Exchange Rate and Utilization of Free Trade Agreement: Perspective of 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 through changing so-called value-added ratio, which is defined as one minus a ratio of non-originating input price to export product price. We present theoretical demonstration on this potential linkage, and provide empirical examination with rich tariff-line-level data on the utilization of FTA schemes in Korea's imports from ASEAN countries. Our theoretical framework proposes that a depreciation of exporters' currency against importers' currency enhances FTA utilization through improving value-added ratio, and those effects are stronger for products with higher demand elasticity. We also show strong empirical supports to those theoretical predictions.

Keywords: Free trade agreement; Exchange rates; Exchange rate pass-through; Rules of origin
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1. Introduction

In this study, we introduce monetary aspects into discussion on free trade agreements (FTAs). Large amount of studies on FTAs have been conducted from the standpoint of international trade. A typical study is to examine the effects of FTAs on

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trade between FTA member countries or trade with non-member countries. Examples include 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. Marmolejo (2011) is one of limited examples. He examines how the FTA's entry into force affects exchange rate pass-through (ERPT) and presents that FTAs have direct and indirect effects to alter ERPT. In order to deepen our understanding, 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 in this study. Several studies have empirically examined the elements that affect preference utilization rates, which are defined as the share of imports under preference schemes in total imports. Most previous studies have investigated the utilization of unilateral tariff schemes. For example, 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 the trade of the EU and the US with their preferential trading partners. Francois et al. (2006) and Manchin (2006) examined the preferential trade relations of the EU and non-least-developed African, Caribbean, and Pacific (ACP) countries under the Cotonou Agreement, while Hakobyan (2015) examined US GSP utilization by 143 GSP-eligible countries. These studies consistently found that the utilization rates of preferential schemes are higher for products with a larger tariff margin (i.e. a larger difference between general tariff rates and FTA rates) or larger shipments.

When utilizing FTA rates, exporters need to comply with rules of origin (RoOs).[1] There are several types of RoOs including the regional value content (RVC) rule, change-in-tariff classification (CTC) rule, technical requirement/specific process (TECH) rule, and wholly-obtained (WO) rule. For example, the RVC rule determines the country of origin of goods by examining whether the total values of the inputs imported from non-member countries (called "non-originating inputs") occupy less than a certain share (e.g. 40 percent) of prices in export products. Such a ratio of input prices to export product prices is called the "value-added ratio." The CTC rule requires export products to have a

[1] 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 the non-trivial costs 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).

different tariff classification from non-originating inputs. Any of these rules or a combination of them are set for each product as RoOs under each FTA scheme.[2]

Exchange rates potentially play an important role in compliance with RoOs. Suppose a case where the exporter's currency depreciates to the importer's currency, noting that the value-added ratio is defined as one minus a ratio of a non-originating input price to an export product price. These prices are denominated in exporter's currency. Provided that, following existing studies,[3] ERPT is generally incomplete and part of exchange rate changes are reflected onto 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.[4] Exchange rates play important role also in compliance of the CTC rule. In the case of CTC, the so-called "De Minimis" rule is often available as a bailout measure, which allows non-originating inputs to have the same tariff classification if those inputs occupy only a certain small share in prices of export products (e.g. 10 percent). Thus, effects of exchange rates take place in a similar way to the case of the RVC rule. As a result, for both the RVC rule and CTC rule, the export prices and the values of non-originating inputs are crucial in determining compliance with RoOs. The depreciation of exporters' currency against importers' currency is supposed to improve the value-added ratio, ensuring compliance with RoOs, and thus enhancing FTA utilization.[5]

In this paper, we theoretically and empirically examine the above relationship between exchange rates and FTA utilization. In the theoretical part, we derive mainly two predictions. One is that, as mentioned above, depreciation of the exporter's currency against the importer's currency enhances FTA utilization. The other is that such effects of exchange rates become larger when exporting products with higher demand elasticity.

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[2] Later, we will present the distribution of RoOs in our empirical sample FTA, which shows that RoOs related to RVC and CTC are set for more than 90 percentages of our sample.

[3] On the determinants of ERPT, many authors have examined both theoretical and empirical research not only from a macroeconomic point of view but also from a microeconomic one. See, for instance, Campa and Goldberg (2005), Choudhri and Hakura (2006), Ito and Sato (2008), and Taylor (2000) for macroeconomic determinants. Amiti, Itshoki and Konings (2014), Berman, Martin and Mayer (2012), and Cook (2014) examine the relation between firms' productivity and ERPT from a microeconomic point of view. Burnstein and Gopinath (2013) give a comprehensive review of the literature. All of these studies present the existence of incomplete ERPT. For instance, Campa and Goldberg (2005) find that the degree of short-run ERPT into import prices is 0.61 in average for OECD countries.

[4] In this sense, changes in exchange rates may also affect the utilization of GSP in the U.S., in which RoOs are set to 35 percent RVC rules.

[5] The effect of exchange rates on FTA utilization receives practical attention. For example, the Japan Chamber of Commerce and Industry, which is the party in charge of issuing certificates of origin in Japan, recommends firms periodically (e.g., every month) to check the change of exchange rates and confirm whether or not to comply with RoOs.

