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The Role of Vehicle Currency in ASEAN-EU Trade: A Double-Aggregation Method*

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Abstract

This study is the first to scrutinize how real effective exchange rate, together with the vehicle currency exchange rate, asymmetrically influences the total trade balance between ASEAN (Association of Southeast Asian Nations) and the EU (European Union). This research employs quarterly data between 2000Q1 and 2018Q1, which is derived from several sources. We introduce a method for constructing the double-aggregated real effective exchange rate between ASEAN and the EU that captures the roles of all their currencies. Moreover, we propose the formula to compute vehicle currency exchange rate to assess the importance of vehicle currency in ASEAN-EU trade. Additionally, as asymmetrical impacts of exchange rate on trade balance are well documented by current studies, we employ Nonlinear Autoregressive Distributed Lag (NARDL) model of Shin et al. (2014) to analyze the impacts of currency depreciation as well as appreciation in detail. The findings confirm the prominence of USD as vehicle currency in ASEAN-EU trade. Both depreciation and appreciation of ASEAN's currencies against USD can foster ASEAN's trade balance in the long run. Short-run asymmetrical impacts as well as J-curve effect are found in the vehicle currency models only. The results are robust for the cases of EU-28 and EU-27.

Keywords: ASEAN, EU, Double-aggregation Method, Trade Balance, Vehicle Currency

JEL Classification Code: F10, F31, F40

1. Introduction

The globalization of trade between the host country and the rest of the world has added a large amount of value to the economy. Furthermore, many countries in the world have devalued or revalued their currencies as a result of time-dependent exchange rate systems (Nguyen & Do, 2020). Devaluation of domestic currency can foster a country's trade balance in the long run if the Marshall-Lerner condition is satisfied: the sum of export and import price elasticities in absolute values exceeds one (Wilson, 2001; Purwono et al., 2018). Further, when trade balance reacts negatively under the influence of currency devaluation in the short run and then positively in the long run, the J-curve effect is evidenced (Magee, 1973; Rose & Yellen, 1989). Another way to look at J-curve effect is observing the pattern of short-run coefficients of exchange rate (Bahmani-Oskooee, 1985). Based on the aforementioned frameworks, a myriad of studies have examined the exchange rate-trade balance linkage in many countries, and their development goes in line with the introduction of new econometric methods (Bahmani-Oskooee & Ratha, 2004; Bahmani-Oskooee & Hegerty, 2010; Bahmani-Oskooee & Fariditavana, 2015; Phong et al., 2019; Abbas et al., 2020; Bhat & Bhat, 2021). It is now well documented that exchange rate asymmetrically impacts trade balance in many cases, and thus linear assumption can be unhelpful (Bahmani-Oskooee & Fariditavana, 2016; Bahmani-Oskooee & Aftab, 2018; Bahmani-Oskooee & Kanitpong, 2019). Hence, asymmetrical impacts of exchange rate need to be assessed to enable more detailed findings.

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Virtually all studies neglect the role of vehicle currency – a third-country currency used in the trade of two countries (Magee & Rao, 1980) when analyzing the exchange rate-trade balance nexus, which can be deemed a common weakness. This is a considerable problem when a vehicle currency such as USD is mainly employed in the export and import of a country (or region) and her trading partners, and thus conventional studies that only report the results of bilateral exchange rates can lack important characteristics as well as useful policy recommendations. In fact, USD has long been the world-leading vehicle currency for several decades, and it is utilized in nearly 88% of international transactions (Krugman, 1980; Bank for International Settlements, 2016, 2019). Furthermore, available statistics show that USD is heavily used as vehicle currency in the EU as well as ASEAN countries. Specifically, in the period 2000–2018, USD is the most employed currency in the trade between the EU and non-EU partners, and its utilization rate is always higher than the second most important one (i.e., euro) (Eurostat, 2019). Yang and Gu (2016) mentioned that USD is the major currency used in the international trade of Singapore, and they also affirmed the essential role of USD as vehicle currency in Singapore-China trade. Goldberg and Tille (2008) demonstrated that USD occurred in 66% and 83.9% of the total trade invoicing in Malaysia and Thailand. Additionally, USD maintains its dominant position in Thailand's international trade (Lai & Yu, 2015; Bank of Thailand, 2019). Besides, in the case of Vietnam, 90% of the export and import transactions are invoiced in USD (Agency of Vietnam's Ministry of Finance, 2018). Consequently, from the above statistics, it can be inferred that USD is the crucial vehicle currency in the trade between ASEAN and the EU, and it should not be neglected.

