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Currency Choice and Trade Balance: Nonlinear Effects of USD Use in ASEAN-China Trade

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In this paper, we analyse how the trade balance between the Association of Southeast Asian Nations (ASEAN) and China responds under different currency arrangements, specifically when the US dollar (USD) is used as a payment currency versus when it is not, by employing the NARDL estimation method. The results demonstrate that the decline of ASEAN currencies, irrespective of the currency utilized for payment, leads to a deterioration in ASEAN's trade balance with respect to China. Moreover, the upswing of ASEAN currencies relative to Chinese yuan (CNY) or the USD has a negligible impact, which suggests asymmetrical responses of the trade balance. In addition, ASEAN's income plays a crucial role in shaping its trade balance, exerting a noticeable negative influence. The findings of this paper imply that a devaluation policy is inapplicable to ASEAN's trade balance with China, and the increased usage of the CNY may not strongly affect their trade outcomes.

Keywords: *ASEAN; China; Exchange rate; NARDL; Nonlinear impacts; USD; Vehicle Currency.*

Introduction

Cross-border sales of goods may be priced in the domestic currencies of the two parties or in that of a third nation commonly used as a global invoicing currency (Goldberg & Tille, 2008).

For many years, the USD has been predominantly used for invoicing the exports and imports of manifold countries, even in transactions that do not involve the United States directly (Ito & Chinn, 2014; Gopinath *et al.,* 2020; Boz *et al.,* 2022). Hence, it is no wonder that the USD has become the most widely used currency globally, occurring in nearly 88 % of the total international transactions, which is more than double the proportion of Euro (BIS, 2016, 2019). And it is not surprising that the USD is largely utilized in the trade involving the EU and external partners, despite the Euro's widespread global usage (Eurostat, 2019). Further, in the trade of other countries, especially emerging market economies, the dominance of USD is indisputable. For instance, in the exportation of Asian and Pacific economies, the shares of USD were always larger than 80 % over the period 1985–2012 (Ito & Chinn, 2014). Similarly, Asian developing nations utilized the USD in more than 75 % of their exports over the period 2005–2015, while the statistics from Latin America ones were nearly 100 % (Boz *et al.,* 2022). Moreover, China also makes substantial use of the USD in its foreign trade; for example, in 2015, 90 % of its trade value with Russia was conducted in USD (Dobson & Masson, 2009; Simes, 2020). In addition, for ASEAN countries, the USD also plays the dominant role in their international trade (Bao & Le, 2022).

Despite the dominant role of the USD in international transactions, it has been overlooked in a wide range of research examining the impact of exchange rate movements on balance of trade dynamics, especially in bilateral and sectoral contexts. This is the limitation of existing studies, which can cause the inadequacy of important findings. For instance, Bao and Le (2021a) documented that the ASEAN-EU trade balance improved when the payment currency USD was used, but showed no significant response otherwise. Thus, no significant result would be identified if excluding the influence of the USD as the main settlement currency. In addition, for trade flows between selected Southeast Asian economies and European countries, the omission of the USD's role in invoicing was associated with a reduction in significant empirical findings (Bao & Le, 2022). Hence, the role of the USD should not be neglected because it can strongly influence a country's trade dynamics with global partners (Gopinath *et al.,* 2020; Boz *et al.,* 2022). Specifically, companies frequently employ the USD for settling their exports, and thus the exchange rate between a nation's currency and the USD has a greater influence on its trade volumes with other countries than the direct exchange rates between its currency and those of its trading partners. Therefore, neglecting the influence of the USD in researching trade balance could lead to an incomplete analysis.

Although both ASEAN and China are the crucial trading partners of each other, there is a lack of research investigating the link between exchange rate movements and trade balance outcomes in their trading relationships. Additionally, no research has scrutinized the importance of the USD when it is employed as a payment currency in ASEAN-China trade. Motivated by the deficiency of empirical results in the existing literature, the objective of this paper is to investigate how the trade balance between ASEAN and China is influenced by payments in USD compared to payments in local currencies. Specifically, the payments in USD is represented by the exchange rate between the USD and ASEAN currencies (hereafter denoted as RUSD). And the payments in local currencies is reflected by the exchange rate between the Chinese yuan (CNY) and ASEAN currencies (hereafter denoted as RCNY).

The contributions of this paper can be summarized as follows: to begin with, it is the first study to compare the effects of payments in USD and payments in local currencies on ASEAN-China balance of trade. Moreover, it is also the first to analyse the nonlinear adjustments of the trade balance when the vehicle currency is used and not used. In addition, this paper can provide detailed empirical evidence and useful implications when China would like to facilitate the application of the CNY in the global trade and reduce the reliance on the USD (Huang, 2019; Yeung, 2021). Namely, in the de-dollarization process, ASEAN is one of the most important trading partners that China can facilitate the share of the CNY and discourage that of the USD in its exports and imports (NikkeiAsia, 2018; Reuters, 2019). Specifically, with the strong demand of Chinese products by ASEAN, China may have the advantage in bargaining power, which helps foster the use of the CNY in the trade with ASEAN. The findings of this paper indicate that the RNCY and the RUSD have relatively similar effects on ASEAN-China trade balance. Hence, increasing payments in CNY and reducing payments in USD would not significantly affect the trade balance between the two parties compared to before. Thus, China and ASEAN can foster the share of CNY in their trade without facing a considerable decline in their trade balances.

