rates affect the utilization of a free trade agreement (FTA) scheme considering the importance of rules of origin (RoOs). Exchange rates affect exporters' compliance with RoOs by changing the so-called value-added ratio, which is defined as [1 – (Non-originating input price / Export product price)]. We present theoretical underpinnings on this potential linkage with a model of pricing-to-market and provide an empirical examination using rich tariff-line-level data on the utilization of FTA schemes in Korea's imports from the Association of Southeast Asian Nations (ASEAN) countries. The theoretical framework proposes that a depreciation of exporters' currency against importers' currency enhances FTA utilization by improving the value-added ratio, and such effects are stronger for products with higher demand elasticity. We also show strong empirical support for our theoretical predictions.

Keywords: Free trade agreement, Exchange rates, Exchange rate pass-through, Rules of origin

JEL Classification: F1; F3

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1. Introduction

In this study, we introduce monetary aspects into a discussion on free trade agreements (FTAs). Many studies on FTAs have been conducted from the standpoint of international trade. A typical such study examines the effects of FTAs on trade between FTA member countries or trade with non-member countries. Examples include the works by Baier and Bergstrand (2007), Caporale et al. (2009), Magee (2008), Medvedev (2010), Roy (2010), and Vicard (2009). All these researchers focus on the *real* aspect of FTAs. On the other hand, *monetary* aspects of FTAs have received little attention, with Marmolejo (2011) a notable exception. He examines how an FTA's entry into force affects the exchange rate pass-through (ERPT) and asserts that FTAs have direct and indirect effects that alter the ERPT. In order to deepen our understanding of FTAs, it is worth exploring further how monetary aspects of the economy can be related to FTAs.

Specifically, we explore the role of exchange rates in determining product-level utilization of FTA tariff schemes. Many researchers have empirically examined the elements that affect preference utilization rates, which are defined as the share of imports under preference schemes out of total imports. Existing studies have consistently found that utilization rates are higher for products with a larger tariff margin (i.e., a larger difference between general tariff rates and FTA rates) or larger shipments.[1] In addition to these elements, it is well known that rules of origin (RoOs) play an important role in FTA utilization.[2] There are several types of RoOs: regional value content (RVC) rule; change-in-tariff classification (CTC) rule; technical requirement/specific process (TECH) rule; and wholly-obtained (WO) rule. Exporters are required to comply with any or combination of these RoOs when they utilize FTA rates. Previous studies have shown that FTA utilization rates are lower for products with more-restrictive RoOs.

This is a seminal study that sheds light on the potential role of exchange rates in exporters' compliance with RoOs. Among various types of RoOs, we especially focus on RVC and CTC rules. The RVC rule determines goods' country of origin by examining whether the total values of the inputs imported from non-member countries (called "non-

[1] Bureau et al. (2007) examined the 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) focused on EU and US trade with their preferential trading partners. Francois et al. (2006) and Manchin (2006) studied preferential trade relations of the EU and non-least-developed African, Caribbean, and Pacific (ACP) countries under the Cotonou Agreement. See Hakobyan (2015) for US GSP utilization by 143 GSP-eligible countries.

[2] To comply with RoOs, exporters need to certify that their export products are produced (i.e., originate) in FTA member countries. To do that, they must collect several documents, including a list of inputs, production flow chart, production instructions, invoices for each input, contract documents, and so on. Such documentation preparation becomes a non-trivial cost for exporters. The role of such fixed costs, which we do not consider explicitly in this study, in determining firms' FTA utilization is examined by Demidova and Krishna (2008) and Cherkashin et al. (2015).

originating inputs") comprise less than a certain share (e.g., 60%) of prices in export products. Specifically, one minus such a ratio of non-originating input price to export product price is defined as the "value-added ratio," and the value-added ratio is used to determine goods' country of origin. In the calculation of the value-added ratio, non-originating input price and export product price are denominated in the exporter's currency. Suppose that the exporter's currency depreciates relative to the importer's currency. Correspondingly, following existing studies,[3] ERPT is generally incomplete and part of these exchange rate changes are reflected in export prices denominated in exporters' currency. The depreciation of the exporter's currency against the importer's currency raises unit export prices in terms of the exporters' currency and improves the value-added ratio. As a result, this depreciation makes it easier for exporters to comply with the RVC rule.

Such effects of exchange rates may also operate in the CTC rule, which requires export products to have a different tariff classification from their non-originating inputs. For the CTC rule, the so-called "De Minimis" rule is often available as a bailout measure, as it allows non-originating inputs to have the same tariff classification if those inputs occupy only a certain small share in the prices of export products (e.g., 10%). Thus, the share of non-originating inputs plays a certain role also in compliance with the CTC rule. As a result, the depreciation (appreciation) of exporters' currency against importers' currency could serve to improve (deteriorate) the value-added ratio and enhance (diminish) FTA utilization. Indeed, this outcome of exchange rate changes has received public attention. For example, the Japan Chamber of Commerce and Industry, which is the party in charge of issuing certificates of origin in Japan, recommends that firms periodically check changes in exchange rates (e.g., every month) and confirm whether or not they still comply with RoOs.

In this paper, we consider this issue both theoretically and empirically. In the theoretical part, we derive two main predictions. One is that, as mentioned above, depreciation of the exporter's currency against the importer's currency enhances FTA utilization at the product level. The other is that such effects of exchange rates become larger when exporting products with higher demand elasticity. The value-added ratio is practically defined as a concave function of export price and thus exchange rates. Accordingly, the effect of exchange rates on value-added ratio is increasing in the demand

[3] Ca'Zorzi et al. (2007) and Law et al. (2016) discuss that emerging countries tend to suffer more from price effects of exchange rates than developed countries, implying ASEAN firms' tendency of pricing-to-market for exports to Korea. Given the incomplete ERPT, numerous researchers have sought to reveal the determinants of the ERPT (Amiti et al., 2014, Berman et al., 2012, Burnstein and Gopinath, 2013, Campa and Goldberg, 2005, Choudhri and Hakura, 2006, Cook, 2014, Ito and Sato, 2008, Ito et al., 2012, and Taylor, 2000).

elasticity as higher demand elasticity leads to lower markup of export price. Given that FTA utilization rates become higher when the value-added ratio of exporters' products becomes higher, the effect of exchange rates on FTA utilization rates is expected to be larger when demand elasticity is higher.

In the empirical part, we assess these theoretical predictions for exports from the Association of South East Asian Nations (ASEAN) countries to Korea. To do this, we employ rich tariff-line level data on FTA utilization by 10 ASEAN countries exporting to Korea during the 2007–2011 period. In this trade flow, ASEAN countries can use ASEAN–Korea FTA (AKFTA) schemes. AKFTA on trade in goods entered into force on June 1 2007 between Korea and ASEAN member countries. To examine the role of exchange rates, we need a sample containing sufficient variation, which can be obtained by including many years and many countries in the estimation data set. The focus on AKFTA enables us to not only include many export countries in our empirical analysis but also control for any effects based on the differences across FTAs because we focus on single FTA, i.e., AKFTA. Furthermore, since AKFTA is not a customs union (e.g., European Union) but an FTA, exporters are required to comply with RoOs when they utilize AKFTA schemes. In such a process, exchange rates will play a significant role. As a result, our empirical investigation supports the above-mentioned theoretical predictions. In particular, the positive effects from exchange rates are found to be larger in the case of RVC rules than in the case of non-RVC rules. Our findings contribute to deepening our understanding of how macroeconomic conditions (i.e., exchange rates) can affect microeconomic policy effects (i.e., FTA utilization).