Albeit manifold J-curve studies are available for ASEAN as well as EU individual countries, the inter-regional trade between the whole ASEAN and the entire EU has not been scrutinized even though these two groups are the reciprocally vital trading partners of each other. Namely, ASEAN is the EU's third largest trading partner while the EU is only behind China as ASEAN's biggest trading partner (European Commission, 2020). Further, no research has inspected the asymmetrical influences of real effective exchange rate as well as vehicle currency exchange rate on ASEAN's trade balance with the EU. Thus, this paper aims to fill the aforesaid gap. In order to effectively capture the exchange rate between ASEAN and the EU, we introduce a method for constructing double-aggregated real effective exchange rate that reflects the roles of all currencies in the two regions. Moreover, we also propose the formula to calculate the vehicle currency exchange rate to examine the importance of USD in ASEAN-EU trade. Also, we apply Nonlinear Autoregressive Distributed Lag (NARDL) model of Shin et al. (2014) to assess short-run and long-run impacts of both kinds of exchange rate on ASEAN's trade balance with the EU. The findings are robust for EU-28 and EU-27 and affirm the importance of USD as vehicle currency in ASEAN-EU inter-regional trade.

2. Literature Review

The exchange rate-trade balance nexus, especially the J-curve effect, has been investigated for many countries in the world including most of ASEAN members. At aggregate level, Bahmani-Oskooee (1985) proposed a method to detect J-curve phenomenon by observing the coefficients of exchange rate variable at different lag lengths. He selected four countries (Greece, India, Korea, and Thailand) with quarterly data spanning 1973–1980 and found that only Thailand did not associate with the J-curve effect. Arize (1994) utilized Johansen cointegration technique on the sample of nine countries (some of which are ASEAN members: Indonesia, Malaysia, Philippines, Singapore, and Thailand) in the period 1973Q1–1991Q1 and documented that depreciation of domestic currencies fostered trade balance in all cases except for Malaysia. Nevertheless, Yusoff (2010) reported positive impact of ringgit depreciation on Malaysia's trade balance between 1977Q1 and 1998Q2 by using VECM method. Kyophilavong et al. (2013) employed ARDL method on the 1993Q1–2010Q4 data of Laos and showed that trade balance is unresponsive to exchange rate in the long run. Phong et al. (2018) examined the impacts of real effective exchange rate on Vietnam's trade balance from 2000Q1 to 2015Q4 by ARDL approach, and their findings supported the existence of Marshall-Lerner condition as well as the J-curve effect. Phong et al. (2019) revisited the case of Vietnam by extending the time frame to 2000Q1–2018Q1 and adding more trading partners to represent the rest of the world. With the application of NARDL method, they revealed short-run and long-run asymmetrical influences of real effective exchange rate. Besides, they demonstrated that both VND depreciation and appreciation enhanced Vietnam's trade balance.

In order to reduce aggregation bias, researchers tried to employ bilateral data. Wilson and Tat (2001) inspected the Singapore-US trade during 1970–1996 and found that real exchange rate did not affect trade balance. However, Bahmani-Oskooee and Harvey (2012) spotted J-curve phenomenon in the trade balance of Singapore with respect to Canada, Philippines, Saudi Arabia and the US. Some articles devoted to other ASEAN countries can be instanced as Bahmani-Oskooee and Kanitpong (2001) for Thailand; Bahmani-Oskooee and Harvey (2009, 2017) for Indonesia; Bahmani-Oskooee and Harvey (2010) for Malaysia; Harvey (2013, 2018) for the Philippines; Bineau (2016) for Cambodia; and Kyophilavong et al. (2018) for Laos. Most of the aforementioned papers utilized ARDL or NARDL methods on time-series data, but Bineau (2016) used Fully Modified Ordinary Least Squares on panel data. Specifically, he scrutinized the impacts of exchange rate on Cambodia's trade balance with some large individual

trading partners and a group of countries, the European Union (EU), in the period 1998Q1–2014Q3. He found that currency devaluation can boost Cambodia's bilateral trade balance. A notable aspect of Bineau (2016) is that the EU was treated just like an individual country, and the exchange rate between Cambodia and the EU was also calculated by the same formula as the other trading partners. This could be somewhat unclear because there are many countries in the EU with different currencies. Therefore, the real effective exchange rate adjusted by the trade share of each EU member should be utilized instead of the bilateral one to represent the exchange rate between Cambodia and the whole EU.