The remaining structure of this paper begins with a review of relevant literature. And the subsequent part outlines the methodology and data used in analyses. Then, the empirical findings are presented and discussed. Finally, the paper concludes with key insights and provides implications derived from the findings.

Literature Review

Before Magee (1973) introduced the concept of the J-curve effect, the analysis of exchange rate effects on trade balances primarily relied on the Marshall-Lerner condition, which holds that a depreciation is beneficial if the combined absolute values of the price elasticities of demand for exports and imports exceed one (Bahmani-Oskooee & Mitra, 2010; Bahmani-Oskooee & Zhang, 2014). This is a method to indirectly assess how trade balances respond under the influences of exchange rates by estimating the export and import functions separately (Rose, 1991; Bahmani *et al.,* 2013; Bahmani-Oskooee & Zhang, 2014). Moreover, the Marshall-Lerner condition is purely about the connection of trade balances with exchange rates in the long run, thus lacking the short-run dynamics (Bahmani-Oskooee & Mitra, 2010). As documented by Magee (1973), a trade balance may not immediately react to currency depreciation, to wit it can temporarily worsen and then increase, which resembles the image of the "J" letter. Bahmani-Oskooee (1985) introduced a method for detecting the J-curve effect, which requires analysing how the impact of exchange rate changes unfolds over time through the examination of lagged exchange rate coefficients. Later, Rose and Yellen (1989) introduced another approach to verify the J-curve phenomenon by detecting whether the trade balance is discouraged in the short run and then fostered in the long run.

Grounded in the above-mentioned frameworks, manifold papers investigated the roles of exchange rates in shaping the trade balances of many countries and territories. Recently, exchange rates were found to exert nonlinear impacts on trade balances (e.g., Bahmani-Oskooee & Fariditavana, 2016), and the nonlinear connection between these two variables became the focus of many papers (e.g., Iyke & Ho, 2017; Bahmani-Oskooee & Fariditavana, 2020; Bao *et al.,* 2023). Accordingly, empirical evidences regarding the nonlinear effects were documented across various countries, and the NARDL approach was considered more effective compared to the traditional ARDL model (e.g., Bahmani-Oskooee & Aftab, 2017; Bahmani-Oskooee & Nasir, 2019).

The J-curve effect in ASEAN nations has also been inspected by multiple scholarly works. At aggregate level, several studies have examined how fluctuations in the exchange rates of ASEAN countries influence their trade balances with the global economy. Some examples include Arize (1994), who analyzed five countries; Phong et al. (2018) for Vietnam; Yusoff (2010) for Malaysia; Kyophilavong et al. (2013) for Laos; and Bahmani-Oskooee and Kanitpong (2017) for Malaysia. With the applications of different methods such as VECM, ARDL, and NARDL, they reported distinguishable findings even for the same country. For instance, Yusoff (2010), using a VECM approach to examine the case of Malaysia, found that the depreciation boosted the trade balance from the first quarter of 1977 to the second quarter of 1998. However, when Bahmani-Oskooee and Kanitpong (2017) used quarterly data over the period 1975–2016 and applied newer estimation methods, they documented no impact for the case of Malaysia. Thus, dissimilar methods and time spans can lead to different results. Moreover, results from studies conducted at the aggregate level are highly sensitive to how the rest of the world is represented in the analysis, particularly in terms of which and how many countries are included. This sensitivity adds to the issue of aggregation bias.

Thus, to decrease the aggregation bias, partner-specific and sector-specific analyses have been conducted. Some bilateral-level papers were published for the cases of Malaysia (e.g., Baharumshah, 2001; Bahmani-Oskooee & Harvey, 2010), Thailand (e.g., Bahmani-Oskooee & Kanitpong, 2001; Brahmasrene & Jiranyakul, 2002), Singapore (e.g., Wilson & Tat, 2001), Indonesia (e.g., Bahmani-Oskooee & Harvey, 2009, 2017), Cambodia (e.g., Bineau, 2016), Laos (e.g., Kyophilavong *et al.,* 2018), and Vietnam (e.g., Lee, 2018). In most of the aforesaid papers, large trading partners of ASEAN members (e.g., China, the UK, the US, and Japan) were usually included. For example, A study by Bahmani-Oskooee and Harvey (2009) showed that, during trade with the US and China from 1974Q1 to 2008Q4, Indonesia's trade balance was unresponsive to exchange rate changes, whereas it improved in trade with the UK and Japan. Meanwhile, a subsequent research by Bahmani-Oskooee and Harvey (2017), covering the data from 1990Q1 to 2015Q4 and using the NARDL method, found the negative effect of Indonesian rupiah depreciation against the CNY on Indonesia's trade balance with China, while the outcome for Indonesia-US trade was positive.