The rest of this paper is organized as follows. Section 2 provides our theoretical underpinnings to reveal potential linkages between exchange rates and FTA utilization. After explaining our empirical framework in Section 3, we present the estimation results in Section 4. Finally, we conclude the paper in Section 5.

2. Theoretical Underpinnings

This section pins down a potential channel through which exchange rates can affect FTA utilization based on simple theoretical setup where ASEAN firms produce final goods using non-originating intermediate inputs and export products to Korea. ASEAN firms are assumed to be able to use an FTA tariff scheme only when they comply with the stipulated RoOs. Based on this setup, we provide two testable propositions.

2.1. Firms

To explicitly demonstrate the linkage between exchange rates and value-added ratio,

which plays a key role in compliance with RoOs, we assume that the production technology of ASEAN firms follows a Leontief function[4]

$$y(f) = \min\{a(f)n(f), m(f)\}, \tag{1}$$

where $y(f)$ is the output, $a(f)$ is the labor productivity of Firm f, $n(f)$ is labor input, and $m(f)$ is the Cobb-Douglas function, represented here as

$$m(f) = [m_1(f)]^{\gamma}[m_2(f)]^{1-\gamma}, \tag{2}$$

where $m_1(f)$ and $m_2(f)$ are intermediate inputs purchased from AKFTA member and non-member countries, respectively.[5] The assumption of a Leontief production function leads to the following relations:

$$n(f) = \frac{y(f)}{a(f)}, \tag{3}$$

$$m(f) = y(f). \tag{4}$$

Eq. (3) implies that firms with better labor productivity input less labor.

Firms' cost minimization over intermediate inputs from AKFTA member and non-member countries leads to following demand schedules:

$$m_1(f) = \gamma \frac{p}{p_1} m(f), \tag{5}$$

$$m_2(f) = (1-\gamma) \frac{p}{p_2} m(f), \tag{6}$$

where p_1 (p_2) is the unit price of intermediate inputs from member (non-member) countries, which is denominated in the currency of ASEAN firms. p is the cost index for intermediate inputs defined by

$$p = \left[\frac{p_1}{\gamma}\right]^{\gamma} \left[\frac{p_2}{1-\gamma}\right]^{1-\gamma}. \tag{7}$$

As a result, marginal cost is derived as

$$mc(f) = \frac{w}{a(f)} + p. \tag{8}$$

Thus, marginal costs are smaller for firms with higher labor productivity.

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[4] The use of a Leontief production function allows us to derive the value-added ratio in a straightforward way and provides simple guidance for our empirical tests. Extensions with a more-generalized function such as a constant elasticity of substitution (CES) function lead to richer theoretical consequences but such an extension does not necessarily contradict our theoretical predictions here.

[5] The presence of heterogeneity in firms' labor productivity is discussed from many perspectives. For instance, Datta et al. (2005) and Koch and McGrath (1996) presented that each firm's human resource management affects its labor productivity. Further, Wagner (2002) found positive causal effects of starting to export on firms' labor productivity.

2.2. Pricing

Let $P^{X*}(f)$ be the consumer unit price, which includes tariffs, of the output of Firm f denominated in the importer's currency (i.e., Korean won (KRW)). Assuming monopolistic competition in the Korean market, we let the following function represent the demand on each product:

$$q(f) = [P^{X*}(f)]^{-\sigma} Y, \tag{9}$$

where σ is the product-specific demand elasticity, and Y is the exogenous demand shifter.

Our focus is how monetary phenomena, i.e. changes in exchange rates, affect the use of FTA schemes. Thus, to be apart from the neutrality of money, we introduce price rigidity employing pre-set price setting used in studies such as Devereux et al. (2004) and Devereux et al. (2007). Specifically, export prices are set in advance before observing exchange rates in the current period. Thus, unexpected changes in exchange rates do not affect those prices, which are set in advance. Further, we focus on the case where firms follow full pricing-to-market (PTM) behavior to simply present the potential effect of exchange rate changes on the use of the FTA scheme.[6] In our context, KRW is the local currency for ASEAN exporters. Accordingly, assumptions of pre-set price and full PTM lead to the result that KRW prices of export products are not affected by unexpected changes in exchange rates. Based on those two assumptions, price-setting decisions can be described as follows:

$$\max_{\tilde{P}^{X*}(f)} E\{\delta\pi(f)\} = E\left\{\delta\left(\varepsilon\tilde{P}^{X*}(f) - mc(f)\right)[P^{X*}(f)]^{-\sigma}Y\right\}, \tag{10}$$

where ε is the bilateral exchange rate of the importer's currency (KRW) to the exporter's currency (ASEAN currency), and $\tilde{P}^{X*}(f)$ is the KRW export price. δ is the discount factor, which is assumed to be exogenous to the firm as in Devereux et al. (2007).[7]

Letting τ represent (1 + the tariff rate) (where $\tau > 1$), of which magnitude depends on the tariff scheme, the relation between consumer price and KRW export price is given by

$$P^{X*}(f) = \tau\tilde{P}^{X*}(f). \tag{11}$$

Exporters maximize expected profits given the marginal cost and tariff rate.[8] First-order

[6] The assumption of full PTM by final- and intermediate-good exporters significantly simplifies our theoretical discussion. In Appendix, we will loosen this assumption and examine the case of partial PTM, which is presented in studies such as Corsetti and Pesenti (2005). We will show that our propositions are likely to hold as far as the effect of bilateral exchange rates on export prices dominates that on the cost of non-originating intermediate inputs.

[7] In our partial equilibrium framework where nominal demand is exogenously endowed, stochastic discount factor corresponds with exogenous discount factor.