Several researchers investigate the commodity trade of ASEAN countries. For example, Bahmani-Oskooee et al. (2016) employed ARDL and NARDL models to analyze the impacts of exchange rate on Malaysia's trade balance with Singapore at industry level over the period 2000M04–2014M12, and they found short-run and long-run asymmetrical effects in some cases. Bahmani-Oskooee and Aftab (2016) inspected Malaysia's trade balance with Thailand between 2000M04 and 2014M12 with the application of ARDL and NARDL methods. Their findings indicated that nonlinear method was more superior than the conventional linear one in disclosing significant results, which is compatible with the conclusions of Bahmani-Oskooee and Fariditavana (2015, 2016). Again, Bahmani-Oskooee and Aftab (2017) focused on Malaysia, but in this case, the EU was her trading partner. They used euro/ringgit exchange rate as a proxy for the exchange rate between Malaysia and the EU, which might not thoroughly reflect the movement between ringgit and all the currencies of EU members. Their results also confirmed the effectiveness of NARDL technique, and exchange rate asymmetrically influenced Malaysia's trade balance with the EU in the majority of industries. Besides, Bahmani-Oskooee and Kanitpong (2019) evaluated Thailand-China commodity trade from 2000Q1 to 2016Q4 with the application of ARDL and NARDL frameworks, and their findings also confirmed the effectiveness of the latter. Namely, under ARDL framework, baht depreciation against renminbi did not influence Thailand's trade balance with China. Nonetheless, under NARDL framework, more significant results together with asymmetric J-curve effects in 10 industries were revealed.

To the best knowledge of the authors, Ketenci and Uz's (2010) is perhaps the only research covering the trade between the two regions EU and ASEAN. Particularly, they examined the trade between the EU and individual partners (Canada, China, Japan, Norway, Russia, Switzerland, Turkey, and the US), together with some regional ones (ASEAN, CEECs, NAFTA, etc.), in the period 1980–2007 with the application of ARDL method. They separated the import demand function with the export counterpart. They documented that J-curve effect happened in the EU's exportation to Canada, China, Japan, and the NAFTA. Meanwhile, the J-curve pattern of the EU's importation was found in the case of Canada only. Besides, they did not detect cointegration in the EU's importation from ASEAN, CEECs, and NAFTA. Moreover, they demonstrated that the EU's exportation and importation were impacted by income more than exchange rate. Although the trade between EU and ASEAN is analyzed in Ketenci and Uz (2010), some facets need to be considered. First, they used only 15 countries to represent the EU and could not include Laos and Myanmar due to the unavailability of data, which may not fully reflect the exchange rate-trade balance linkage between these two regions. Second, similar to Bineau (2016), regional partners were treated like individual partners, especially when the formula to calculate exchange rate remained the same. As mentioned above, because the EU and ASEAN members have various currencies, bilateral exchange rate is not a sufficient proxy for the exchange rate between these two groups of countries. Thus, a new way of constructing double-aggregated real effective exchange rate (depicted in Section 3) can be more suitable to denote the exchange rate between ASEAN and the EU when all their currencies are included. Third, in common with Bineau (2016), Bahmani-Oskooee and Aftab (2017) as well as the vast majorities of J-curve literature, the role of vehicle currency is neglected.

3. Research Methods and Materials

So as to investigate the effect of exchange rate on ASEAN's trade balance with the EU-28, we combine the typical model used by many papers (e.g., Wilson, 2001; Kyophilavong et al., 2013; Bahmani-Oskooee & Fariditavana, 2015; Phong et al., 2018; Bahmani-Oskooee & Nouira, 2020; Bhat & Bhat, 2021) with our double-aggregation method, which is displayed as follows:

$$\ln TB_t = a + b \cdot \ln REER_t + c \cdot \ln AY_t + d \cdot \ln EY_t + e_t \quad (1)$$

In equation 1, TB is the trade balance between the whole ASEAN and the entire EU-28, measured by the ratio of ASEAN's total export value to the total import value with the EU-28. Besides, REER indicates the aggregated real effective exchange rate of ASEAN (specified in equation 2), and the increase of this variable represents the depreciation of ASEAN's currencies against the EU-28's currencies. Next, AY denotes the real income of ASEAN, computed by the formula in equation 3 where the real GDP index of each Southeast Asian country is adjusted by their respective trade share with the whole EU-28. Also, EY stands for the real income of the EU-28, calculated by the formula in equation 4 in which the real GDP index of each country in the EU-28 is adjusted by their corresponding trade proportion with the entire ASEAN. In addition, e_t is the error term, and "ln" symbolizes natural logarithm operator. The expected sign of b is positive as depreciation is presumed to foster trade balance. The signs of c and d may vary, but normally, c is expected to be negative because more import will happen

if income rises, thus lowering trade balance. Similarly, $d > 0$ is assumed if the EU-28 buy more ASEAN products as their income grows. Last but not least, all variables are under index form where the base quarter 2000Q1 is set to 100.