The value-added ratio is practically defined as a concave function of export price and thus exchange rates. Thus, the effect of exchange rates on value-added ratio is increasing in the demand elasticity as higher demand elasticity leads to lower markup of export price. Given that economy-wide 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 examine these theoretical predictions for exports from the Association of South East Asian Nations (ASEAN) countries to Korea. To do this, we employ the rich tariff-line level data on FTA utilization of ten ASEAN countries exporting to Korea during the period of 2007-2011. In this trade flow, ASEAN countries can use ASEAN-Korea FTA (AKFTA) schemes. AKFTA on trade in goods entered into force on 1 June 2007 between Korea and ASEAN member countries. To examine the role of exchange rates, we need their sufficient variation, which can be obtained by including many years and many countries into estimation sample. 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. 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 among member countries. In such a process, exchange rates will play a significant role. As a result, our empirical investigation supports the above-mentioned theoretical predictions. Those findings contribute to deepening our understanding of how macro-economic conditions (i.e. exchange rates) can affect micro-economic policy effects (i.e. FTA utilization).

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

2. Theoretical Framework

This section proposes a potential channel through which exchange rates 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 FTA tariff scheme only when they comply with RoOs. Based on the setup, we provide testable predictions.

2.1. Firms

To explicitly demonstrate the linkage between exchange rates and value-added ratio which plays a key role for compliance with RoOs, we assume that the production technology of ASEAN firms follows a Leontief function[6]

$$y(\rho) = \min\{a(\rho)n(\rho), m(\rho)\},$$

where $a(\rho)$ is the labor productivity of Firm ρ, $n(\rho)$ is labor input, and $m(\rho)$ is the Cobb-Douglas function represented as

$$m(\rho) = [m_1(\rho)]^{\gamma}[m_2(\rho)]^{1-\gamma}.$$

$m_1(\rho)$ and $m_2(\rho)$ are intermediate inputs purchased from AKFTA member and non-member countries, respectively. The assumption of Leontief production function leads to the following relations:

$$n(\rho) = \frac{y(\rho)}{a(\rho)}, \quad m(\rho) = y(\rho),$$

The first equation above implies that firms with better labor productivity input smaller amount of labor. Firms' cost minimization over intermediate inputs from AKFTA member and non-member countries leads to following demand schedules:

$$m_1(\rho) = \gamma\frac{p}{p_1}m(\rho), \qquad m_2(\rho) = (1-\gamma)\frac{p}{p_2}m(\rho).$$

p_1 (p_2) is the unit price of intermediate inputs from member (non-member) countries which is assumed to be exogenous and denominated in the currency of ASEAN firms.[7] p is the cost index for intermediate inputs defined by

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

As a result, marginal cost is derived as

$$mc(\rho) = \frac{w}{a(\rho)} + p.$$

Thus, marginal cost is revealed to be lower for firms with better labor productivity.

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[6] The assumption of a Leontief production function enables us to derive value-added ratio in a straightforward way, and dramatically simplifies our theoretical analysis. Extension of our theoretical framework by employing more generalized function such as a constant elasticity of substitution (CES) function leads to richer qualitative consequences but such an extension does not necessarily deny our theoretical predictions. Thus, we use a Leontief function to capture potential linkage between exchange rates and FTA utilization in a simple way.

[7] Amiti et al. (2014) explicitly discuss the role of imported intermediate inputs in determining the degree of ERPT. In contrast, we assume that import prices are stabilized in terms of importers' currency as a result of firms' PTM tendency. However, this assumption is just a simplification and not critical for our qualitative predictions as far as the effect of exchange rates on export price dominates that on the cost for non-originating inputs. Furthermore, it is naturally expected that the effect of exchange rates on export price dominates that on the cost for non-originating inputs as the cost for non-originating inputs has to be a certain part of export price so that a firm gains a positive profit.

2.2. Pricing

Let $P^{X*}(\rho)$ be consumer unit price, which includes tariff and transportation cost, of the output of Firm ρ denominated in the importer's currency. Assuming monopolistic competition in Korean market, we let the following function represent the demand on each product:

$$q(\rho) = [P^{X*}(\rho)]^{-\sigma} Y. \quad (1)$$

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

To investigate how exchange rates affect FTA utilization, we introduce price rigidity employing pre-set price assumption used in studies such as Corsetti and Pesenti (2001) and Devereux et al. (2007). Specifically, prices are set in advance to observe exchange rates in the current period. Thus, unexpected changes in exchange rates do not affect invoice-currency prices which are set in advance. Further, we suppose the existence of firms' pricing-to-market (PTM) behavior to demonstrate the potential effect of exchange rate changes on value-added ratio. In other words, Korean won (KRW) prices are set in advance to observe current level of exchange rates. As a result, price setting decision is described in the following manner:

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

where ε is the exchange rate of the importer's currency (ASEAN currency) to the exporter's currency (KRW), and $\tilde{P}^{X*}(\rho)$ is KRW export price.