[8] One might expect that the profit maximizing-mill price (i.e., KRW export price) depends on which tariff scheme an exporter chooses. However, it does not depend on tariff rates and becomes the same

condition leads to the price equation

$$\tilde{P}^{X*}(f) = \frac{\sigma}{\sigma - 1}\frac{mc(f)}{E\{\varepsilon\}}. \tag{12}$$

Thus, only expected changes in exchange rates lead to changes in the consumer prices of final goods. Given the assumption of PTM, export prices of final products denominated in exporter's (ASEAN) currency can be derived as

$$P^X(f) = \varepsilon\tilde{P}^{X*}(f) = \frac{\sigma}{\sigma - 1}\frac{\varepsilon}{E\{\varepsilon\}}mc(f), \tag{13}$$

which implies that unexpected depreciation (appreciation) of an exporter's currency leads to a rise (fall) of the ASEAN currency export price.[9]

2.3. Exchange Rate and Value-Added Ratio

Practically speaking, there are two formulations of value-added ratio. One is build-down method $[R(f)]$, which is defined as

$$R(f) \equiv \frac{P^X(f) - P^I(f)}{P^X(f)} = 1 - b(f), \tag{14}$$

where $P^I(f)$ is the total cost of non-originating inputs, i.e., imports from AKFTA non-member countries, to produce one unit of each export good, and $b(f)$ is the export-price cost share of non-originating inputs [i.e., $b(f) \equiv P^I(f)/P^X(f)$]. Both $P^X(f)$ and $P^I(f)$ are denominated in the exporter's currency. The other is the build-up method, which is equal to $b(f)$. Final-goods exporters are allowed to utilize AKFTA preferential rates only if value-added ratio exceeds the threshold in the case of build-down method (e.g., 40% in the case of RVC) or if it falls below the threshold (e.g., 60% in the case of RVC) in the case of build-up method.

We consider the value-added ratio in build-up method, i.e., $R(f)$, which is adopted in the FTA that is empirically examined later (i.e., AKFTA). Using the notation in the above theoretical setup, $P^I(f)$ can be written as

$$P^I(f) = \frac{p_2 m_2(f)}{y(f)} = p_1\left(\frac{\gamma}{1-\gamma}\frac{p_2}{p_1}\right)^{1-\gamma}. \tag{15}$$

The value-added ratio, $R(f)$, can be rewritten as

$$R(f) = 1 - \frac{p_1\left(\frac{\gamma}{1-\gamma}\frac{p_2}{p_1}\right)^{1-\gamma}}{\frac{\sigma}{\sigma-1}\frac{\varepsilon}{E\{\varepsilon\}}mc(f)}. \tag{16}$$

Thus, we can easily prove that

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for alternative tariff schemes as far as tariff rates are observed in advance.

[9] This export price is exclusive of tariffs in order to be consistent with the practical definition of value-added ratio.

$$\frac{\partial R(f)}{\partial \varepsilon} > 0. \tag{17}$$

Assuming that prices are pre-set and that final- and intermediate-good exporters follow the full PTM manner, depreciation of an exporter's currency leads the ASEAN currency export price to rise and improves the value-added ratio.[10] This happens for all exporters as the exchange rate is a macroeconomic variable. As a result, we can state the following lemma:

Lemma 1: *Value-added ratio rises when the exporter's currency depreciates against the importer's currency.*

According to this lemma, we expect that the firm-level likelihood of complying with RoOs is greater when the exporter's currency is cheaper relative to importer's currency.[11]

Further, we demonstrate how demand elasticity is related to the effect of exchange rates on value-added ratio. We take the following partial derivative to obtain the relation:

$$\frac{\partial}{\partial \sigma}\left[\frac{\partial R(f)}{\partial \varepsilon}\right] > 0, \tag{18}$$

which implies that the effect of exchange rates on value-added ratio is larger for products with higher demand elasticity. Remembering that exchange rates affect value-added ratio via the export price, $\partial R(f)/\partial \varepsilon$ is decomposed as

$$\frac{\partial R(f)}{\partial \varepsilon} = \frac{\partial R(f)}{\partial P^X(f)} \frac{\partial P^X(f)}{\partial \varepsilon}. \tag{19}$$

Thus, $\partial[\partial R(f)/\partial \varepsilon]/\partial \sigma$ can be rewritten by

$$\frac{\partial}{\partial \sigma}\left[\frac{\partial R(f)}{\partial \varepsilon}\right] = \left[\frac{\partial}{\partial \sigma}\frac{\partial R(f)}{\partial P^X(f)}\right]\frac{\partial P^X(f)}{\partial \varepsilon} + \frac{\partial R(f)}{\partial P^X(f)}\left[\frac{\partial}{\partial \sigma}\frac{\partial P^X(f)}{\partial \varepsilon}\right]. \tag{20}$$

Figure 1 graphically demonstrates the relation between exchange rates and value-added ratio for cases with high and low demand elasticity. According to Eq. (14), the value-added ratio is practically defined as a concave function of the export price, which is depicted in the left-hand side of the figure. Therefore, higher demand elasticity leads to a higher derivative of the value-added ratio to export price, i.e., $\partial[\partial R(f)/\partial P^X(f)]/\partial \sigma > 0$, which appears in the first term of Eq. (20). In contrast, higher demand elasticity leads to lower effects from exchange rates on export price ($\partial[\partial P^X(f)/\partial \varepsilon]/\partial \sigma < 0$), which

[10] In the case of partial PTM, the cost of non-originating intermediate inputs is also affected by exchange rates. See Appendix for details.

[11] Statements in Lemmas 1 and 2 are unchanged even when we consider the partial derivative of value-added ratio to changes in logged exchange rates.

appears the second term of Eq. (20). The former positive effect dominates the latter negative effect due to the definition of value-added ratio. As a result, the partial derivative of the value-added ratio by exchange rates, i.e., the slope of the tangent of R locus on the right-hand side of Figure 1, is proven to be steeper when demand elasticity is higher. In sum, the following lemma can be stated:

Lemma 2: *The effect of exchange rate on value-added ratio is increasing in demand elasticity.*

[Insert Figure 1 here]

2.4. Exchange Rate and Product-Level FTA Utilization Rates

We cannot directly examine the effect of exchange rates on value-added ratios because our data set does not report those ratios. Thus, based on Lemmas 1 and 2, we provide testable propositions regarding the effect of exchange rates on product-level FTA utilization rates, which are observable. Suppose that firms in the exporting country are infinitely distributed.[12] We do not assume a specific type of distribution for firm-specific labor productivity. Note that we focus on exports from one particular ASEAN country that is a member of AKFTA, to Korea. Let $Q(f)$ represent exports by Firm f denominated in the importer's currency, and Ω represent the set of firms that export using the AKFTA tariff scheme. Then, the product-level FTA utilization rate, U, can be described as

$$U = \frac{\int_{\Omega} Q(f)\, df}{\int_{\Omega} Q(f)\, df + \int_{\bar{\Omega}} Q(f)\, df}, \tag{21}$$

where $\bar{\Omega}$ is the complementary set of Ω, i.e., the set of firms that export using MFN tariff scheme. Using equations (9) and (11), $Q(f)$ can be given by

$$Q(f) = \tilde{P}^{X*}(f) q(f) = [\tilde{P}^{X*}(f)]^{1-\sigma} \tau^{-\sigma} Y. \tag{22}$$

Combining Eqs. (12), (21), and (22), the product-level FTA utilization rate is rearranged in the following manner:

[12] We do not consider fixed cost for market entry in order to focus on the effect of exchange rates on FTA utilization through compliance with RoOs. Thus, in our model, exchange rate changes do not affect the number of exporters, which is not our focus.