As conventional real effective exchange rate formula is only used for measuring the relative value of a country's currency in comparison with the basket of her partners' currencies, it cannot be applicable for the case of a group of countries like ASEAN. Hence, we introduce a new double-aggregation method to compute the aggregated real effective exchange rate that can represent the relative value of ASEAN's currencies compared to the EU-28's currencies:

$$\text{REER} = \prod_{i=1}^{10}\left(\prod_{j=1}^{28}\text{BER}_i^{w_j}\right)^{\omega_i} \tag{2}$$

In equation 2, BER_i represents the bilateral real exchange rate index between country i in ASEAN and country j in the EU-28. Additionally, w_j is the share of country j in the total trade value of the EU-28 with respect to country i. Thus, the term in bracket indicates the real effective exchange rate of each ASEAN member. After that, all real effective exchange rates of the 10 ASEAN members are adjusted by their corresponding percentage (i.e., ω_i) in the total trade value of ASEAN with the EU-28. Consequently, this method can be considered double-aggregation when all the real effective exchange rates of 10 ASEAN countries are used to create a single variable that can represent the exchange rate between ASEAN and the EU-28.

The real income of ASEAN is calculated by aggregating all real GDP indices of 10 members:

$$\text{AY} = \prod_{i=1}^{10}\text{GDP}_i^{\omega_i} \tag{3}$$

where ω_i is the trade share of each member country in ASEAN already explained in equation 2. For Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam, GDP_i is their quarterly real GDP indices. For Brunei, Cambodia, Laos, and Myanmar, due to the lack of quarterly GDP data, annual data is collected and then interpolated into quarterly frequency following the work of Kyophilavong et al. (2013) and Kyophilavong et al. (2018) when they researched the case of Laos.

Likewise, the real income of the EU-28 is computed as:

$$\text{EY} = \prod_{j=1}^{28}\text{GDP}_j^{\psi_i} \tag{4}$$

In equation 4, GDP_j signifies the real GDP index of country j in the EU-28, and ψ_i is the percentage she occupies in the total trade value of the EU-28 with ASEAN.

In order to capture the role of USD as vehicle currency, we introduce another version of equation 1 by replacing REER with RUSD:

$$\ln\text{TB}_t = a' + b'\cdot\ln\text{RUSD}_t + c'\cdot\ln\text{AY}_t + d'\cdot\ln\text{EY}_t + e'_t \tag{5}$$

In equation 5, RUSD denotes the real exchange rate between 10 ASEAN member's currencies and USD, which is clearly specified in equation 6. The increase of this variable indicates the depreciation of ASEAN's currencies against USD. Thus, $b' > 0$ implies the facilitating effect of depreciation on trade balance. RUSD is also converted into index format with the base quarter 2000Q1.

RUSD is constructed by having all bilateral real exchange rate indices between 10 ASEAN countries and USD adjusted by their respective trade proportion:

$$\text{RUSD} = \prod_{i=1}^{10}(\text{USD/currency}_i)^{\omega_i} \tag{6}$$

So as to inspect the asymmetric impacts of exchange rate on trade balance, the variables REER and RUSD are decomposed into partial sums of positive and negative changes based on the method of Shin et al. (2014):

$$\text{REER}_t^+ = \sum_{k=1}^{t}\max\left(\Delta\ln\text{REER}_k, 0\right) \tag{7}$$

$$\text{REER}_t^- = \sum_{k=1}^{t}\min\left(\Delta\ln\text{REER}_k, 0\right) \tag{8}$$

$$\text{RUSD}_t^+ = \sum_{k=1}^{t}\max\left(\Delta\ln\text{RUSD}_k, 0\right) \tag{9}$$

$$\text{RUSD}_t^- = \sum_{k=1}^{t}\min\left(\Delta\ln\text{RUSD}_k, 0\right) \tag{10}$$