Hence, the results from partner-specific analyses also depend on time, methods, and trading partners.

Sectoral-specific analyses have also been implemented for several ASEAN countries, especially Malaysia. For instance, Malaysia-China trade at sectoral level was examined by Soleymani and Chua (2013) as well as Bahmani-Oskooee and Aftab (2018). When using the ARDL method, the former research reported that 18 out of 52 Malaysian industries' trade balances grew when Malaysia ringgit (MYR) declined in value compared to the CNY in the period 1993Q1–2012Q4. The latter research utilized the NARDL approach to inspect the trade balances of 59 Malaysian industries traded with China between 2001M3 and 2015M12. The findings indicated that the trade balances of nearly 33% of Malaysian industries were asymmetrically facilitated by the depreciation of the MYR against the CNY. Namely, for example, in the Electrical Machinery industry that occupied around 27.6 % of total Malaysia-China trade value, its trade balance improved when the MYR depreciated but were unresponsive to the appreciation counterpart. Besides the Malaysia-China trade examined by the two aforementioned papers, the Malaysia-EU and Malaysia-Singapore counterparts were also investigated (Bahmani-Oskooee & Aftab, 2017; Bahmani-Oskooee et al., 2016). For instance, Bahmani-Oskooee et al. (2016) analyzed Malaysia-Singapore trade at sectoral level from 2000M4 to 2014M12 using the NARDL approach and demonstrated that short-run asymmetries happened in nearly all sectors while the long-run ones occurred in around 31% of the sectors. The evidences of short-term and long-term asymmetries in the responses of trade balances were also found in Thailand-China (e.g., Bahmani-Oskooee & Kanitpong, 2019) as well as Vietnam-US trade (e.g., Ho *et al.,* 2021).

The J-curve literature for China is also available at the aggregate, bilateral, and industry levels (e.g., Brada *et al.,* 1993; Zhang, 1999; Bahmani-Oskooee & Wang, 2006, 2008; Bahmani-Oskooee et al., 2018). Noticeably, most of the existing papers about China centered on China–US trade relations (e.g., Narayan, 2006; Upadhyaya *et al.,* 2020; Wang, 2020), possibly because they are the largest economies in the world, and the ongoing trade tensions between China and the United States have attracted significant interest from scholars. Although ASEAN ranks among China's major economic partners, no research has investigated how exchange rate fluctuations affect the overall bilateral trade balance between them.

Many existing studies overlook how invoicing in a dominant currency, such as the USD, influences trade dynamics, which may partly explain the lack of key insights in a global economy where the USD plays a central role (Bao *et al.,* 2023). Nevertheless, some studies have recognized the influence of vehicle currencies, particularly the USD, when examining how currency values affect trade flows among countries other than the United States. For example, Yang and Gu (2016) examined China-Singapore trade flows and indicated that both China's imports and exports with Singapore deteriorated when the CNY or Singapore dollar depreciated against the USD in the period 1993M1–2013M12. Nhung et al. (2018) analyzed how currency movements influenced economic exchanges involving Vietnam and Japan from 2001Q1 to 2017Q3. Their approach included examining the USD/VND rate to reflect broader invoicing practices, as well as the JPY/VND rate. The study found that both exchange rate measures had a significant impact on Vietnam's trade dynamics in relation to Japan. Recognizing the importance of the vehicle currency USD when it is utilized in nearly 90 percent of Vietnam's global trade activities, Bao and Le (2021b) explored how the USD/VND rate influenced Vietnam's balance of trade with respect to 27 European Union member states along with the United Kingdom. The findings from the NARDL estimation showed that the USD/VND rate had more statistically significant effects on the balance of trade than the exchange rates between local currencies. Bao and Le (2021a) emphasized the significant influence of the USD in shaping exports/imports flows between ASEAN and the European Union. Specifically, while fluctuations in the relative value of regional currencies had no measurable effect on trade outcomes, movements in the USD relative to ASEAN currencies showed a notable impact on trade dynamics. In addition to the USD, Šimáková (2013) provided evidence that the EUR significantly influenced Hungary's trade involving Czechia, Poland, and the UK. This suggests that the prominence of dominant invoicing currencies cannot be neglected when scrutinizing how currency fluctuations affect trade flows between two nations without the participation of the United States.

Methodology

Following Rose and Yellen (1989), Iyke and Ho (2018), and Bao et al. (2023), the influence of RCNY on ASEAN-China trade balance is described as follows:

$$lnTB_t = a + b.lnRCNY_t + c.lnY_t + d.lnYF_t + e_t \quad (1)$$

In Equation 1, the variable TB denotes the balance of trade between ASEAN and China, which is calculated by the ratio exportation to importation of ASEAN. When $TB > 1$, ASEAN exports more to China than it imports from China. Similarly, when $TB < 1$, ASEAN exports less to China than it imports from China. $RCNY$ is the exchange rate between the CNY the currencies of the 10 Southeast Asian countries' currencies, which is constructed by the formula in Equation 2. The increase in $RCNY$ indicates that the currencies of the 10 Southeast Asian countries' currencies decline in value relative to the CNY. Therefore, if $b > 0$, the trade balance of ASEAN with respect to China is fostered by its weakening currencies. In other words, if $b < 0$, the trade balance of ASEAN with respect to China is worsened by its strengthening currencies relative to the CNY.