$$U = \frac{\int_{\Omega} [\tilde{P}^{X*}(f)]^{1-\sigma}[\tau^{FTA}]^{-\sigma}\, d\rho}{\int_{\Omega} [\tilde{P}^{X*}(f)]^{1-\sigma}[\tau^{FTA}]^{-\sigma}\, df + \int_{\bar{\Omega}} [\tilde{P}^{X*}(f)]^{1-\sigma}[\tau^{MFN}]^{-\sigma}\, df}$$

$$= \left(1 + \frac{\mu^{\sigma} \int_{\bar{\Omega}} [mc(f)]^{1-\sigma}\, df}{\int_{\Omega} [mc(f)]^{1-\sigma}\, df}\right)^{-1}, \quad (23)$$

where τ^{FTA} and τ^{MFN} are 1 + FTA and MFN tariff rate, respectively, μ is τ^{FTA} over τ^{MFN} ($\mu \equiv \tau^{FTA}/\tau^{MFN}$), termed the *tariff ratio*. From Eq. (23), we can easily find that a drop in the tariff ratio leads to a rise in the product-level FTA utilization rate. In other words, product-level FTA utilization rates become higher when the margin between FTA and MFN tariff rates is larger. This outcome is consistent with existing studies reviewed in Section 1, and will be empirically tested in the following sections of this paper.

Given that the marginal cost does not depend on exchange rates and Ω ($\bar{\Omega}$) is increasing (decreasing) in ε since the share of FTA users increases when the exporter's currency depreciates against the importer's currency as implied by Lemma 1, we can state the following proposition:

Proposition 1: *Depreciation (appreciation) of final-good exporters' currencies (i.e. ASEAN curencies) against a currency in the export destination country (i.e., KRW) raises (lowers) product-level FTA utilization rates.*

Since a depreciation of exporters' currency relative to importers' currency improves exporters' value-added ratio, more exporters comply with RoOs, and product-level FTA utilization rates rise.

Proposition 1 and Lemma 2 jointly imply that the effect of exchange rates on FTA utilization rates positively depends on demand elasticity through the dependence on demand elasticity of exchange rates' effect on the value-added ratio. Thus, the following proposition can be stated:

Proposition 2: *The effect of exchange rates on the product-level FTA utilization rates becomes larger (smaller) for products with higher (lower) elasticity of demand to export prices.*

In the following sections, we empirically examine the above propositions.

3. Empirical Framework

This section specifies the empirical framework that will be utilized to examine the above testable predictions for Korea's import. As of February 2013, Korea has eight effective FTAs (Korea–Chile FTA, Korea–Singapore FTA, Korea–European Free Trade Association (EFTA) FTA, AKFTA, Korea–India Comprehensive Economic Partnership, Korea–European Union FTA, Korea–Peru FTA, and Korea–US FTA). Among these FTAs, we examine the utilization rates of AKFTA in Korea's imports from ASEAN countries. We focus on one specific FTA to avoid mixing FTAs with different liberalization or removal of non-tariff measures including RoOs. Furthermore, as mentioned in the introductory section, AKFTA is a suitable FTA to examine the role of exchange rates in term of number years after entry into force and the number of member countries. Our analysis covers the period of 2007–2011 at Korea's tariff-line (nine-digit) level.[13] For this period, the common version of harmonized system (HS) is used (HS 2007 version).

AKFTA on trade in goods entered into force on 1 June 2007 between Korea and ASEAN member countries. Malaysia and Singapore were the first signatories to give effect to AKFTA on 1 June 2007. This was followed by Vietnam (29 June 2007), Myanmar (November 27 2007), Indonesia (December 7 2007), the Philippines (January 1 2008), Brunei (July 1 2008), Laos (October 1 2008), Cambodia (1 November 2008), and Thailand (1 January 2010). The tariff reduction schedule consists of two tracks, namely a normal track and a sensitive track. The latter track is further divided into sensitive products and highly-sensitive products. Products under the normal track accounted for 90% of total tariff lines and 90% of the total import value in 2005, while products classified as belonging to the sensitive track accounted for the remaining 10%. Tariffs on products under the normal track were scheduled to be eliminated by January 2008 for Korea. On the other hand, tariff reductions for products classified under the sensitive track were not to start in our sample period; the first obligation for sensitive-track products was to reduce tariffs by 20% in 2012, and this was to be followed by additional tariff reductions later on. Therefore, our sample only covers products under normal track.[14]

The usual specification in the previous studies listed in the introductory section, is as follows:

$$Utilization_{ict} = \beta_1 Margin_{ict} + \beta_2 \ln Size_{ict} + u_c + u_i + u_t + \varepsilon_{ict} \qquad (24)$$

where $Utilization_{ict}$ represents the AKFTA utilization rates (i.e., share of trade values under FTA schemes out of total trade values) in exporting product i from country c in

[13] Our sample period includes the global financial crisis. Therefore, we may expect exogenous shocks to exchange rates.

[14] The sample products are restricted to those having lower FTA rates than MFN rates.

year t. As mentioned above, the month of AKFTA's entry into force differs by countries. Therefore, when computing this variable, particularly in the first year of entry, we use the sum of total values during the entry month to December in the denominator. The other variables are as follows. $Margin_{ict}$ denotes the preference margin for exporting product i from country c in year t. As the tariff ratio in our theoretical framework suggested, this variable is expected to positively impact $Utilization_{ict}$. $Size_{ict}$ is measured by the average of monthly exports of product i from country c in year t.[15] This variable controls for transaction sizes in FTA utilization. As found by previous studies, its coefficient is expected to be significantly positive. Export-country fixed effects (u_c), product fixed effects (u_i), and year fixed effects (u_t) are also included. The product fixed effects are defined at an HS nine-digit level and are expected to control for the differences in types of RoOs, which are defined at an HS six-digit level in the case of AKFTA.

We extend the typical estimation Eq. (24) to examine the role of exchange rates stated in Proposition 1. We introduce the exchange rates of each ASEAN country's currency against KRW (i.e., against the export destination country's currency), which is denoted by $Exchange$.[16] As a result, our empirical specification becomes as follows:

$$Utilization_{ict} = \beta_1 Margin_{ict} + \beta_2 \ln Size_{ict} + \beta_3 \ln Exchange_{ct} + \beta_4 \ln GDP\ \ per\ \ Capita_{ct} + u_c + u_i + u_t + \varepsilon_{ict}. \quad (25)$$

As demonstrated in the previous section, the coefficient for exchange rates, β_3, is related to Proposition 1 and expected to be positive. We also include the exporter's GDP per capita, which approximately represents the exporting country's degree of economic development. We expect that exporters in more-developed countries are more experienced in dealing with documentation preparation to utilize FTA schemes, implying a positive sign of the coefficient β_4.