The partial sums of positive changes (i.e., REER_t and RUSD_t) denote ASEAN's currencies depreciation, and their negative counterparts indicate appreciation. Therefore, the Nonlinear ARDL model of Shin et al. (2014) allows the separation of depreciation and appreciation so that they can have different impacts on trade balance in the short run and the long run. Also, Shin et al. (2014) demonstrated that those partial sums can be treated as normal variables in conventional ARDL error correction specification proposed by Pesaran et al. (2001):

$$\begin{aligned}\Delta\ln\text{TB}_t = {} & \alpha + \sum_{g=1}^{p_1}(\rho_g\cdot\Delta\ln\text{TB}_{t-g}) + \sum_{h=0}^{p_2}(\varphi_h^+\cdot\Delta\text{REER}_{t-h}^+) \\ & + \sum_{l=0}^{p_3}(\varphi_l^-\cdot\Delta\text{REER}_{t-l}^-) + \sum_{m=0}^{p_4}(\gamma_m\cdot\Delta\ln\text{AY}_{t-m}) \\ & + \sum_{n=0}^{p_5}(\delta_n\cdot\Delta\ln\text{EY}_{t-n}) + \lambda\cdot\ln\text{TB}_{t-1} + \beta^+\cdot\text{REER}_{t-1}^+ \\ & + \beta^-\cdot\text{REER}_{t-1}^- + \pi\cdot\ln\text{AY}_{t-1} + \kappa\cdot\ln\text{EY}_{t-1} + \varepsilon_t\end{aligned} \tag{11}$$

$$\begin{aligned}\Delta \ln \mathrm{TB}_t = \alpha' + \sum_{g=1}^{p_1'}(\rho_g' \cdot \Delta \ln \mathrm{TB}_{t-g}) + \sum_{g=1}^{p_1'}(\varphi_h'^{+} \cdot \Delta \mathrm{RUSD}_{t-h}^{+}) \\ + \sum_{l=0}^{p_3'}(\varphi_l'^{-} \cdot \Delta \mathrm{RUSD}_{t-l}^{-}) + \sum_{m=0}^{p_4'}(\gamma^{-}{}_m \cdot \Delta \ln \mathrm{AY}_{t-m}) \\ + \sum_{n=0}^{p_5'}(\delta_n' \cdot \Delta \ln \mathrm{EY}_{t-n}) + \lambda' \cdot \ln \mathrm{TB}_{t-1} \\ + \beta'^{+} \cdot \mathrm{RUSD}_{t-1}^{+} + \beta'^{-} \cdot \mathrm{RUSD}_{t-1}^{-} \\ + \pi' \cdot \ln \mathrm{AY}_{t-1} + \kappa' \cdot \ln \mathrm{EY}_{t-1} + \varepsilon_t'\end{aligned} \quad (12)$$

The examination of both short-run and long-run impacts of real effective exchange rate and vehicle currency exchange rate on ASEAN's trade balance can be evaluated by equation 11 and 12 respectively, which is one of the most remarkable advantages of ARDL approach (Pesaran et al., 2001; Phong et al., 2018). Another special advantage is that it permits the presence of both I(0) and I(1) processes, so unit root test is not necessary because virtually all macroeconomic variables are integrated at order 0 or 1 (Bahmani-Oskooee et al., 2018; Bahmani-Oskooee et al., 2020).

One mandatory task in the procedure of ARDL technique is verifying the cointegration among the variables by the bound test (Nusair, 2017). The null hypothesis of the bound test for the case of equation 11 is H0: $\lambda = \beta^{+} = \beta^{-} = \pi = \kappa = 0$ (i.e., no cointegration), and the alternative hypothesis is H1: $\lambda \neq \beta^{+} \neq \beta^{-} \neq \pi \neq \kappa \neq 0$ (i.e., the presence of cointegration). For the case of equation 12, we have H0: $\lambda' = \beta'^{+} = \beta'^{-} = \pi' = \kappa' = 0$ and H1: $\lambda' \neq \beta'^{+} \neq \beta'^{-} \neq \pi' \neq \kappa' \neq 0$. To determine the outcome of the bound test, the F statistic is compared with the critical values provided by Pesaran et al. (2001): if it exceeds the critical value associated with *I*(1) regressors at a chosen significance level, H0 is rejected; if it is below the critical value associated with *I*(0) regressors, H0 cannot be rejected; and in case it lies between, no conclusion can be made. Besides, in order to ensure the reliability and stability of the estimated results, some tests such as Breusch-Godfrey, Breusch-Pagan, Ramsey RESET, CUSUM (Cumulative Sum of Recursive Residuals) and CUSUMSQ (Cumulative Sum of Squares of Recursive Residuals) are employed to detect autocorrelation, heteroskedasticity, misspecification and instability problems. If the aforementioned test statistics are insignificant, the estimated results are trustworthy and valid.