Next, the variable Y represents the real income of ASEAN, which is computed in Equation 3 where the real GDP of all the 10 Southeast Asian countries are weighted according to their trade proportions with China. Meanwhile, YF symbolizes China's real income, as measured in terms of real GDP. All the variables are converted into index format, with their values in the first quarter of 2000 set to 100. Then, a natural log transformation is performed on them.

$$RCNY_t = \prod_{i=1}^{10} {ER_{i,t}}^{w_{i,t}} \quad (2)$$

In Equation 2, $ER_{i,t}$ denotes the exchange rate of each Southeast Asian country's currency with the CNY at time t. This variable signifies how many units of the i^{th} country's

currency can be exchanged for 1 CNY. Therefore, the increase (decrease) of $ER_{i,t}$ signifies the fall (rise) in value of the currency of the i^{th} country relative to the CNY. The exponent $w_{i,t}$ represents the trade share of the i^{th} member in ASEAN's total trade value with China at time t. Thus, the variable $RCNY$ captures the average fluctuations of the 10 Southeast Asian currencies with the CNY, weighted by their respective trade shares. It also reflects the prominence of each country, to wit: the members with higher trade shares will have their currencies occupy greater roles in the variable $RCNY$. For example, in the first quarter of 2018, Vietnam, Thailand, and Singapore emerged as the top three trading partners of China within the ASEAN region. During this period, their respective shares[1] in ASEAN-China trade were 23.9 % for Vietnam, 15.4 % for Thailand, and 14.7 % for Singapore. These trade shares were used as weights in calculating the variable $RCNY$, meaning that the fluctuations in the exchange rates of these countries with the CNY had a proportionate impact on the overall index. As a result, 23.9 % of the movement in the $RCNY$ during that quarter was attributed to changes in exchange rate between the CNY and the Vietnamese dong (CNY/VND). Similarly, 15.4 % of the $RCNY$'s fluctuation came from changes in the CNY/THB exchange rate, and 14.7 % was due to variations in the exchange rate between the CNY and the Singapore dollar (CNY/SGD). This weighting approach highlights how individual ASEAN member currencies contribute to the composite $RCNY$ based on their trade significance with China.

The variable Y is computed by the following formula:

$$Y_t = \prod_{i=1}^{10} {GDP_{i,t}}^{w_{i,t}} \quad (3)$$

where $GDP_{i,t}$ denotes the real GDP of each Southeast Asian country, and $w_{i,t}$ denotes their shares in trading with China which is already explained in Equation 2.

In order to inspect how the dominant payment currency USD shapes ASEAN-China trade balance, we utilize the following model based on Šimáková (2013), Bao and Le (2021a, 2022), and Bao et al. (2023):

$$lnTB_t = a' + b'.lnRUSD_t + c'.lnY_t + d'.lnYF_t + {e'}_t \quad (4)$$

In Equation 4, $RUSD_t$ denotes the exchange rate between the dominant payment currency USD and the currencies of the 10 Southeast Asian countries at time t in real terms, which is depicted in Equation 5. The rise (fall) of the variable $RUSD$ denotes that the currencies of the 10 Southeast Asian countries, on average, decline (grow) in value relative to the USD. Hence, if $b' > 0$, the trade balance of ASEAN with respect to China is facilitated by its softening currencies relative to the USD. Alternatively, if $b' < 0$, the trade balance of ASEAN with respect to China deteriorates due to its strengthening currencies relative to the USD. All the other variables used in this equation remain unchanged and are identical to those specified in Equation 1. They retain the same definitions, functional roles, and interpretations as previously introduced, ensuring consistency across the analytical framework

Following Bao and Le (2021c), the variable $RUSD$ is computed as:

$$RUSD_t = \prod_{i=1}^{10} \left(\frac{USD}{Currency_i}\right)_t^{w_{i,t}} \quad (5)$$

In Equation 5, the exchange rate between the currency of each Southeast Asian country and the USD is used for constructing the variable $RUSD$. Specifically, the proportion of total trade that each Southeast Asian country contributes in its trade with China is incorporated into the calculation of $RUSD$. Namely, $w_{i,t}$ is the trade proportion that the i^{th} ASEAN member holds in ASEAN's total trade value with China at time t. This means that the calculation method explicitly considers the relative importance of each country's trade volume with China, ensuring that countries with larger trade shares have a greater contribution to the variation of $RUSD$.