We first estimate this model by the ordinary least squares (OLS) method as a baseline estimation. Then, we use the fractional logit method proposed by Papke and Wooldridge (1996) since our dependent variable lies in the unit interval, i.e., [0, 1]. It should be noted that it becomes difficult to obtain the convergence of likelihood in the fractional logit estimation if we introduce fixed effects, particularly HS nine-digit-level

[15] Most previous studies (e.g., Hakobyan 2015) used the product-country-level annual trade values. Keck and Lendle (2012) employed the product-customs district-level monthly trade data, which the called "pseudo-transaction-level" trade values. Due to the availability of the data, this paper uses the product-country-level monthly trade values that meet a medium level of accuracy as a proxy for average of firm-level transaction sizes between product-country-level annual trade values and pseudo-transaction-level trade values.

[16] One may examine the same analysis using the exchange rates of each ASEAN country's currency against the USD given the fact that major invoicing currency in Asia is the USD. However, estimation results do not change at all due to inclusion of year fixed effects, which capture KRW exchange rates against the USD.

fixed effects. Therefore, we introduce dummy variables indicating types of RoOs and HS section-level fixed effects instead of HS nine-digit-level fixed effects when estimating the fractional logit model. RoOs types reported in Table 1 are used to define RoOs dummy variables. Furthermore, we cluster standard errors in HS nine-digit codes in the case of fractional logit model.

Our data sources are as follows. The data on FTA utilization and tariff margin were obtained from Korea Customs and Trade Data Institute (KCTDI). We collected the data on export countries' exchange rates against KRW from the ASEAN stats[17] and the World Development Indicator (average of period). Data on $Size$ were obtained from the World Trade Atlas. In the empirical analysis, we exclude Singapore from our sample export countries because Singapore has not only multilateral but also bilateral FTAs with Korea. In this case, firms' decisions on FTA use will be qualitatively different; firms' decisions are not simply between MFN rates and AKFTA rates but among MFN rates, Korea-Singapore FTA rates, and AKFTA rates. Since our purpose is not to examine such complicated decisions on tariff schemes, we exclude Singapore from our analysis.

Before showing our estimation results, we take a brief overview of our sample. Figure 2 depicts the changes in nominal exchange rates against KRW. In the figure, data from 2006 is normalized to 100 for each sample country. All sample export countries experienced appreciation until 2009 maybe because of the global financial crisis. Except for Vietnam, their currencies were stable against the KRW afterwards. On the other hand, Vietnam's currency depreciated by nearly 35% from 2009 to 2011.

[Insert Figure 2 here]

Figure 3 shows changes in AKFTA utilization rates for exports from each ASEAN country to Korea, defined as the share of the exports under the AKFTA scheme out of total exports of AKFTA eligible products. Based on the year of entry into force, the starting year thus differs by country in this figure. Overall, these rates seem to change in a complicated manner. All countries do not necessarily show a rise in their utilization rates over time. While Thailand, Laos, and Malaysia have low rates (around 35% in 2011), utilization rates are relatively high when exporting from Myanmar, Brunei, and Vietnam (around 75%–95%).

[Insert Figure 3 here]

[17] http://aseanstats.asean.org/.

Table 1 reports the distribution of RoOs in AKFTA. In AKFTA, RoOs are set at an HS six-digit level. The major RoOs are "Change-in-Heading (CH) or RVC," followed by "Change-in-Chapter (CC) or RVC," and WO. In AKFTA, the build-down method was applied for RVC. Most of the RVC rules set either 40% or 50% as a cutoff for the necessary value-added shares of originating inputs. Additionally, the cutoff in De Minimis in AKFTA is 10%. Exchange rates will potentially affect compliance of these RoO types, which account for more than 90% of all RoOs at a HS six-digit level. On the other hand, exchange rates will not have significant effects on compliance of WO. In addition, the De Minimis rule for HS50-63 products is weight-based, not value-based.[18] Exchange rates will not affect RoO compliance in this type of RoOs.

[Insert Table 1 here]

4. Empirical Results

In this section, we first present the estimation result from the analysis of Proposition 1. After conducting a robustness check on this result, we also empirically examine Proposition 2. The basic statistics for the estimation sample are provided in Table 2.

[Insert Table 2 here]

4.1. Baseline Results

The baseline estimation results by the OLS are reported in column (I) in Table 3. The coefficient for exchange rates is related to the statement in Proposition 1 and is estimated to be positive and significant. From a quantitative viewpoint, a 10% depreciation of the exporter's currency against KRW leads to a 2.3 percentage point rise in FTA utilization rates. This result implies that the depreciation of ASEAN currencies against KRW improves the value-added ratio evaluated in ASEAN currencies and thus significantly encourages ASEAN exporters to utilize the AKFTA scheme. In short, this empirical result supports Proposition 1.

[Insert Table 3 here]

[18] Rule 10-1-(a) of Annex 3 in the AKFTA legal text says that *for a good provided for in Chapters 50 through 63 of the Harmonized System, the weight of all non-originating materials used in its production that do not undergo the required change in tariff classification does not exceed ten (10) percent of the total weight of the good*.

The results on tariff margin and trade sizes are totally consistent with the results of the previous studies listed in the introductory section. The coefficient on the tariff margin is significantly positive, indicating that ASEAN exporters are more likely to use the AKFTA scheme when it is more attractive in terms of tariff payments relative to the MFN scheme. The coefficient on trade sizes is also significantly positive, implying that the AKFTA utilization rates are higher when transaction sizes are larger. The coefficient on GDP per capita is significantly positive. This finding suggests that the AKFTA scheme is more likely to be used when an exporter's country is more developed, possibly because exporters in such countries have better knowledge and experience to deal with documentation preparation for AKFTA utilization.

4.2. Robustness Checks

We conducted three kinds of robustness checks on the above results. First, we re-estimate our model by the fractional logit method. This estimation result is shown in column (II) in Table 3. As mentioned before, in this estimation, we introduce HS section fixed effects and RoO dummy variables instead of HS nine-digit level fixed effects. The results are qualitatively unchanged compared with the baseline result reported in column (I). In particular, the coefficient on exchange rates is again estimated to be significantly positive, consistent with our first theoretical proposition.

Second, we employed the instrumental variable (IV) method in order to tackle endogeneity issues in $Size$. As pointed out by Hakobyan (2015), the coefficient for $Size$ might suffer from endogeneity biases because unobserved shocks may have an influence on both average trade values and the dependent variable (particularly its denominator). As an instrument, following Hakobyan (2015), we used a binary variable with a value of 1 if Korea imported a concerned product from any other ASEAN country (which implies that there is import demand in Korea for the given product) and zero otherwise (Rest of ASEAN). The results are reported in column (III). The *F* statistic is sufficiently high and shows that our instrument is not weak. The results found for our explanatory variables were qualitatively similar to those in column (I). In particular, the coefficient on exchange rates is again estimated to be significantly positive.

Third, we try to differentiate the sources of the exchange rates effects on FTA utilization. Our conjecture on those effects is based on the compliance of RoOs. However, exchange rates could affect the rate of FTA utilization if relative profits of FTA exports to MFN exports were affected by exchange rates. Demidova and Krishna (2008) focus on the role of fixed costs of FTA utilization, which stem mainly from the documentation preparation, and demonstrate that FTA users are exporters who can obtain sufficient export profits to cover such fixed costs (see footnote 2). Thus, for instance, an FTA

utilization rate could be positively associated with exchange rates if depreciation of exporters' currency increased the relative profits from FTA exports compared to MFN exports. In other words, FTA utilization rates can be affected by exchange rates not through the value-added ratio.