In addition, the Wald test is used to compare the long-run coefficients of REER_t and REER_t in equation 11, together with those of RUSD_t and RUSD_t in equation 12, to detect long-run asymmetric impacts of exchange rates on ASEAN's trade balance in case they have nearly the same sign, significance and magnitude. If the Wald test's *F* statistic is significant, there exists long-run asymmetry; otherwise, no long-run asymmetry is found (Bahmani-Oskooee et al., 2018). Nevertheless, when the effects of exchange rate depreciation and appreciation on trade balance are clearly distinguishable, short-run and long-run asymmetries can be detected by simple observation (Bahmani-Oskooee & Baek, 2018). Namely, the presence of short-run asymmetric impacts can be witnessed when the short-run coefficients of exchange rate depreciation and appreciation have different lag lengths, signs or significance (Bahmani-Oskooee & Nasir, 2019). Moreover, when the long-run ones vary in sign or significance, long-run asymmetry is identified (Bahmani-Oskooee & Saha, 2017).

This research employs quarterly data between 2000Q1 and 2018Q1, which is derived from several sources. First, the export and import values of ASEAN and EU-28 countries are downloaded from Direction of Trade Statistics (provided by IMF). Second, exchange rate and consumer price index data are retrieved from International Financial Statistics (provided by IMF). Third, the source of EU-28 countries' real GDP is Eurostat (downloaded from FRED, Federal Reserve Bank of St. Louis). Fourth, ASEAN countries' GDP is collected from various sources including International Financial Statistics, Eurostat, OECD, FRED, Asian Development Bank (ADB) and General Statistics Office of Vietnam. As quarterly GDP of Brunei, Cambodia, Laos and Myanmar are unavailable, annual GDP is collected and then interpolated into quarterly data (Kyophilavong et al., 2013; Kyophilavong et al., 2018).

4. Results and Discussion

The impacts of real effective exchange rate and vehicle currency exchange rate on ASEAN's total trade balance with the entire EU-28 during the period 2000Q1–2018Q1 are reported in Table 1. Concerning the REER model, neither the depreciation nor the appreciation of ASEAN's currencies against the EU-28's counterparts influences ASEAN's trade balance. Thus, no evidence of asymmetric effect, J-curve phenomenon and Marshall-Lerner condition is found. Nevertheless, regarding the model in which the vehicle currency is employed, ASEAN's trade balance is facilitated by both the depreciation and appreciation of their currencies against USD (respectively denoted by RUSD^{+} and RUSD^{-}). In addition, although the presence of long-run asymmetric impact is denied because of small Wald test's *F* statistic (i.e., 0.07), the short-run asymmetry exists because ASEAN's trade balance reacts differently to USD exchange rate's positive and negative fluctuations. Moreover, the Marshall-Lerner condition is satisfied when the depreciation of ASEAN's currencies against USD boosts their trade balance with the EU-28. Further, asymmetric J-curve effect is also detected in the vehicle currency model. Specifically, the J-curve pattern is induced by both ASEAN's currencies depreciation and appreciation against USD, as indicated

Table 1: The Impacts of Exchange Rates on ASEAN's Trade Balance with the EU–28

Variables	Short Run		Variables	Long Run	
	REER Model	Vehicle Currency Model		REER Model	Vehicle Currency Model
$\Delta REER_t^+ (\Delta RUSD_t^+)$	–0.03	–0.56	$REER_t^+ (RUSD_t^+)$	–0.39	1.60***
$\Delta REER_{t-1}^+ (\Delta RUSD_{t-1}^+)$		0.20	$REER_t^- (RUSD_t^-)$	–0.26	1.53***
$\Delta REER_{t-2}^+ (\Delta RUSD_{t-2}^+)$		–0.33	$lnAY_t$	–2.79	–0.69
$\Delta REER_{t-3}^+ (\Delta RUSD_{t-3}^+)$		–0.68	$lnEY_t$	2.35	0.69
$\Delta REER_{t-4}^+ (\Delta RUSD_{t-4}^+)$		0.72	Constant	0.66	4.19
$\Delta REER_{t-5}^+ (\Delta RUSD_{t-5}^+)$		–0.74	EC	–0.09*	–0.95***
$\Delta REER_{t-6}^+ (\Delta RUSD_{t-6}^+)$		0.98	Bound test	0.54	3.93**
$\Delta REER_t^+ (\Delta RUSD_t^-)$	–0.02	0.37	Adj-R^2	0.41	0.76
$\Delta REER_{t-1}^- (\Delta RUSD_{t-1}^-)$		–0.64	Breusch-Godfrey	0.39	0.71
$\Delta REER_{t-2}^- (\Delta RUSD_{t-2}^-)$		–0.98	Breusch-Pagan	0.58	1.43
$\Delta REER_{t-3}^- (\Delta RUSD_{t-3}^-)$		–1.14*	Ramsey RESET	0.90	0.20
$\Delta REER_{t-4}^- (\Delta RUSD_{t-4}^-)$		–0.52	CUSUM	S	S
$\Delta REER_{t-5}^- (\Delta RUSD_{t-5}^-)$		0.11	CUSUMSQ	U	S
$\Delta REER_{t-6}^- (\Delta RUSD_{t-6}^-)$		–1.05*	Long-run Wald test		0.07
$\Delta lnAY_t$	–0.27	–0.21			
$\Delta lnAY_{t-1}$		–0.91			
$\Delta lnAY_{t-2}$		0.39			
$\Delta lnAY_{t-3}$		–0.33			
$\Delta lnAY_{t-4}$		–0.58			
$\Delta lnAY_{t-5}$		0.97			
$\Delta lnAY_{t-6}$		–0.70			
$\Delta lnAY_{t-7}$		0.48			
$\Delta lnEY_t$	1.51	0.95			
$\Delta lnEY_{t-1}$	0.34	0.14			
$\Delta lnEY_{t-2}$	1.66	2.77**			
$\Delta lnEY_{t-3}$	–0.23	–0.58			
$\Delta lnEY_{t-4}$	–2.17**	–0.84			
$\Delta lnEY_{t-5}$	1.93	1.53			
$\Delta lnEY_{t-6}$	–2.72**	–3.53**			