Letting T and τ, respectively, represent one plus tariff rate ($T > 1$), which depends on the tariff scheme, and iceberg transportation cost ($\tau > 1$), the relation between consumer price and KRW export price is given by

$$P^{X*}(\rho) = T\tau \tilde{P}^{X*}(\rho). \quad (2)$$

Exporters maximize expected profits given the marginal cost, tariff rate, and transportation cost.[8] First order condition leads to the price equation

$$\tilde{P}^{X*}(\rho) = \frac{\sigma}{\sigma - 1} \frac{mc(\rho)}{E\{\varepsilon\}}. \quad (3)$$

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

[8] We do not explicitly consider the relation between exporters' price setting and the choice of the tariff scheme. However, profit maximizing mill price becomes same for alternative tariff schemes as far as the tax rate is observed in advance.

$$P^X(\rho) = \varepsilon \tilde{P}^{X*}(\rho) = \frac{\sigma}{\sigma - 1}\frac{\varepsilon}{E\{\varepsilon\}} mc(\rho), \tag{4}$$

which implies that only unexpected changes in exchange rates lead to changes in export price.[9]

2.3. Exchange Rate and Value-added Ratio

As we repeatedly noted, so-called value-added ratio plays a key role for exporters' compliance with RoOs and utilization of FTA schemes. Practically, there are two types of formulation on value-added ratio. One is build-down method ($R^{\mathrm{D}}(\rho)$), which is defined as

$$R^{\mathrm{D}}(\rho) \equiv \frac{P^X(\rho) - P^I(\rho)}{P^X(\rho)} = 1 - b(\rho). \tag{5}$$

$P^I(\rho)$ 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 $b(\rho)$ is the share of costs of non-originating inputs in export prices (i.e., $b(\rho) \equiv P^I(\rho)/P^X(\rho)$). The other is the build-up method ($R^U(\rho)$) and is equal to $b(\rho)$. Final-good exporters are allowed to utilize AKFTA preferential rates only if value-added ratio reaches a given level in the case of build-down method (e.g., 40 percent in the case of RVC) or if it falls below a given level (e.g., 60 percent in the case of RVC) in the case of build-up method. We consider $R^{\mathrm{D}}(\rho)$, which is adopted in the FTA that is empirically examined later (i.e., AKFTA).[10]

Using the notation in above theoretical setup, $P^I(\rho)$ can be written as

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

Value-added ratio, $R^{\mathrm{D}}(\rho)$, can be rewritten by

$$R^{\mathrm{D}}(\rho) = 1 - \frac{p_1 \left(\frac{\gamma}{1-\gamma}\frac{p_2}{p_1}\right)^{1-\gamma}}{\frac{\sigma}{\sigma-1}\frac{\varepsilon}{E\{\varepsilon\}} mc(\rho)}.$$

Thus, we can easily prove that

$$\frac{\partial R^{\mathrm{D}}(\rho)}{\partial \varepsilon} > 0.$$

Assuming that prices are pre-set and final- and intermediate-good exporters follow PTM manners, a depreciation of exporter's currency leads to a rise of ASEAN currency export price and an improvement of value-added ratio.[11] This happens for all exporters as

[9] This export price is exclusive of tariff and transportation cost to be consistent with the practical definition of value-added ratio.

[10] Our theoretical results are qualitatively unchanged even if we employ build-up method.

[11] As for final-good exporters, we also assumed that intermediate-good exporters follow the PTM

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 importer's currency.*

According to the lemma, we expect that firm-level likelihood of complying with RoOs is larger when exporter's currency is cheaper relative to importer's currency.[12]

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 examine the relation:

$$\frac{\partial}{\partial \sigma}\left[\frac{\partial R^{\mathrm{D}}(\rho)}{\partial \varepsilon}\right] > 0,$$

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 export price, $\partial R^{\mathrm{D}}(\rho)/\partial \varepsilon$ is decomposed as

$$\frac{\partial R^{\mathrm{D}}(\rho)}{\partial \varepsilon} = \frac{\partial R^{\mathrm{D}}(\rho)}{\partial P^{X}(\rho)}\frac{\partial P^{X}(\rho)}{\partial \varepsilon}.$$

Thus, $\partial[\partial R^{\mathrm{D}}(\rho)/\partial \varepsilon]/\partial \sigma$ can be rewritten by

$$\frac{\partial R^{\mathrm{D}}(\rho)}{\partial P^{X}(\rho)}\frac{\partial P^{X}(\rho)}{\partial \varepsilon} = \left[\frac{\partial}{\partial \sigma}\frac{\partial R^{\mathrm{D}}(\rho)}{\partial P^{X}(\rho)}\right]\frac{\partial P^{X}(\rho)}{\partial \varepsilon} + \frac{\partial R^{\mathrm{D}}(\rho)}{\partial P^{X}(\rho)}\left[\frac{\partial}{\partial \sigma}\frac{\partial P^{X}(\rho)}{\partial \varepsilon}\right].$$