To show the validity of the channel on which we focus, we investigate how the effect of exchange rates differs across RVC and non-RVC cases. Our propositions are derived based on the channel through the value-added ratio, which best fits the RVC case. Although CTC could be affected by exchange rates through the De Minimis rules, the effect of exchange rates should be less significant than in the RVC case. Indeed, the De Minimis rules in some products are weight-basis rather than value-basis. Our conjecture cannot be applied to this case. In short, the effect of exchange rates on the FTA utilization rate should be most significant for the case of RVC than for other types of RoOs if our conjecture is correct.

To examine this, we introduce an interaction term of exchange rates with RVC dummy, which is 1 if RoOs are either of RVC, CC&RVC, and CH&RVC and is 0 otherwise. We do not include co-equal rules (e.g., CC/RVC) into this group because firms may choose non-RVC rules when they certify the origin of goods. The estimation result by the OLS is reported in column (IV). Consistent with our expectation, the coefficient on this interaction term is significantly positive. Therefore, the effect of exchange rates is larger in the case of RVC. This finding indicates the validity of our propositions driven through the effect of exchange rates on value-added ratio, i.e., RoO compliance. The other variables have similar results to those in other columns in Table 3.[19]

4.3. Demand Elasticity

In this last subsection, we examine Proposition 2 on the relationship between demand elasticity and the effect of exchange rates on FTA utilization rate. We thus add an interaction term for exchange rates to demand elasticity in ASEAN countries' exports to Korea. For this interaction term, we employ demand elasticity in export products ($Elasticity$) estimated by Broda et al. (2006) at an HS three-digit level for Korea. Considering the interaction effect of demand elasticity, the estimation equation (25) can be rearranged in the following manner:

[19] Our theoretical framework implies that *unexpected* changes in exchange rates affect the value-added ratio and rate of AKFTA utilization. We checked the robustness of the results by assuming static expectations and using a logged exchange rate in the current year less logged exchange rate in the previous year, but the major results were unchanged.

$$Utilization_{ict} = \beta_1 Margin_{ict} + \beta_2 \ln Size_{ict} + \beta_3 \ln Exchange_{ct} + \beta_4 \ln GDP\ \ per\ \ Capita_{ct} + \beta_5 \ln Exchange_{ct} \times Elasticity_i + u_c + u_i + u_t + \varepsilon_{ict}. \quad (26)$$

According to Proposition 2, we expect β_5 to be positive. Again, we estimate this model with the OLS method rather than with the fractional logit method to obtain intuitive interpretation on results of interaction terms (Ai and Norton, 2003). Then, we check the robustness of the result using the IV estimation technique and introducing the interaction term of exchange rates with RVC dummy, as done in Section 4.2. The results are reported in Table 4. The effect of exchange rates is again estimated to be positive, supporting Proposition 1. Furthermore, coefficient β_5 was estimated as positive, implying that exchange rates have a greater effect on FTA utilization when exporting involves products with higher demand elasticity. In other words, our estimation supports Proposition 2.

[Insert Table 4 here]

5. Concluding Remarks

This paper investigated how exchange rates affect firms' FTA utilization. From a practical point of view, exchange rates are expected to affect FTA utilization for exports by changing the value-added ratio, which plays an important role in compliance with RoOs. Our empirical analyses robustly showed that depreciation of final-good-exporters' currency against the destination country currency enhances FTA utilization. We also revealed that such positive impacts of exchange rates are larger for products with higher demand elasticity. In general, it is believed that the depreciation of domestic currency leads to an increase in exports under the Marshall-Lerner condition through lower prices in terms of importers' currency relative to prices of products from other countries. Our findings presented here imply that the trade creation effect of currency depreciation is not limited to such a direct channel between FTA member countries. Since trade values mostly increase when switching from MFN schemes to FTA schemes because of the latter's lower tariff rates, the depreciation of domestic currency may increase more than when only considering above typical effect through relative price changes.

We discussed the possibility that exchange rates affect FTA utilization through compliance with RoOs. However, the computation formulation in RVC differs across FTAs. For instance, the net cost (NC) formulation, which is defined as [1–(value of non-originating materials/"net cost")], is employed as a measure to determine the origin of automobiles in the Trans Pacific Partnership. The net cost is "total cost" minus "sales promotion, marketing and after-sales service costs, royalties, shipping and packing costs,

and non-allowable interest costs." This NC measure is less sensitive to changes in exchange rates than the value-added ratio because the NC measure does not include the export price, changes in which are the source of the exchange rates' effect on the value-added ratio, as demonstrated in this study. As a result, the effect of exchange rates on FTA utilization should be smaller when the NC method rather than the value-added method is employed. In other words, the use of the NC method would free exporters from the fear of exchange rate fluctuations and contribute to stabilizing exporters' use of FTA schemes. Our analyses provide a guidance for the design of FTAs with a focus on the relation between exchange rates and RoOs.

Since the present study is a seminal work on impacts of exchange rates on FTA utilization, many subjects remain for future research. In this paper, we examined impacts in the AKFTA which employs the build-down method for the RVC rule. However, as noted above, those impacts would differ across alternative measures of value-added ratios such as NC and build-up methods. An investigation into how those impacts differ when other measurements are used for RoO compliance would be informative. Further, exporters must care not only about exchange rate levels but also volatility. In other words, the degree of uncertainty in exchange rates is also expected to affect use of FTA scheme as uncertainty becomes a potential cost for risk-averse exporters. Theoretical and empirical examinations of the aspect of uncertainty are also important both from academic and practical points of view.

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Table 1. Distribution of RoOs in AKFTA at an HS Six-Digit Level

	Number	Share (%)
CC	5	0.1
CH	12	0.2
CC/RVC	514	10
CH/RVC	3,907	77
CH/RVC/TECH	21	0.4
CS/RVC	66	1
RVC/WO	6	0.1
CC&RVC	2	0.04
CH&RVC	4	0.1
RVC	61	1
WO	454	9
Total	5,052	100

Source: Legal text of AKFTA

Table 2. Basic Statistics

	Obs	Mean	Std. Dev.	Min	Max
Utilization	40,738	0.267	0.408	0	1
ln Exchange rates	40,738	-1.077	3.583	-6.781	2.918
ln Exchange rates * RVC Dummy	40,738	-0.022	0.573	-6.781	2.918
ln Exchange rates * Elasticity	40,738	-5.459	45.102	-774.868	383.731
Margin	40,738	8.579	4.080	1	50
ln Size	40,738	8.376	2.805	0	19.906
ln GDP per capita	40,738	7.656	0.861	5.931	10.493
Rest of ASEAN	40,738	0.672	0.469	0	1