Notes: The exchange rate RUSD in brackets is used in the vehicle currency model only. The asterisks ***, **, * respectively indicate significance at 1%, 5% and 10% levels. CUSUM and CUSUMSQ tests have stable (S) or unstable (U) result. The outcomes of Breusch–Godfrey, Breusch–Pagan, Ramsey RESET and Wald tests are denoted by *F* statistics.

by the coexistence of insignificant or negative short-run coefficients and the positive long-run ones (Rose & Yellen, 1989; Bahmani-Oskooee & Fariditavana, 2015, 2016). From the above-mentioned results, it is obvious that USD plays a vital role in ASEAN-EU trade, and the incorporation of USD into the analysis of exchange rate-trade balance nexus is very helpful and meaningful, especially when both parties rely much on the world's most popular currency to settle their payment for import and export. Besides, it can be inferred that the application of USD as vehicle currency is favorable for ASEAN's trade balance with the EU-28, and the stimulating effect happens regardless of ASEAN's currencies movement against USD. Hence, Southeast Asian countries can continue to select USD as the most important invoicing currency in their international sales contracts to support their trade balance with the EU.

Table 2: The Impacts of Exchange Rates on ASEAN's Trade Balance with the EU-27

Variables	Short Run		Variables	Long Run	
	REER Model	Vehicle Currency Model		REER Model	Vehicle Currency Model
$\Delta REER_t^+ (\Delta RUSD_t^+)$	–0.14	0.17	$REER_t^+ (RUSD_t^+)$	–0.76	1.42***
$\Delta REER_{t-1}^+ (\Delta RUSD_{t-1}^+)$		0.59	$REER_t^- (RUSD_t^-)$	–0.43	1.48***
$\Delta REER_{t-2}^+ (\Delta RUSD_{t-2}^+)$		0.26	$lnAY_t$	3.64	–1.19**
$\Delta REER_{t-3}^+ (\Delta RUSD_{t-3}^+)$		–0.18	$lnEY_t$	–4.39	1.67
$\Delta REER_{t-4}^+ (\Delta RUSD_{t-4}^+)$		1.13	Constant	1.53	1.43
$\Delta REER_{t-5}^+ (\Delta RUSD_{t-5}^+)$		–0.27	EC	–0.19***	–0.66***
$\Delta REER_{t-6}^+ (\Delta RUSD_{t-6}^+)$		1.41**	Bound test	1.11	3.98**
$\Delta REER_t^+ (\Delta RUSD_t^-)$	–0.08	0.99	Adj-R^2	0.42	0.73
$\Delta REER_{t-1}^- (\Delta RUSD_{t-1}^-)$		–0.51	Breusch-Godfrey	0.67	0.05
$\Delta REER_{t-2}^- (\Delta RUSD_{t-2}^-)$		–0.38	Breusch-Pagan	0.75	0.77
$\Delta REER_{t-3}^- (\Delta RUSD_{t-3}^-)$		–0.21	Ramsey RESET	0.03	0.53
$\Delta REER_{t-4}^- (\Delta RUSD_{t-4}^-)$		–0.64	CUSUM	S	S
$\Delta REER_{t-5}^- (\Delta RUSD_{t-5}^-)$		0.70	CUSUMSQ	S	S
$\Delta REER_{t-6}^- (\Delta RUSD_{t-6}^-)$		–1.42***	Long-run Wald test		0.02
$\Delta lnAY_t$	0.26	–0.79**			
$\Delta lnAY_{t-1}$	–0.63				
$\Delta lnAY_{t-2}$	–0.69				
$\Delta lnAY_{t-3}$	0.13				
$\Delta lnAY_{t-4}$	–0.64				
$\Delta lnAY_{t-5}$					
$\Delta lnAY_{t-6}$					
$\Delta lnAY_{t-7}$					
$\Delta lnEY_t$	–0.01	1.93			
$\Delta lnEY_{t-1}$	2.88***	0.46			
$\Delta lnEY_{t-2}$	1.16	2.24**			
$\Delta lnEY_{t-3}$	–1.64	–0.32			
$\Delta lnEY_{t-4}$		–1.24			
$\Delta lnEY_{t-5}$		1.02			
$\Delta lnEY_{t-6}$		–3.40***			