Figure 1 graphically demonstrates the relation between exchange rates and value-added ratio for cases with high and low demand elasticity. According to Equation (5), value-added ratio is practically defined as a concave function of export price, which is depicted in the left hand side of the figure. Therefore, higher demand elasticity leads to higher derivative of value-added ratio to export price, i.e. $\partial[\partial R^{\mathrm{D}}(\rho)/\partial P^{X}(\rho)]/\partial \sigma > 0$, which appears in the first term of above equation. In contrast, higher demand elasticity leads to lower effects of exchange rates on export price ($\partial[\partial R^{\mathrm{D}}(\rho)/\partial P^{X}(\rho)]/\partial \sigma > 0$), which appears the second term of above equation. The former positive effect dominates the latter negative effect as a result of the definition of value-added ratio. As a result, partial derivative of value-added ratio by exchange rates, i.e. the slope of the tangent of R^{D} locus on the right hand side of Figure 1, is proved to be steeper when demand elasticity is higher. In sum, the following lemma can be stated:

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behavior. Thus, p_1 and p_2 do not respond to unexpected changes in ε.

[12] 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.

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

=== Figure 1 ===

2.4. Exchange Rate and Product-level FTA Utilization Rate

We cannot directly examine the effect of exchange rates on value-added ratio because our dataset does report it. Thus, based on lemmas 1 and 2, we provide testable predictions on the effect of exchange rates on the product-level FTA utilization rates, which is observable. Suppose that firms in exporting country are infinitely distributed.[13] 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 which is a member of AKFTA, to Korea. Let $Q(\rho)$ represent exports of Firm ρ denominated in the importer's currency, and Ω represent the set of firms that export using AKFTA tariff scheme. Then, product-level FTA utilization rate, U, can be described as

$$U = \frac{\int_{\Omega} Q(\rho)\, d\rho}{\int_{\Omega} Q(\rho)\, d\rho + \int_{\bar{\Omega}} Q(\rho)\, d\rho}, \tag{6}$$

where $\bar{\Omega}$ is the complementary set of Ω, i.e. the set of firms that export using MFN tariff scheme. Using equations (1) and (2), $Q(\rho)$ can be given by

$$Q(\rho) = \tilde{P}^{X*}(\rho)q(\rho) = [\tilde{P}^{X*}(\rho)]^{1-\sigma}[T\tau]^{-\sigma}Y. \tag{7}$$

Combining equations (3), (6), and (7), the product-level FTA utilization rate is rearranged in the following manner:

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

$$= \left(1 + \frac{\mu^{\sigma} \int_{\bar{\Omega}} [mc(\rho)]^{1-\sigma}\, d\rho}{\int_{\Omega} [mc(\rho)]^{1-\sigma}\, d\rho} \right)^{-1}.$$

Here, T^{FTA} and T^{MFN} are one plus FTA and MFN tariff rate, respectively. μ is T^{FTA} over T^{MFN} ($\mu \equiv T^{FTA}/T^{MFN}$) and we call it as *tariff ratio*. From the above equation, we can easily find that a fall of tariff ratio leads to a rise of product-level FTA utilization rate. In other words, product-level FTA utilization rates becomes higher when the margin

[13] We do not assume the fixed cost for market entry 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.

between FTA and MFN tariff rates is larger. This consequence is consistent with existing studies reviewed in Section 1, and will be empirically tested in the following sections of this paper.

Remembering that marginal cost does not depend on exchange rates and Ω ($\bar{\Omega}$) is increasing (decreasing) in ε as implied by Lemma 1, we can state the following proposition:

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

Since a depreciation of exporters' currency to importers' currency improves value-added ratio of exporters, more exporters comply with RoOs, and product-level FTA utilization rates rise. It should be noted that the consequence significantly depends on the assumption of PTM behavior of exporters. However, as is suggested by a large amount of existing studies, the consequence qualitatively holds to the extent that ERPT into export prices is incomplete.

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

Corollary: *The effect of exchange rates on the product-level FTA utilization rates becomes larger for products with higher elasticity of demand to export prices.*

In the following sections, we empirically examine above Proposition and Corollary.

3. Empirical Framework

This section specifies the empirical framework to examine the above testable predictions for Korea's import. As of February 2013, Korea has eight FTAs that have become effective (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. Our focus on one specific FTA is 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 the length of years after the entry into force and the number of member countries. Our analysis was conducted for the period of 2007-2011 at Korea's tariff-line level (nine-digit level). 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. Indonesia, Malaysia, Myanmar, Singapore, and Vietnam were the first group of signatories to give effect to AKFTA on 1 June 2007. This was followed by the Philippines (1 January 2008), Brunei (1 July 2008), Laos (1 October 2008), Cambodia (1 November 2008), and Thailand (1 January 2010). The tariff reduction schedule consists of two tracks, including normal track and sensitive track. The latter track is further divided into sensitive product and highly-sensitive product. Products under normal track accounted for 90% of total tariff lines and 90% of total import value in 2005, while products classified as sensitive track accounted for the remaining 10%. Tariffs on products under normal track were scheduled to be eliminated by January 2008 for Korea. On the other hand, tariff reduction for products classified under sensitive track was 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 covers only products under normal track.[14]