To analyze how the variables $RCNY$ and $RUSD$ impact the trade balance of ASEAN with respect to China in a nonlinear framework, the increase and decrease in these variables are separated and will be explicitly incorporated into the estimation procedure based on the NARDL approach developed by Shin et al. (2014). Specifically, the term $lnRCNY_t$ in Equation 1 will be decomposed into $RCNY_t^+$ and $RCNY_t^-$ in Equations 6 and 7, respectively. While the former (i.e., $RCNY_t^+$) captures the rise in $lnRCNY_t$, the latter (i.e., $RCNY_t^-$) captures the fall in $lnRCNY_t$. Similarly, $RUSD_t^+$ in Equation 8 and $RUSD_t^-$ in Equation 9 reflect the increase and decrease in $lnRUSD_t$, respectively.

$$RCNY_t^+ = \sum_{j=1}^{t} \max\left(\Delta lnRCNY_j, 0\right) \quad (6)$$

$$RCNY_t^- = \sum_{j=1}^{t} \min\left(\Delta lnRCNY_j, 0\right) \quad (7)$$

$$RUSD_t^+ = \sum_{j=1}^{t} \max\left(\Delta lnRUSD_j, 0\right) \quad (8)$$

$$RUSD_t^- = \sum_{j=1}^{t} \min\left(\Delta lnRUSD_j, 0\right) \quad (9)$$

It should be noted that the $RCNY_t^+$ in Equation 6 is always positive. This is because its value increases only when the change in $lnRCNY_t$ is positive, and it remains unchanged when there is no change in $lnRCNY_t$. The $RCNY_t^-$ is always negative as its value only goes down when the change in $lnRCNY_t$ is negative and equals 0 otherwise. As a result, $RCNY_t^+$ signifies the weakening currencies of the 10 Southeast Asian countries compared to Chinese currency (i.e., CNY), and the $RCNY_t^-$ denotes the strengthening ones. With analogous rationale, the value of $RUSD_t^+$ is always larger than 0, and it indicates the decline in values of the 10 Southeast Asian countries' currencies relative to the dominant payment currency (i.e., USD). On the contrary, $RUSD_t^-$ is always smaller than 0 and denotes the stronger ASEAN currencies relative to the USD.

The Equation 1 only describes how the $RCNY$ drives the overall trade balance of the 10 Southeast Asian countries with respect to China in the long run, and thus there is no information regarding the short-term effects. In addition, Equation 1 also lacks the nonlinear setting for the variable $RCNY$. Consequently, to enable estimation in both the long

[1] Authors' calculation

run and the short run, as well as allow the nonlinear pattern developed by Shin et al. (2014), Equation 1 is converted into the following form:

$$\begin{aligned}\Delta lnTB_t = \alpha &+ \sum_{g=1}^{p_1}(\rho_g.\ \Delta lnTB_{t-g}) \\ &+ \sum_{h=0}^{p_2}(\varphi_h^+.\ \Delta RCNY_{t-h}^+) \\ &+ \sum_{l=0}^{p_3}(\varphi_l^-.\ \Delta RCNY_{t-l}^-) \\ &+ \sum_{m=0}^{p_4}(\kappa_m.\ \Delta lnY_{t-m}) \\ &+ \sum_{n=0}^{p_5}(\pi_n.\ \Delta lnYF_{t-n}) + \lambda.lnTB_{t-1} \\ &+ \beta^+.RCNY_{t-1}^+ + \beta^-.RCNY_{t-1}^- \\ &+ \gamma.lnY_{t-1} + \delta.lnYF_{t-1} + \varepsilon_t \qquad (10)\end{aligned}$$

In the context of this study, Equation 10 is referred to as the RCNY model, which is named after the exchange rate variable RCNY. The NARDL model presented in Equation 10 follows an estimation procedure that mirrors the methodology employed in the traditional ARDL framework. Namely, the NARDL model permits that all variables can be I(1) variables, or some of them are I(1) and the remaining ones are I(0). Therefore, the issue relating to the occurrence of unit roots does not pose a major concern in macroeconomic analysis, which is a remarkable advantage when using the NARDL approach (Bahmani-Oskooee & Harvey, 2017; Bahmani-Oskooee & Aftab, 2018). Besides, the NARDL approach allows that the variables can have different lags. In Equation 10, p_1, p_2, p_3, p_4, and p_5 indicate the optimal lags of the variables, and they can be determined by conventional information criteria. The procedure of estimating the RCNY model in Equation 10 begins with checking for the existence of a long-run equilibrium relationship (i.e., cointegration). And the bounds test can be applied for this purpose, following the same procedure as that used in the conventional ARDL framework. Namely, the bounds test is conducted under the hypotheses H_0: $\lambda = \beta^+ = \beta^- = \gamma = \delta = 0$ and H_1: $\lambda \neq \beta^+ \neq \beta^- \neq \gamma \neq \delta \neq 0$. The stable equilibrium relationship is verified when the hypothesis H_0 is rejected. In contract, if the hypothesis H_0 is not rejected, the conclusion is mixed as the cointegration may or may not exist, which is subject to the test statistic and the critical value of the lower bounds. Specifically, if the former is below the latter, the conclusion is no cointegration. However, if former is above the latter, the conclusion about whether cointegration exists is unclear. Once the stable equilibrium relationship is detected, the estimation procedure relying on ordinary least squares (OLS) can be used for estimating the variables' coefficients. It should be noted that in the NARDL approach, similar to its ARDL counterpart, the short-term and long-term effects can be estimated at the same time. This is considered another benefit of utilizing the NARDL approach.