Table 3. Baseline Results

	(I)	(II)	(III)	(IV)
ln Exchange rates	0.2304***	0.5877*	0.2371***	0.2290***
	[0.0475]	[0.3403]	[0.0476]	[0.0475]
ln Exchange rates * RVC Dummy				0.0058**
				[0.0028]
Margin	0.0117***	0.0299***	0.0119***	0.0117***
	[0.0013]	[0.0056]	[0.0013]	[0.0013]
ln Size	0.0679***	0.5531***	0.0598***	0.0679***
	[0.0007]	[0.0103]	[0.0013]	[0.0007]
ln GDP per capita	0.2172***	0.6277*	0.2220***	0.2162***
	[0.0464]	[0.3238]	[0.0465]	[0.0464]
Method	OLS	Fractional	IV	OLS
RoO Dummy	NO	YES	NO	NO
Exporter FE	YES	YES	YES	YES
HS Nine-digit FE	YES	NO	YES	YES
HS Section FE	NO	YES	NO	NO
Year FE	YES	YES	YES	YES
Number of observations	40,738	40,738	40,738	40,738
Cragg-Donald Wald F statistic			1.5E+04	
Adjusted/Centered R-squared	0.5058		0.5058	0.5059
Log pseudolikelihood		-15296.13		

Notes: This table reports the estimation results by OLS in column "OLS" and by fractional logit technique in column "Fractional." The dependent variable is the share of imports under AKFTA out of total imports. Parentheses indicate robust standard errors in column "OLS" and standard errors clustered in HS nine-digit codes in column "Fractional." ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In column "IV," we employ the instrument variable method. We use as an instrument for Sizes, a binary variable that takes the value of 1 if Korea imports a concerned product from any other ASEAN countries and is 0 otherwise (Rest of ASEAN).

Table 4. Export Elasticity

	(I)	(II)	(III)
ln Exchange rates	0.2307***	0.2375***	0.2293***
	[0.0475]	[0.0476]	[0.0475]
ln Exchange rates * Elasticity	0.0001**	0.0001**	0.0001**
	[0.0000]	[0.0000]	[0.0000]
ln Exchange rates * RVC Dummy			0.0060**
			[0.0028]
Margin	0.0117***	0.0119***	0.0117***
	[0.0013]	[0.0013]	[0.0013]
ln Size	0.0680***	0.0598***	0.0680***
	[0.0007]	[0.0013]	[0.0007]
ln GDP per capita	0.2181***	0.2228***	0.2170***
	[0.0464]	[0.0465]	[0.0464]
Method	OLS	IV	OLS
Number of observations	40,738	40,738	40,738
Cragg-Donald Wald F statistic		1.5E+04	
Adjusted/Centered R-squared	0.5059	0.5642	0.5059

Notes: This table reports the estimation results by OLS in column "OLS" and by the instrument variable method in column "IV." The dependent variable is the share of imports under AKFTA in total imports. The parentheses indicate robust standard errors. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In column "IV," we use as an instrument for Sizes, a binary variable that takes the value of 1 if Korea imports a concerned product from any other ASEAN countries and is 0 otherwise (Rest of ASEAN). In all specification, we include export country dummy variables, year dummy variables, and HS nine-digit code dummy variables.

Figure 1. Exchange Rates and Value-Added Ratio

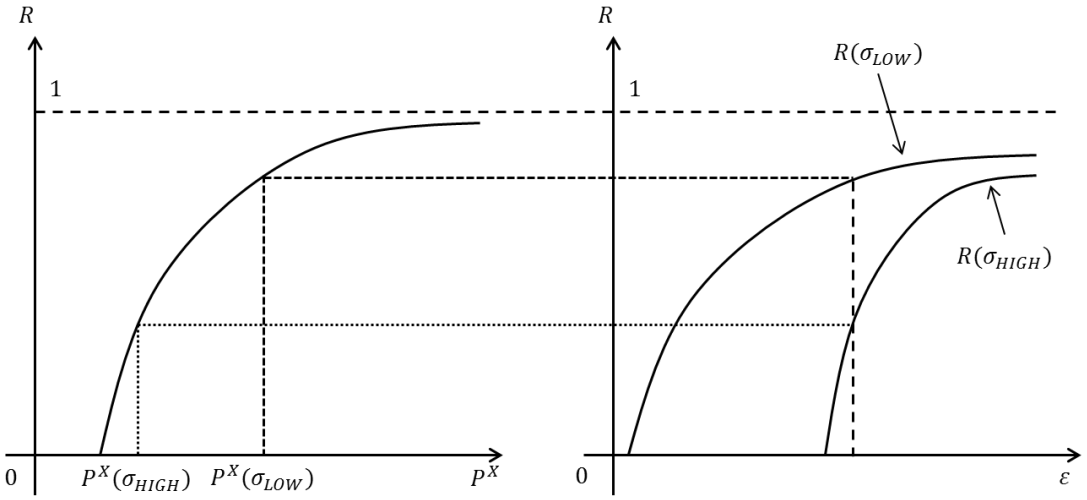
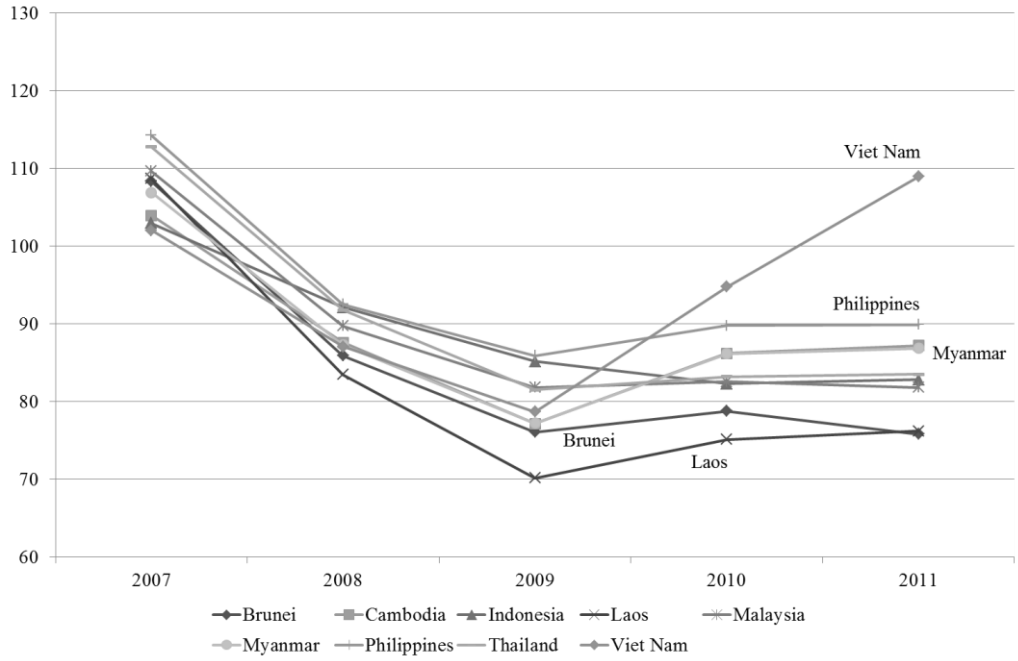
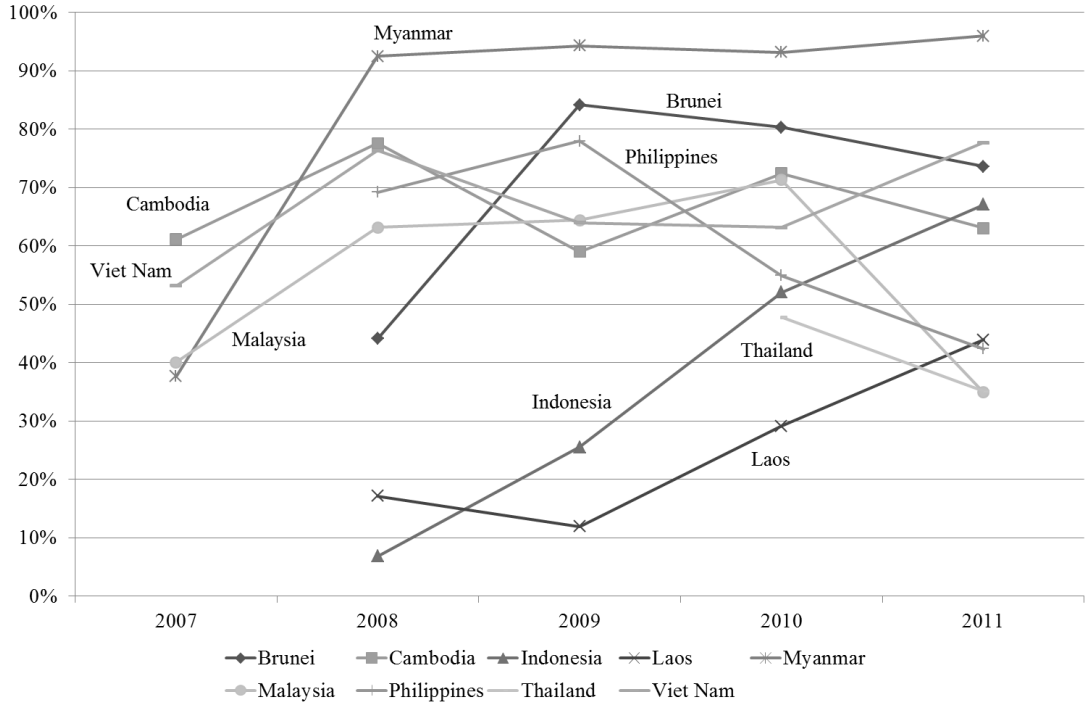


