

# Real Effective Exchange Rate, Broad Money Supply, and Trade Balance in Vietnam: An Empirical Analysis from Bounds Test to a Cointegration Approach

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**Objectives:** This paper aims to investigate the impact of the real effective exchange rate and broad money supply on the trade balance in Vietnam using quarterly data from the first quarter of 2000 to the fourth quarter of 2018. **Methods/ Statistical analysis:** Using the ARDL-ECM approach to investigate this effect, a cointegration relationship exists between real effective exchange rate, broad money supply and trade balance. **Findings:** Results demonstrate that real effective exchange rate has a short-term negative impact on trade balance. Additionally, broad money supply has a positive impact on trade balance in the short run and long run with a very weak effect. Surprisingly, it was found that real foreign income and local income have no impact on trade balance.

**Keywords:** *Exchange rate, broad money supply, trade balance, ARDL-ECM.*

**JEL Classification Code:** E43, E44, F31, F62, G18

## Introduction

Vietnam's economy is growing strongly and integrating deeply into the world economy with the trade balance being improved recently after a long period of deficit, bad debts in the banking system, and instable economic policies including the exchange rate policy (Nguyen and Do, 2020; Dao et al., 2020). In this case, the question "is the current exchange rate

suitable?” poses a problem that needs to be carefully discussed and planned for Vietnam. This is not only because the exchange rate policy must support export and import, but also because other significant macroeconomic variables have a large impact to Vietnam's economy along with income growth (GDP), basic interest rates, inflation, etc. (Le and Ishida, 2016; Nguyet et al. 2017; Nguyen and Do, 2020). In the context of the current world economy and Vietnam's economy, there is an opinion to support the action of appreciating the Vietnam Dong (VND) compared to other currencies. In other words, the VND has depreciated because when the VND depreciates, the price of Vietnam's exports will be relatively cheaper than other countries, so exports will increase. However, according to other views, the depreciation of VND does not necessarily solve the problem of trade balance or will put pressure on commodity prices, inflation, capital inflows, etc. Although there have been many empirical studies and policy making reports, the discussion on how changes in exchange rates will improve the trade balance (Le and Ishida, 2016; Nguyen et al., 2017; Tran et al, 2020). However, there is still much disagreement about how the effect of exchange rate adjustments has an impact on the trade balance. In addition, assessing the relationship with the impact of exchange rates with the trade balance should be studied to provide a new perspective. In the study of Le and Ishida (2016), the devaluation of the Vietnamese currency in the long term will have a positive impact on the improvement of the trade balance with the research partners in the period 1990 - 2013. As suggested in a recent study by Nguyen et al. (2017), this research indicates that devaluation of the Vietnamese currency will worsen the trade balance in the period 2000-2015.

There has been no empirical study on the relationship between exchange rate and trade balance in Vietnam in recent years, in particular to testing the J curve phenomenon in the country. Therefore, this study takes into account the previous research outlined above and continues to build upon this research in order to assess the effects of real effective exchange rate on Vietnam's trade balance in the short and long term. This research project will also assess whether volatility of the local currency can help improve the trade balance. The research objectives are to analyse this relationship in the short and long term in the period 2000 - 2018. Further, this research will discuss how the growth of money supply affects Vietnam's trade balance in the research period.

The remainder of the paper is organised as follows. In the next section, the study will discuss the theoretical framework and review the existing literature. Then the researchers will present the research model, variables, and data collection methods used in the study. Finally, the researchers will present the main results which will be followed by a discussion and conclusion.

## Theoretical Framework

Referring to the studies of factors affecting trade balance, there have many types of research in terms of both theoretical and empirical. Theoretically, a country's economic transactions with an open economy are reflected in its balance of payments. The exchange rate exists in a close relationship with the balance of payments as well as the with the balance of payments components such as the trade account in the current account (Koivu and García-Herrero, 2007; Nguyen and Do, 2020; Hussain and Hassan, 2020; Hussain et al., 2020; Kamran et al., 2020). Numerous studies have given many theoretical frameworks related to trade balance in the world. This includes the theories of Le and Ishida (2016); Nguyen et al. (2017); Tran et al. (2020), Mukherjee et al. (2020). Through the research, the following approaches are established: elasticity approach, absorption approach and monetary approach.