When the coefficients of $RCNY^+$ and $RCNY^-$ are distinctive, the nonlinear influence of the variable RCNY on the ASEAN-China trade balance is detected. Statistically, it can be checked by testing the difference between $\frac{\beta^+}{\lambda}$ (i.e., the coefficient of $RCNY^+$ in the long run) and $\frac{\beta^-}{\lambda}$ (i.e., the coefficient of $RCNY^-$ in the long run) (Bahmani-Oskooee & Harvey, 2017; Bahmani-Oskooee & Aftab, 2018). In case one of these coefficients is insignificant and the other is significant, we can easily witness the long-run asymmetry without conducting the difference test (e.g., Wald test). Similarly, the short-run asymmetric pattern can be checked by testing if $\sum_{h=0}^{p_2}\varphi_h^+ \neq \sum_{l=0}^{p_3}\varphi_l^-$. More specifically, if the coefficients φ^+ and φ^-have different lags, signs, or significance, we can conclude the presence of short-run asymmetry by observation. However, when they are akin to each other, the Wald test should be conducted. Besides, when $\beta^+ > 0$, the Marshall-Lerner condition is identified as the fall in value of 10 Southeast Asian countries' currencies relative to the CNY fosters ASEAN's trade balance (Rose, 1991; Bahmani-Oskooee & Wang, 2006). Further, the J-curve effect is found when φ^+ is negative while β^+ is positive (Bahmani-Oskooee & Harvey, 2017). The combination of insignificant $\varphi^+$and positive $\beta^+$is also an indication of the J-curve phenomenon. The estimation results may not be reliable when autocorrelation (also known as serial correlation), heteroskedasticity, and model miss-pecification (also known as wrong functional form) are present, as these issues violate key assumptions of regression analysis and can lead to biased or inconsistent estimates. Thus, to verify the precision and reliability of the estimated results, we will need to inspect whether autocorrelation, misspecification, and heteroskedasticity happen in the model. Accordingly, several diagnostic tests are conducted. These include the Breusch-Godfrey test, which is used to detect the presence of autocorrelation in the residuals; the Breusch-Pagan test, which assesses whether heteroskedasticity exists in the error terms; and the Ramsey RESET test, which helps identify whether the model suffers from functional form misspecification. Additionally, to ensure the stability of the estimated coefficients over time, structural stability tests (such as CUSUM and $CUSUM^2$) are performed to detect any potential parameter shifts or changes in the model's behavior throughout the sample period. Implementing the aforesaid tests is essential to ensure the robustness and reliability of the estimation results.

Akin to the RCNY model, to analyze how the RUSD determines the overall trade balance of the 10 Southeast Asian countries with respect to China in the long run as well as the short run, we will examine Equation 11 which is the transformation of Equation 4 based on the NARDL approach. The model specified in Equation 11 is referred to as the RUSD model, which is named after the exchange rate RUSD. The procedure for estimating this model follows a similar approach to that used for the RCNY model outlined in Equation 10.

The data used in this research spans from the first quarter of 2000 to the first quarter of 2018. The sources of data include Asian Development Bank (ADB), Federal Reserve Economic Data (FRED), the IMF's databases on trade flows (DOTS) and financial indicators (IFS), and the General Statistics Office of Vietnam. Because studies relating to the J-curve effect normally found different results depending on methods and time, the period 2000Q1–

2018Q1 and the method used by this paper are selected to be identical to those of Bao and Le (2021a) for a better comparison of the importance of the dominant payment currency (i.e., the USD) in ASEAN's trade with different partners. Moreover, the sample period from 2000Q1 to 2018Q1 predates both the COVID-19 pandemic and the Russia-Ukraine war—two events that had significant effects on the global economy, including the economies of China and the ASEAN countries. Therefore, selecting this time frame allows the study to avoid distortions in ASEAN-China trade that may have been caused by these major global disruptions.

$$\Delta lnTB_t = \alpha' + \sum_{g=1}^{p'_1} (\rho'_g . \Delta lnTB_{t-g}) + \sum_{h=0}^{p'_2} (\varphi'^{+}_h . \Delta RUSD^{+}_{t-h}) + \sum_{l=0}^{p'_3} (\varphi'^{-}_l . \Delta RUSD^{-}_{t-l}) + \sum_{m=0}^{p'_4} (\kappa'_m . \Delta lnY_{t-m}) + \sum_{n=0}^{p'_5} (\pi'_n . \Delta lnYF_{t-n}) + \lambda' . lnTB_{t-1} + \beta'^{+} . RUSD^{+}_{t-1} + \beta'^{-} . RUSD^{-}_{t-1} + \gamma' . lnY_{t-1} + \delta' . lnYF_{t-1} + \varepsilon'_t \quad (11)$$

Empirical Results

To begin with, an overview of the main statistical properties of the variables is provided in Table 1.