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

$$Utilization_{ict} = \beta_1 Margin_{ict} + \beta_2 \ln Size_{ict} + u_c + u_i + u_t + \varepsilon_{ict}, \qquad (8)$$

where $Utilization_{ict}$ represents the AKFTA utilization rates (i.e., the share of trade values under FTA schemes in total trade values) in exporting product i from country c in 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 our theoretical framework suggested, this variable is expected to positively affect $Utilization_{ict}$. $Size_{ict}$ is measured by the average of monthly exports of product i from country c in year t.[15] This variable

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

[15] Most of the 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 and called these data "pseudo-transaction-level" trade values. Due to the availability of the data, this paper uses the product-country-level monthly trade values, which meet a medium level of accuracy as a

controls for transaction sizes in FTA utilization. As found in the 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 effects of RoOs, which are defined at an HS six-digit level in the case of AKFTA.

We extend the typical estimation equation (8) to examine the role of exchange rates stated in the proposition. We introduce the exchange rates of each ASEAN country's currency against KRW (i.e., against the currency of the export destination country), which is denoted by $Exchange$.[16] As a result, our empirical specification becomes as follows:

$$Utilization_{ict} = \beta_1 Margin_{ict} + \beta_2 \ln Size_{ict} + \beta_3 \ln Exchange_{ct} + \beta_4 \ln GDP\ per\ Capita_{ct} + u_c + u_i + u_t + \varepsilon_{ict}. \quad (9)$$

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

We basically estimate this model by the ordinary least square (OLS) method. We also use the fractional logit method proposed by Papke and Wooldridge (1996) since our dependent variable lies in the unit interval, i.e., [0, 1]. However, it becomes difficult to obtain the convergence of likelihood in the estimation when controlling for our fixed effects, particularly HS nine-digit-level fixed effects. Therefore, we introduce RoOs fixed effects 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 fixed effects. Furthermore, we cluster standard errors in HS nine-digit codes.

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). The data on $Size$ were obtained from World Trade Atlas. In the empirical analysis, we exclude Singapore from our sample export

proxy for 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 USD given the fact that major invoicing currency in Asia is USD. However, estimation results do not change at all due to our inclusion of year fixed effects, which capture exchange rates of KRW against USD.

[17] http://aseanstats.asean.org/. Results are unchanged if we use exchange rates of ASEAN currencies against the U.S. dollar (USD) considering the fact that USD is well used as invoicing currency in international trade among Asian countries.

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 will choose their tariff scheme from among MFN rates, bilateral FTA rates, and multilateral FTA rates rather than simply from between MFN rates and FTA rates. Since our aim is not to examine such complicated decisions on tariff schemes, we chose not to examine the FTA utilization in exporting from Singapore to Korea.

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. Except for Vietnam, their currencies were stable against the KRW afterwards. Vietnam's currency depreciated by nearly 35 percent from 2009 to 2011.

=== Figure 2 ===

Figure 3 shows the changes in AKFTA utilization rates when exporting from each ASEAN country to Korea, defined as the share of the exports under the AKFTA scheme in total exports of AKFTA eligible products. Based on the year of entry into force, the starting year 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. For example, while Thailand, Laos, and Malaysia have low rates (around 35 percent in 2011), the utilization rates are relatively high when exporting from Myanmar, Brunei, and Vietnam (around 75 percent - 95 percent).

=== Figure 3 ===

Table 1 reports the distribution of RoOs in AKFTA. In AKFTA, 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 percent or 50 percent as a cutoff for the necessary value-added shares of originating inputs. Additionally, the cutoff in De Minimis in AKFTA is 10 percent. Thus, in the case of AKFTA, it is possible that the compliance of RoOs in exporting products with RVC- or CTC-related RoOs is affected by exchange rates. Namely, except for products with WO (just 9 percent of all products), all products are categorized as such. In addition, as mentioned later, we need to pay some attention to the rule that the De Minimis

for HS50-63 products is weight-based, not value-based.[18]

=== Table 1 ===

4. Empirical Results

In this section, we present the estimation result on the analysis on the proposition. After conducting the robustness check on this result, we also empirically examine the corollary. The basic statistics for the estimation sample are provided in Table 2

=== Table 2 ===

4.1. Baseline Results

The baseline estimation results are reported in Table 3. Columns "OLS" and "Fractional" present the results with the OLS and fractional logit models, respectively. The results are qualitatively same for those two cases. The coefficient for exchange rates is related to the statement in above proposition and is estimated to be positive and significant. From the quantitative viewpoint, the OLS estimation suggests that a ten percent depreciation of the exporter's currency against KRW leads to a 2.3 percent point rise in FTA utilization rates. This result implies that the depreciation of ASEAN currencies against KRW improves the export profit and value-added ratio evaluated in ASEAN currencies and thus significantly encourages ASEAN exporters to utilize AKFTA scheme. In short, this empirical result supports our proposition.