### *Elasticity Approach and Marshall-Lerner Condition*

As observed in the previous study, Bickerdike – Robinson – Metzler condition (BRM condition) is the initial theoretical foundation for the elasticity approach. This approach was established by the research of by Bickerdike (1920) and later, Robinson (1947) and Metzler (1948) continue to contribute to the elasticity method by clarifying and detailing Bickerdike's ideas. As shown by Marshall-Lerner condition, which was developed by Marshall (1923), Lerner (1944) and the theory of J-curve curve effects of the relationship between exchange rate and trade balance, further developed and extended this argument. In addition, Marshall-Lerner condition is a further extension of Bickerdike – Robinson – Metzler condition. The most studies discuss that trade balance is defined as exports minus imports, thus:

$$TB = X - M = X - SM^* \quad (1)$$

$M^*$  is the import value in foreign currency price, in contrast to  $M$ , the import price in local currency price. Accordingly,  $M = SM^*$ , when  $S$  is the exchange rate, then equation above is transformed as follows:

$$\frac{dT B}{d S} = \frac{d X}{d S} - S \frac{d M^*}{d S} - M^* \quad (2)$$

And after rearranging equation (2), we have the following relationship:

$$\frac{dT B}{d S} = \frac{X}{S} \frac{d X / X}{d S / S} - M^* \frac{d M^* / M^*}{d S / S} - M^* = \frac{X}{S} E_X + M^* E_M - M^* = M^* \left( \frac{X}{S M^*} E_X + E_M - 1 \right) \quad (3)$$

When  $E_X = \frac{d X / X}{d S / S}$  and  $E_M = \frac{d M^* / M^*}{d S / S}$  are the elasticity of exports and imports, with both added the function of exchange rates. This demonstrates exports almost increasing and

imports almost decreasing when the exchange rate rises, or the local currency depreciates. Further, assuming the initial equilibrium transaction i.e.  $X = SM^*$  at the beginning of the analysis, then, equation (3) becomes:

$$\frac{dT B}{dS} = M^*(E_X + E_M - 1) \quad (4)$$

It is important to note that Equation (4) is a Marshall - Lerner condition, stating that domestic currency devaluation leads to an improvement in the domestic trade balance of the country, which is conditional on the sum of export and import elasticities. Its exports are larger than one unit. Therefore, trade balance worsens after the devaluation of the local currency if the country's total export and import elasticity is lower than one unit (Wang, 2009). If  $E_X$  and  $E_M$  represent for export elasticity and import elasticity, we express the Marshall-Lerner condition as an expression:

$E_X + E_M > 1$  (in case of improved trade balance) and  
 $E_X + E_M < 1$  (in case of declined trade balance)