Table 1

Overview of the Main Statistical Properties

Variables	Average	Max	Min	S	N
lnTB	4.38	4.85	3.83	0.25	73
lnY	4.85	5.10	4.60	0.12	73
lnYF	5.72	6.62	4.60	0.57	73
$RCNY^{+}$	1.22	3.20	0.00	1.04	72
$RCNY^{-}$	-1.23	-0.03	-2.15	0.60	72
$RUSD^{+}$	1.14	3.00	0.00	0.95	72
$RUSD^{-}$	-1.26	-0.00	-2.23	0.64	72

Notes: Max, Min, S, and N denote the maximum, minimum, standard deviation, and the number of observations, respectively.

The NARDL estimation outcomes of the RCNY and the RUSD models are depicted in Tables 2 and 3. In both models, there are evidences for the existence of the long-run equilibrium relationship (i.e., cointegration) based on the significant bounds test and the negative error correction terms (ECT). Besides, with the small F-statistics of the autocorrelation test (i.e., Breusch-Godfrey test), the issue of autocorrelation is not detected. Similarly, the problems of heteroskedasticity and misspecification are not found in the models. In addition, there are no structural breaks in the estimation results, as indicated by the stable outcomes of the CUSUM and $CUSUM^2$ tests. Based on the outcomes presented above, the estimated coefficients demonstrate reliability and stability, making them suitable for subsequent analysis and the formulation of policy recommendations.

Table 2

Estimation Results of the RCNY Model

RCNY model			
Variables	**Coeff.**	**Variables**	**Coeff.**
$\Delta RCNY^{+}_t$	-0.153**	$RCNY^{+}_t$	-0.566*
$\Delta RCNY^{-}_t$	0.092	$RCNY^{-}_t$	0.341
ΔlnY_t	0.243	lnY_t	-4.946**
ΔlnY_{t-1}	0.542	$lnYF_t$	-1.126
$\Delta lnYF_t$	0.499		
$\Delta lnYF_{t-1}$	1.312**		
$\Delta lnYF_{t-2}$	1.023*		
$\Delta lnYF_{t-3}$	1.104*		
Constant	8.755***		
ECT	-0.271***	Heteroskedasticity	1.205
Bounds test	3.268*	Misspecification	0.003
Adjusted R^2	0.575	CUSUM	Stable
Autocorrelation	0.923	$CUSUM^2$	Stable

*Notes: The Coeff. column lists the coefficients of the variables or the tests' results. $RCNY^{+}_t$ and $RCNY^{-}_t$ denote the fall (rise) in the value of ASEAN currencies relative to the CNY, respectively. The results of bounds test, autocorrelation, heteroskedasticity, and misspecification tests are displayed in F-statistics. ECT is error correction term. The significance at 10%, 5%, and 1% levels is demonstrated by *, **, and ***.*

In the RCNY model presented in Table 2, a 1% decline in the value of ASEAN currencies relative to the Chinese yuan leads to an approximate 0.566% deterioration in ASEAN's net trade position with China over the long term, while an increase in currency value shows no significant effect. This indicates the presence of long-run asymmetry, as the impacts of currency weakening and strengthening are not equivalent in terms of their influence on trade dynamics between ASEAN and China (Bahmani-Oskooee & Harvey, 2017; Bahmani-Oskooee & Aftab, 2018). Likewise, the short-run asymmetry is also observed when the coefficients of $\Delta RCNY^{+}_t$ and $\Delta RCNY^{-}_t$ are distinctive. Additionally, the J-curve effect is not observed, as currency depreciation in ASEAN countries leads to a worsening trade performance. This also suggests a violation of the Marshall-Lerner condition. Besides, a 1% rise in the income of Southeast Asian countries reduces their overall trade balance with China by approximately 4.946%. Thus, over time, ASEAN's trade position appears to be driven more significantly by changes in its income levels than by shifts in currency values relative to the Chinese yuan. In the short run, ASEAN's trade balance is positively affected by the variables representing the changes of China's income (i.e., $\Delta lnYF_{t-1}$, $\Delta lnYF_{t-2}$, and $\Delta lnYF_{t-3}$), signifying that when China's income grows in the short run, China purchases more ASEAN's products and consequentially boosts ASEAN's exportation and trade balance.

Table 3

Estimation Results of the RUSD Model

RUSD model			
Variables	**Coeff.**	**Variables**	**Coeff.**
$\Delta RUSD^{+}_t$	-0.188**	$RUSD^{+}_t$	-0.663**
$\Delta RUSD^{-}_t$	0.086	$RUSD^{-}_t$	0.303

RUSD model			
Variables	**Coeff.**	**Variables**	**Coeff.**
ΔlnY_t	0.255	lnY_t	-4.447**
ΔlnY_{t-1}	0.553	$lnYF_t$	-1.414*
$\Delta lnYF_t$	0.500		
$\Delta lnYF_{t-1}$	1.356**		
$\Delta lnYF_{t-2}$	1.060		
$\Delta lnYF_{t-3}$	1.120**		
Constant	8.85***		
ECT	-0.28***	Heteroskedasticity	1.195
Bounds test	3.527*	Misspecification	0.026
Adjusted R^2	0.583	CUSUM	Stable
Autocorrelation	1.081	$CUSUM^2$	Stable