=== Table 3 ===

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 for tariff margin is significantly positive, indicating that ASEAN exporters are more likely to use the AKFTA scheme when the AKFTA scheme is more attractive in terms of tariff payment relative to the case of MFN scheme. The coefficient for trade sizes is also significantly positive, implying that the AKFTA utilization rates are higher when transaction size is larger. The coefficient for GDP per capita is significantly positive. This finding suggests that the

[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*.

AKFTA scheme is more likely to be used when exporters' country is more developed possibly because exporters in such countries have better knowledge and experiences to deal with documentation preparation for AKFTA utilization.

4.2. Robustness Check

We conducted three kinds of robustness checks on the above results. First, from our estimation sample, we dropped products that have WO criterion as RoOs or those that are categorized into HS 50-63. We thus call this a "restrictive sample". The rationale for this is because, as mentioned before, it is possible for exchange rates to affect the compliance of RoOs only in the case of RVC- or CTC-related RoOs, and because De Minimis rules are weight-basis rather than value-basis in the case of products categorized into HS50-63. This practical fact implies that, the potential channel that we demonstrated in our theoretical section does not work in the dropped samples. The results are reported in column (I) of Table 4. While the coefficient for GDP per capita turned out to be insignificant, that for exchange rates was still positively significant.

=== Table 4 ===

Second, we employed the instrumental variable (IV) method in order to tackle the endogeneity issues in $Size$. As pointed out in 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 countries (which implies that there is an import demand in Korea for the given product) and zero otherwise (Rest of ASEAN). The results are reported in column (II) of Table 4 for the restricted sample.[19] The *F* statistic is sufficiently high and shows that our instrument is not weak. The results on our explanatory variables were qualitatively similar to those in Table 3 and column (I) in Table 4. In particular, the coefficient for exchange rates is again estimated to be significantly positive.

Third, we examined the "extensive margin" in FTA utilization. Exchange rates affect trade values regardless of tariff schemes used in exports. Therefore, our results of significant association between FTA utilization rates and exchange rates are possibly driven by the effects of exchange rates on trade values under MFN schemes (i.e., the

[19] The results presented in columns (II) and (III) are unchanged qualitatively when we use the full sample.

denominator in the dependent variable). In order to address this issue, we examined the model in which the dependent variable takes the value one if any positive trade values under AKFTA schemes are observed, and zero otherwise. This extensive margin of FTA utilization is examined by estimating the linear probability model (LPM), since our model includes a large number of fixed effects (e.g., HS nine-digit fixed effects). The results are reported in column (III) of Table 4. We estimate this model with the restricted sample but the result is unchanged when we use all observations. Although the coefficient for GDP is insignificant, the coefficients for all other variables are unchanged and positively significant.[20]

4.3. Demand Elasticity

In this subsection, we examine the corollary on the relation between demand elasticity and the effect of exchange rates on FTA utilization rate. To do that, we add an interaction term of the 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, Greenfield, and Weinstein (2006) at an HS three-digit level for Korea. Considering the interaction effect of demand elasticity, the estimation equation (9) can be rearranged in the following manner:

$$Utilization_{ict} = \beta_1 Margin_{ict} + \beta_2 \ln Size_{ict} + \beta_3 \ln Exchange_{ct} + \beta_4 \ln GDP\ per\ Capita_{ct} + \beta_5 \ln Exchange_{ct} \times Elasticity_i + u_c + u_i + u_t + \varepsilon_{ict}. \quad (10)$$

According to the corollary, 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 IV and LPM estimation techniques, as done in Section 4.2.

The results are reported in Table 5. The results reported are based on the restricted sample but those results are unchanged even when we use the full sample. The effect of exchange rates is again estimated to be positive, supporting our theoretical proposition. Further, coefficient β_5 was estimated as positive, implying that the effect of exchange rates on FTA utilization is larger when exporting involves products with higher demand elasticity. In other words, our estimation supports Corollary. These results are robust based for IV and LPM models. In sum, we can state that the depreciation of the export country's currency against the KRW contributes to enhancing FTA utilization rates

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

possibly through the rise of export product prices evaluated in the export country's currency. Furthermore, such a positive effect becomes larger when exporting products with higher demand elasticity.

=== Table 5 ===

5. Concluding Remarks

This paper investigated how exchange rates affect firms' FTA utilization. From a practical point of view, exchange rates have a potential influence on FTA utilization in exporting, through the compliance of RoOs, i.e., value-added ratio. Our theoretical and empirical analyses robustly showed that depreciation of final-good exporters' currency against the currency of the destination country 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 through a relative fall of prices in terms of importers' currency relative to prices of products from other countries. In addition, our findings in this paper suggest that it also encourages firms to use FTA schemes. Since trade values mostly increase when switching from MFN schemes to FTA schemes because of the lower tariff rates, the depreciation of domestic currency may increase more greatly than only when considering above typical effect through relative price changes.