Figure 2. Changes in Nominal Exchange Rates against KRW (2006 = 100)



Source: ASEAN Stats and World Development Indicators

Figure 3. Changes in AKFTA Utilization Rates



Source: Authors' calculations based on data from the Korea Customs and Trade Data Institute (KCTDI).

Appendix. Partial PTM

In this appendix, we examine a case where final- and intermediate-good exporters follow partial PTM. The structure of the model is basically same as in Section 2. On firms' pricing behavior, we follow Corsetti and Pesenti (2005). By definition of ERPT elasticity $\eta \equiv -\partial \ln \tilde{P}^{X*}(f)/\partial \ln \varepsilon$, KRW export price of ASEAN brands is given by

$$\tilde{P}^{X*}(f) = \frac{\ddot{P}^{X}(f)}{\varepsilon^{\eta}}, \qquad 0 \le \eta \le 1. \tag{A1}$$

ASEAN firms choose $\ddot{P}^{X}(f)$ in the previous period to maximize the present discounted value of profits, that is

$$\max_{\ddot{P}^{X}(f)} E\{\delta\pi(f)\} = E\left\{\delta\left(\varepsilon^{1-\eta}\ddot{P}^{X}(f) - mc(f)\right)\left[\tau\varepsilon^{-\eta}\ddot{P}^{X}(f)\right]^{-\sigma}Y\right\}. \tag{A2}$$

First-order condition implies

$$\ddot{P}^{X}(f) = \frac{\sigma}{\sigma-1}\frac{E\{\varepsilon^{\eta\sigma}mc(f)\}}{E\{\varepsilon^{\eta\sigma}\varepsilon^{1-\eta}\}}. \tag{A3}$$

Thus, export prices denominated in KRW and an ASEAN currency are, respectively, given by

$$\tilde{P}^{X*}(f) = \frac{\sigma}{\sigma-1}\frac{1}{\varepsilon^{\eta}}\frac{E\{\varepsilon^{\eta\sigma}mc(f)\}}{E\{\varepsilon^{\eta\sigma}\varepsilon^{1-\eta}\}}, \qquad P^{X}(f) = \frac{\sigma}{\sigma-1}\varepsilon^{1-\eta}\frac{E\{\varepsilon^{\eta\sigma}mc(f)\}}{E\{\varepsilon^{\eta\sigma}\varepsilon^{1-\eta}\}}. \tag{A4}$$

Combining (14), (15) and (A4), the value-added ratio is rewritten as

$$R(f) = 1 - \frac{p_1\left(\frac{\gamma}{1-\gamma}\frac{p_2}{p_1}\right)^{1-\gamma}}{\frac{\sigma}{\sigma-1}\varepsilon^{1-\eta}\frac{E\{\varepsilon^{\eta\sigma}mc(f)\}}{E\{\varepsilon^{\eta\sigma}\varepsilon^{1-\eta}\}}}. \tag{A5}$$

ε affects p_1 if ASEAN firms use intermediate inputs imported from Korea. Defining ERPT elasticity of p_1 by $\eta_1 \equiv \partial \ln p_1/\partial \ln \varepsilon$, partial derivative of $R(f)$ with respect to ε is derived as

$$\frac{\partial R(f)}{\partial \varepsilon} = \frac{\sigma-1}{\sigma}\frac{\left(\frac{\gamma}{1-\gamma}\frac{p_2}{p_1}\right)^{1-\gamma}\frac{p_1}{\varepsilon}[(1-\eta)-\gamma\eta_1]}{\varepsilon^{1-\eta}\frac{E\{\varepsilon^{\eta\sigma}mc(f)\}}{E\{\varepsilon^{\eta\sigma}\varepsilon^{1-\eta}\}}}. \tag{A6}$$

(A6) indicates that Lemma 1 and Proposition 1 hold if $(1-\eta)-\gamma\eta_1 > 0$. In other words, a depreciation of an ASEAN currency against KRW enhances firms' likelihood to comply with RoOs and raises FTA utilization rate if the impact of exchange rates on KRW export price dominates that on the cost of non-originating imported inputs. Lemma 2 and Proposition 2 are expected to hold as impacts of σ on $E\{\varepsilon^{\eta\sigma}mc(f)\}$ and $E\{\varepsilon^{\eta\sigma}\varepsilon^{1-\eta}\}$ offset each other and those on $(\sigma-1)/\sigma$ should work significantly.