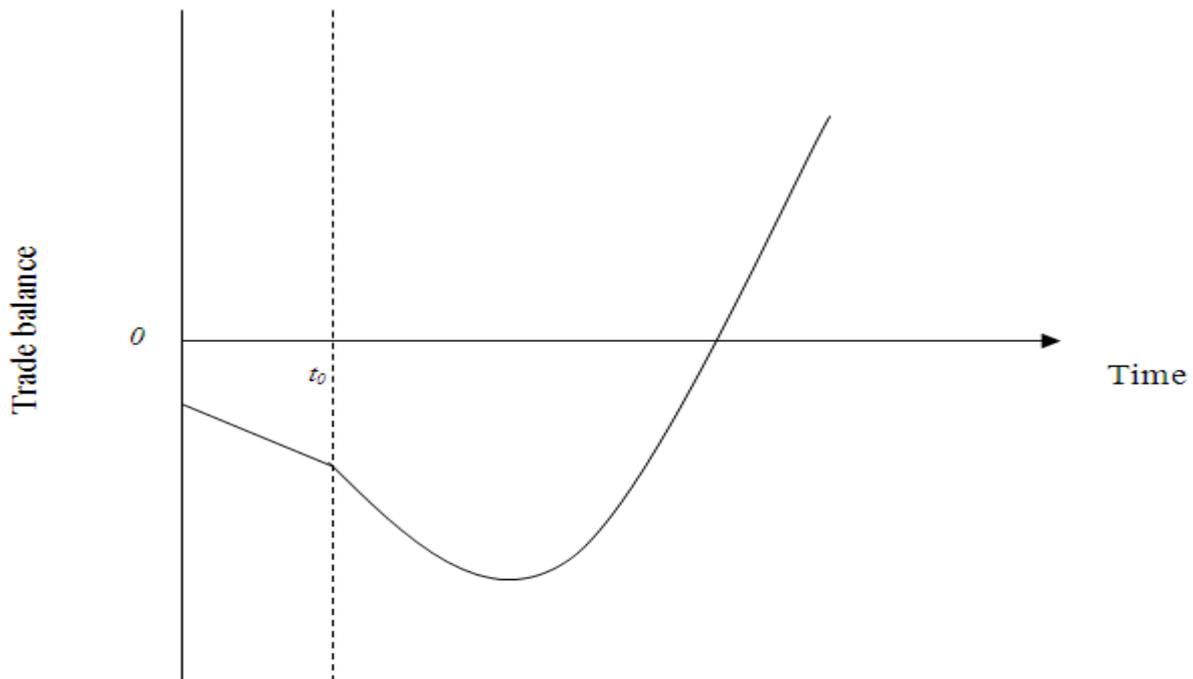
### ***J Curve Phenomenon***

Following the approach in macroeconomics (Marshall, 1923; Lerner, 1947; Robinson, 1947; Metzler, 1948), J curve reflects the devaluation of the national exchange rate affecting the trade balance over time (Robinson, 1947; Metzler, 1948). Theoretically, in the short-term, shortly after the devaluation of the currency, domestic importers face rising import prices when they pay for goods in the local currency. Therefore, net exports decreased. On the other hand, domestic exporters face lower export prices due to the relatively inelastic demand of export and import in the short term. The non-elasticity of this demand is caused by a slowdown in changing consumer behaviour and the delay of renegotiation agreements. In other words, in the short run when prices are relatively stable, trade balance faces a decline due to the stickiness of prices and the sluggishness in changing demand. The assumption is when the goods are still traded at the price before devaluation. Therefore, trade balance is worsened by the value of total imports in foreign currencies multiplied by the increase in the price of foreign currencies since the contracts were performed before depreciation forced prices and fixed volumes. The short-term period is often referred to as the period of “exchange rate pass-through”. Subsequently, domestic demand began to shift from abroad to domestic production of substitutes as a response to higher import prices, resulting in an improvement in the trade balance.

Numerous empirical studies have demonstrated that the J curve phenomenon predicts that trade balance will improve in the long run to a level higher than its pre-depreciation level (Bahmani-Oskooee, 1985; Melvin and Norrbin, 2012). The dynamic reaction of the trade

balance in the form of short-term dip and long-term recovery takes the shape of the letter J flattened, thus the J curve phenomenon is described in Figure 1.

**Figure 1.** The J- curve



**Source:** Melvin and Norrbin (2012)

## Literature Review

In terms of empirical research, many studies have concluded that exchange rate, money support, and other factors can influence the trade balance in a specific country or region. Bahmani-Oskooee (1985) introduced a new testing method for the J curve and applied this method to four countries with different exchange rate mechanisms (Greece, India, South Korea, and Thailand) in the period 1973-1980. The study concluded that trade balance was defined the difference between exports and imports (TBt). This was found by applying an Almon lag structure on the exchange rate (E/P), and world income (YWt), domestic currency (Mt), and some strong currencies of the rest of the world (MWt). This data analysed the effects of exchange rate changes or devaluation given by Kruger (1983). A major finding of a J curve for Greece, India, and Korea was found, although the period in which the trade balance worsens is different for each different case. Bahmani-Oskooee (1985) also concluded that the long-term impact on trade balance occurs only in the case of Thailand.

Stučka (2004) explored the long and short-term effects of exchange rates and trade balance in Croatia from Q1/1994 to Q2/2002. Using the ARDL model and found the effect of REER on

the trade balance. At the same time, there exists a J curve effect in Croatia. Further investigated on a study in China by Koivu and García-Herrero (2007), trade balance is very sensitive to the volatility of REER and indicated that if the RMB (Yuan) are properly priced. It had a positive impact on China's trade surplus between 1994 and 2005. However, Wang et al. (2012) concluded that the appreciation of the Renminbi has no long-term impact on the balance of trade, while the appreciation has a significant short-term impact on research on the devaluation of China and its trading partners in the period 2005-2009.