*Notes: The Coeff. column lists the coefficients of the variables or the tests' results. $RUSD^+_t$ and $RUSD^-_t$ denote the fall (rise) in the value of ASEAN currencies relative to the USD, respectively. The results of bounds test, autocorrelation, heteroskedasticity, and misspecification tests are displayed in F-statistics. ECT is error correction term. The significance at 10%, 5%, and 1% levels is demonstrated by *, **, and ***.*

The results of the RUSD model in Table 3 go in line with those of the RCNY model. The decline in value of the 10 Southeast Asian countries' currencies relative to the US dollar lowers their overall trade position with respect to China in the long run. Moreover, the upswing in value of the 10 Southeast Asian countries' currencies relative to the US dollar has no connection it their trade position with China. Therefore, the asymmetric pattern can be observed in the long run. And this is also witnessed in the short run. Further, there is no indication for the appearance of the J-curve effect as well as the Marshall-Lerner condition. Additionally, the income of the 10 Southeast Asian countries worsens their trade position, and its impact also seems the strongest among the variables. Furthermore, in the short term, China's income growth has a positive effect on ASEAN's trade performance, reflecting a pattern similar to that observed in the RCNY model. Nevertheless, in the long term, while China's income in the RCNY model has a negative but insignificant impact, it becomes significant in the RUSD model. Specifically, when China's income grows by 1%, ASEAN's trade balance deteriorates by approximately 1.414%. This suggests that China will purchase less products from ASEAN when its income rises, which causes the drop in ASEAN's exportation as well as trade balance. It can be witnessed that the RCNY and RUSD models are very compatible with each other in terms of estimation results. Whether or not the US dollar is used as a payment currency in trade between ASEAN and China, a decline in the value of ASEAN currencies tends to negatively affect its trade performance.

The outcomes of the RCNY and RUSD models can also be interpreted from the viewpoint of China. Particularly, when ASEAN's trade balance declines, China's trade balance goes up. In other words, a stronger Chinese yuan relative to ASEAN currencies or the U.S. dollar tends to boost China's net trade position in its exchanges with ASEAN, yet the depreciation of CNY shows no effect. Besides, the high demand of ASEAN for Chinese products is probably a key element boosting China's exports to ASEAN and thus facilitating its trade position with ASEAN.

Conclusions

The vast majority of J-curve studies disregard the importance of the US dollar as the dominant payment currency. This can be considered a limitation of many existing papers because the US dollar can affect the exportation and importation between countries that are not the United States. Therefore, considering the use of the US dollar in international trade is essential when examining how currency movements affect trade outcomes. To the best of the author's knowledge, this is the first empirical analysis to examine how ASEAN's trade dynamics with China respond nonlinearly depending on whether trade is denominated in the US dollar or in Chinese yuan, thereby capturing the differential effects of vehicle currency usage versus direct currency settlement. The findings from the NARDL estimation reveal that, over the long term, both trading through the US dollar and directly with the Chinese yuan exert adverse and asymmetric effects on ASEAN's trade performance with China. Specifically, when ASEAN currencies weaken relative to either the dollar or the yuan, trade conditions deteriorate, whereas currency strengthening does not produce a significant impact. Accordingly, the findings do not support the Marshall-Lerner condition, as a reduction in the value of ASEAN currencies does not lead to more favorable trade outcomes. Asymmetrical responses over time are evident in both the RUSD and RCNY models. The behavior of the estimated coefficients across different time horizons shows no evidence of the trade response typically associated with the J-curve effect. Furthermore, the results indicate that trade dynamics between ASEAN and China are primarily shaped by ASEAN's income levels. When income increases, demand for Chinese goods rises, leading to higher import volumes and a subsequent deterioration in ASEAN's trade position.

The analyses of this study provide some implications that may support strategic decisions in shaping trade and currency policies between China and ASEAN nations. For ASEAN, its trade balance with China depends more on its demand of Chinese products than the exchange rates RUSD or RCNY. And the downswing of the 10 Southeast Asian currencies cannot foster their overall trade position with China. Therefore, ASEAN cannot rely on weak currencies to boost its trade balance, no matter when the vehicle currency USD is used or not used. For China, in the circumstance that it aims to lessen reliance on the USD and facilitate the international usage of the CNY (Huang, 2019; Yeung, 2021), promoting the role of the CNY to be increasingly adopted for pricing and settlement of trade in the Asia-Pacific region is very helpful in its de-dollarization effort (Lai & Yu, 2015). And ASEAN is among the top major trading partners of China in the world as well as the Asia-Pacific region. Consequently, stimulating the use of the CNY in trading with Southeast Asian countries can contribute to the de-dollarization process without considerably distorting the trade positions of both parties. The limit of this paper is that it does not examine the determinants of currency selection for trade invoicing in ASEAN-China trade. Therefore, reducing the share of the USD and fostering

the proportion of the CNY in ASEAN-China trade can be difficult due to some factors such as the dominance of the USD in the regional supply chain network (Ito & Chinn, 2014). Thus, future studies can explore this issue to enable more novel findings.

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