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Table 1. Distribution of RoOs in AKFTA at 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 * Elasticity	40,738	-5.459	45.102	-774.868	383.731
Margin	40,738	8.579	4.080	1	50
ln Sizes	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

	OLS	Fractional
ln Exchange rates	0.230***	0.588*
	[0.047]	[0.340]
Margin	0.012***	0.030***
	[0.001]	[0.006]
ln Size	0.068***	0.553***
	[0.001]	[0.010]
ln GDP per capita	0.217***	0.628*
	[0.046]	[0.324]
RoO Dummy	NO	YES
Exporter FE	YES	YES
HS Nine-digit FE	YES	NO
HS Section FE	NO	YES
Year FE	YES	YES
Number of observations	40,738	40,738
Adjusted R-squared	0.5058	
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 in total imports. The parentheses are 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 all specifications, we include export country dummy variables, year dummy variables, and HS nine-digit code dummy variables. In the column "Restricted", we drop products that have wholly-owned criterion as RoOs or those that are categorized into HS 50-63.

Table 4. Robustness Checks

Estimation	OLS	IV	LPM
	(I)	(II)	(III)
ln Exchange rates	0.124**	0.124**	0.158**
	[0.062]	[0.062]	[0.074]
Margin	0.012***	0.012***	0.008***
	[0.002]	[0.002]	[0.002]
ln Size	0.062***	0.054***	0.080***
	[0.001]	[0.001]	[0.001]
ln GDP per capita	0.075	0.072	0.111
	[0.065]	[0.065]	[0.077]
Cragg-Donald Wald F statistic		1.1E+04	
Number of observations	30,594	30,594	30,594
Adjusted/Centered R-squared	0.4903	0.5536	0.4877

Notes: In this table, we drop products that have wholly-owned criterion as RoOs or those that are categorized into HS 50-63. In columns "IV", we employ the instrument variable method. We use as an instrument for Sizes, a binary variable that takes the value one if Korea imports a concerned product from any other ASEAN countries and zero otherwise (Rest of ASEAN). The dependent variable in columns "OLS" and "IV" is the share of imports under AKFTA in total imports. Columns "LPM" report the results for the linear probability model, in which the dependent variable takes the value one in the case of positive trade values under FTA schemes and zero otherwise. The parentheses are robust standard errors. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. In all specifications, we include export country dummy variables, year dummy variables, and HS nine-digit code dummy variables.

Table 5. Export Elasticity

Estimation	OLS	IV	LPM
	(I)	(II)	(III)
ln Exchange rates	0.125**	0.126**	0.160**
	[0.062]	[0.062]	[0.074]
ln Exchange rates * Elasticity	0.0001**	0.0001**	0.0001***
	[0.000]	[0.000]	[0.000]
Margin	0.012***	0.012***	0.008***
	[0.002]	[0.002]	[0.002]
ln Size	0.062***	0.054***	0.082***
	[0.001]	[0.001]	[0.001]
ln GDP per capita	0.077	0.073	0.114
	[0.065]	[0.065]	[0.077]
Cragg-Donald Wald F statistic		1.1E+04	
Number of observations	30,594	30,594	30,594
R-squared/Centered R-squared	0.4904	0.5537	0.4878

Notes: In this table, we drop products that have wholly-owned criterion as RoOs or those that are categorized into HS 50-63. In columns "IV", we employ the instrument variable method. We use as an instrument for Sizes, a binary variable that takes the value one if Korea imports a concerned product from any other ASEAN countries and zero otherwise (Rest of ASEAN). The dependent variable in columns "OLS" and "IV" is the share of imports under AKFTA in total imports. Columns "LPM" report the results for the linear probability model, in which the dependent variable takes the value one in the case of positive trade values under FTA schemes and zero otherwise. The parentheses are robust standard errors. ***, **, and * indicate 1%, 5%, and 10% significance, respectively. 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