Kurtović (2017) studied Albanian the real effective exchange rate (REER) data and trade balance quarterly from 1994 to 2015, using VECM model and a co-integration test. The study's findings suggest that GDP has a positive effect on trade balance with a weak presence of J curve effect in the both long and short run. In addition, dumping will improve trade balance but will not work with an inappropriate macro policy. As suggested in Begović and Kreso (2017), the opposite conclusion could be found because devaluation of domestic currency would cause a decline in trade balance when they were analysing panel data for 2000-2015 period of transitioning economies in Europe (including: Albania, Bosnia & Herzegovina, Bulgaria, Cyprus, Croatia, Estonia, Greece, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia, Turkey).

In a study in the US, Rose and Yellen (1989) investigated the presence of a J curve at a bilateral level during 1963-1988 for US quarter data by testing stationarity for time-series data and cointegration between variables. Rose and Yellen (1989) argued that bilateral analysis is useful because it does not require the construction of an income variable that represents the rest of the world and that it reduces the aggregate bias. With the same conclusion, Rose (1991) used the overall trade data of 5 major OECD countries, UK, Canada, Germany, Japan, and the USA to find the relationship between REER and trade balance. In addition, Bahmani-Oskooee and Kantipong (2001) studied Thailand and their 5 major trading partners by using ARDL model combined with quarterly data from 1973-1997. The model results only showed the existence of the J-curve effect in bilateral trade between Thailand and Japan and the US.

Further discussed on trade balance, Yuen-Ling et al. (2009) determined the relationship between the real exchange rate and the trade balance of Malaysia from 1955 to 2006 with some conclusions as follows: (1) there exists a relationship which is a long-term relationship between the exchange rate and the trade balance, (2) devaluation of the local currency will improve the trade balance in the long term, (3) there is no J curve effect in the case of Malaysia. This conclusion contradicts Duasa's (2007) earlier study, where there was no long-term relationship between the exchange rate and the trade balance of Malaysia between 1974 and 2003. Similarly, Bahmani-Oskooee and Fariditavana (2015) also used bilateral trade data for this new method using the ARDL approach both linear and nonlinear. With the bilateral

trade data between the United States and the six major trading partners, namely Canada, France, Germany, Italy, Japan and the United Kingdom, when using the linear ARDL approach, they found evidence of the effects of the J curve for the trade model between USA and Canada, France and Germany. However, when the asymmetric ARDL approach was used, the J curve effect was discovered in five of the six models (except for the Japanese case).

Bahmani-Oskooee et al. (2016) conducted a study in Mexico with their 13 trading partners, applying both linear and asymmetric methods with cointegration and error correction models, to test whether the impact of the devaluation of the peso on the trade balance is different from the impact of the peso appreciation. The linear ARDL model gives a long-term coefficient that is statistically significant for the six partners, which implies that while the fall in pesos improves Mexico's trade balance with these countries. The increase Price of pesos hurt their trade balance. However, the asymmetric ARDL model results showed that the appreciation and depreciation of the local currency have a significantly different effect on the trade balance. Indeed, while the depreciation of the peso improves the trade balance of Mexico with Brazil, Canada, France, Japan, Korea, Spain, and the UK, the appreciation of the peso worsens the trade balance. This includes trade in the case of Brazil, Canada, France, USA, India, Japan, Korea, Peru and Spain. Thus, the exchange rate change has an asymmetric effect on Mexico's bilateral trade balance. Table 1 demonstrates the results of all above discussions:

**Table 1:** Brief Summaries of Previous Study

<b>Authors</b>	<b>Analysis method</b>	<b>Independent variable</b>	<b>Results</b>
Bahmani - Oskooee (1985)	Almon lag structure	Exchange rate; Income of the world and nation; Domestic and the rest of world strong money supply	Evidence of J curve in different cases Long-term impact only occurs in the case of Thailand
Rose & Yellen (1989)	Cointegration	REER, U.S real GNP, GDP/GNP of foreign	No impact of exchange rates on trade balance Contribute to a method of separating trade data and establishing their relationship with exchange rates.
Rose (1991)	Cointegration	CPI, M1, Short-term interest,	Exchange rates have a significant effect on trade balance.