Notes: The exchange rate RUSD in brackets is used in the vehicle currency model only. The asterisks ***, **, * respectively indicate significance at 1%, 5% and 10% levels. CUSUM and CUSUMSQ tests can have stable (*S*) or unstable (*U*) result. The outcomes of Breusch-Godfrey, Breusch-Pagan, Ramsey RESET and Wald tests are denoted by *F* statistics.

The diagnostic tests confirm that both REER and vehicle currency models are not associated with autocorrelation, heteroskedasticity, wrong functional form, and instability of coefficients. Moreover, the error correction terms (EC) are all negative and statistically significant, thus acknowledging the cointegration among the variables. Hence, the estimation results are valid and trustworthy.

In the period 2000Q1–2018Q1, the UK was still a member of the EU and she had always been one of the largest trading partners of every Southeast Asian country. Thus, our main empirical models and results already capture the importance of the UK so that the ASEAN-EU trade in the selected time frame is fully analyzed. In Table 2, in order to reflect the fact that the UK left the EU, we re-investigate the trade between

ASEAN and the EU-27 in the same time span with the same method to inspect if Brexit has any effect in the exchange rate-trade balance nexus of ASEAN. The results in Table 2 are very similar to those in Table 1. Namely, no long-run and short-run influence of aggregated real effective exchange rate is witnessed in the REER model, but the appreciation and depreciation of ASEAN's currencies against USD still encourage ASEAN's trade balance with the EU-27.

In addition, Marshall-Lerner condition and J-curve phenomenon are also supported. Unlike the situation of EU-28 where J-curve effect is caused by both ASEAN's currencies depreciation and appreciation against USD, only J-curve effect induced by ASEAN's currencies appreciation against USD is observed in the case of EU-27. Next, in the vehicle currency model, no long-run asymmetry is found (due to insignificant Wald test's F statistic), but the occurrence of short-run asymmetric impacts is also observed. Further, the models in Table 2 are also free from any issues and thus reliable. Therefore, although the UK is a crucial trading partner of Southeast Asian countries, Brexit does not change the exchange rate-trade balance connection between ASEAN and the EU, and the vital role of USD as the vital vehicle currency still prevails. Consequently, the findings of this study can be applicable for ASEAN's trade balance with the EU-28 as well as the EU-27.

5. Conclusion

This study scrutinizes how the two kinds of exchange rate (i.e., real effective exchange rate and vehicle currency exchange rate) asymmetrically impact ASEAN's total trade balance with the whole EU. We propose a method to compute double-aggregated real effective exchange rate between ASEAN and the EU that captures all their currencies. Also, we present the formula for calculating the exchange rate between ASEAN's currencies and USD, which can effectively denote the importance of vehicle currency in the inter-regional ASEAN-EU trade. The NARDL estimation results indicate short-run asymmetry when ASEAN's trade balance responds distinguishably to the positive and negative fluctuations of USD. In addition, J-curve effect is detected in the vehicle currency model. Moreover, while real effective exchange rate does not affect ASEAN's trade balance with the EU, USD exchange rate enhances it in the long run, and the findings are robust in the cases of EU-28 and EU-27. Therefore, the crucial and beneficial role of USD as vehicle currency in ASEAN-EU trade is acknowledged, which reflects the fact that USD is the dominant invoicing currency in ASEAN's as well as EU countries' international trade. With the method proposed in this paper, future research can evaluate the exchange rate-trade balance linkage between other regions.

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