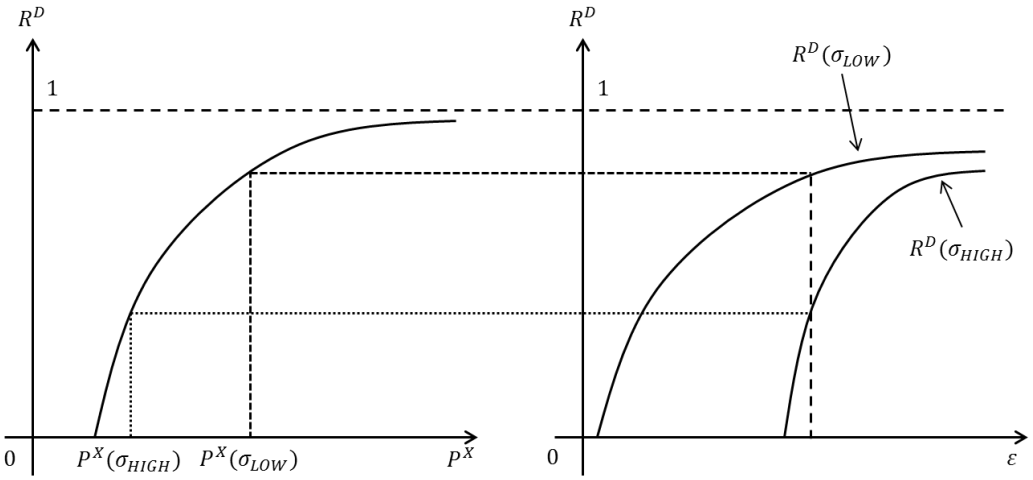
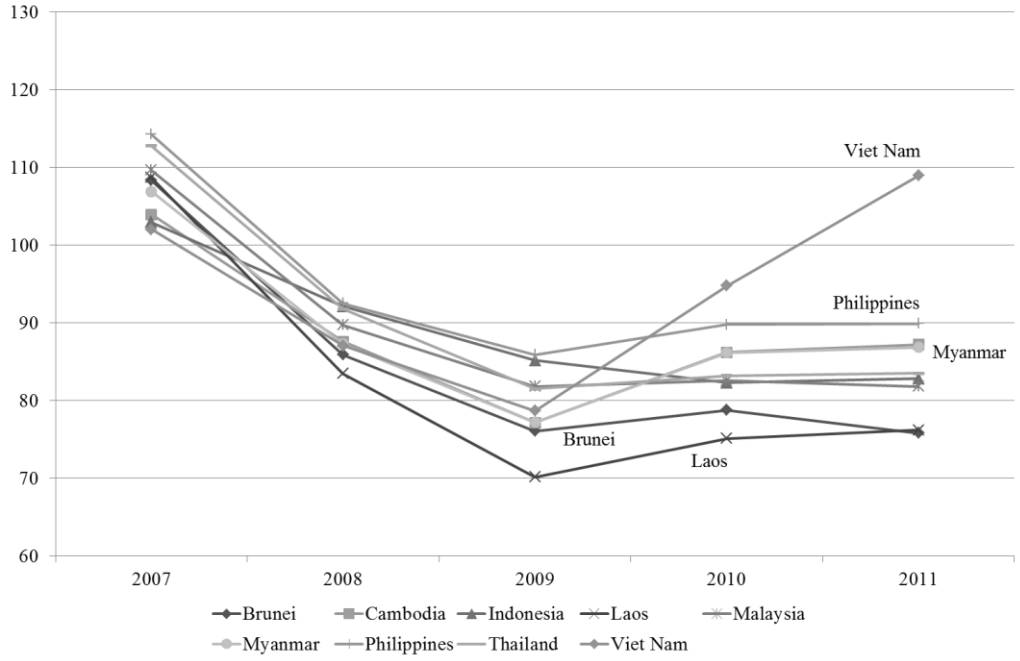
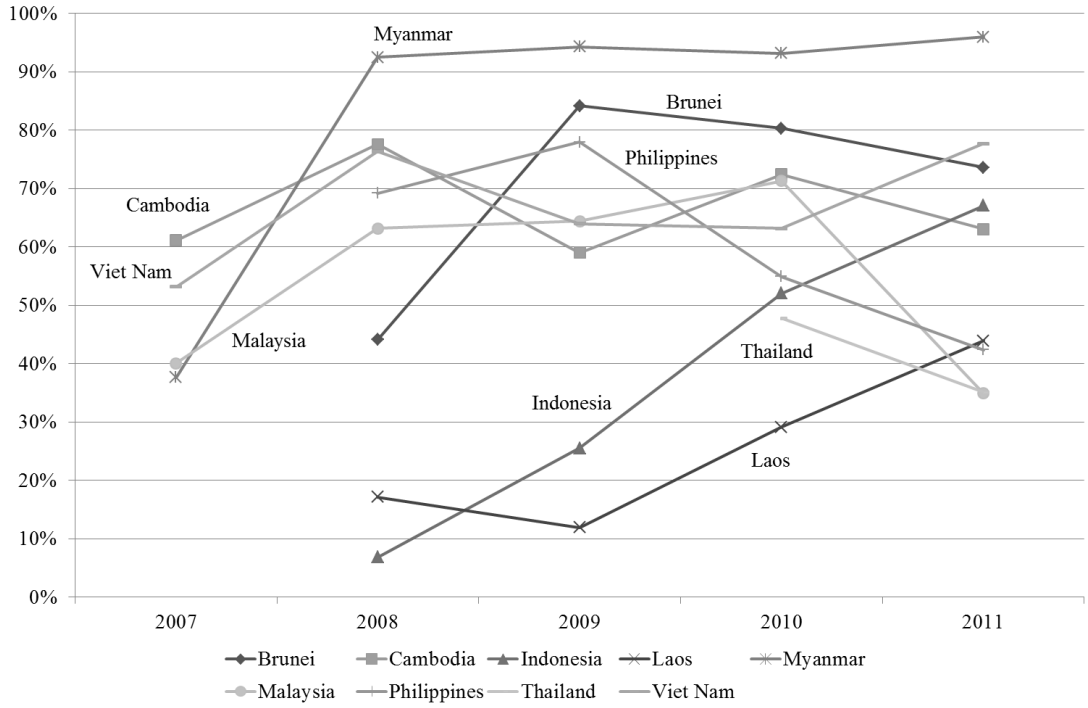


Figure 2. Changes in Nominal Exchange Rates against KRW (2006 = 100)



Source: ASEAN Stat 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).