		REER	The Marshall - Lerner condition is still met.
Stučka (2004)	ARDL model	REER based on CPI and PPI, Domestic and foreign GDP	Find the impact of REER on the trade balance Find evidence of J curve
Koivu & Garcia-Herrero (2007)	Cointegration Johansen	REER, Domestic and foreign needs, Controls	China's trade balance is sensitive because of fluctuations of REER Properly priced Yuan will have an impact on China's trade surplus.
Duasa (2007)	ARDL model	Exchange rate; GDP; Money supply M3	There is no J curve effect Exchange rate has no effect on trade balance in long and short term. Income and money supply play an important role in affecting the trade balance in long term.
Yuen-Ling et al. (2009)	Cointegration Granger causality, VECM	Exchange rate; Malaysia and U.S GDP	A long-term relationship exists between the exchange rate and the trade balance. Devaluation of the local currency will improve the trade balance in the long run and have no J curve effect.
Wang et al. (2012)	Fully-modified OLS Panel ECM	Exchange rate and GDP	The appreciation of the renminbi has no long-term impact on the trade balance, while it has a significant short-term impact.
Shah and Majeed (2014)	ARDL model	REER; Pakistan GDP; Money supply M2	Exchange rates, money supply and income play a major role in determining the long-term response of trade balance Devaluation has a negative effect in both short and long term on trade balance
Bahmani-Oskooee & Fariditavana (2015)	Linear and nonlinear ARDL model	Real exchange rate; U.S and trade partners 's income	The effect of exchange rates on the trade balance is asymmetric There appears a curve J; Introduction of non-linear ARDL

			model (asymmetrical model).
Bahmani-Oskooee, et al. (2016)	Linear and nonlinear ARDL model	Real exchange rate; Mexico and trade partners 's income	The linear model shows that appreciating the domestic currency improves trade balance but devaluation hurts trade balance. The nonlinear model shows that currency appreciation hurts on three partners but improves on each.
Begovic and Kreso (2017)	Generalised method of moments (GMM) FEM	REER, GDP growth, gov spending, term of trade, EU membership, labour productivity, FDI	Explaining the devaluation of REER reduces the trade balance due to high import dependence and low exportability.
Kurtovic (2017)	VECM Cointegration IRF	REER; Albania and trade partners GDP	GDP has a positive impact on trade balance. There is a weak presence of curve effect. Devaluation will improve trade balance but is ineffective with an inappropriate macro policy.

## Materials and Research Model

### *Materials*

This study uses the secondary data on a quarterly basis in the period of Q1/2000 to Q4/2018. First, nominal exchange rate data between Vietnam and partners is collected from the Asian Regional Integration Centre (ARIC) database of the Asian Development Bank (ADB), the database International Financial Statistics (IFS) of the International Monetary Fund (IMF). Second, the GDP of Vietnam and its partners is collected from data banks of Organisation for Economic Co-operation and Development (OECD), ARIC, IFS, World Bank (WB) and FED. Further, statistics on Vietnam's trade values and between with Vietnamese partner were collected from General Statistics Office and the Direction of Trades (DOTS) database of the IMF, UN Comtrade, World Trade Centre (ITC). Data on the CPI of Vietnam and its partners are sourced from the International Monetary Fund in IFS, OCED, and FED databases. Data on Vietnam's M2 growth are collected from the ARIC database.

### ***Nominal Effective Exchange Rate (NEER) and Real Effective Exchange Rate (REER)***

The calculation formula and data collection of real effective exchange rate are presented as follows:

The study follows the base year of 2000 because of the following reasons: (1) The State Bank announced the change of Vietnam's exchange rate mechanism to float with regulated and nominal value of VND carried closer to real value in relation to other currencies; (2) It is easier to collect data since 2000. Thus, the quarter 1/2000 is selected as the base period used for calculation, due to the quarterly data used in the study. Further, currency basket and nominal exchange rate used for the study including the following currencies: the U.S Dollars (USD), Euro (EUR), Australian Dollar (AUD), Japanese Yen (JPY), Chinese Renminbi Yuan (CNY), Singapore Dollar (SDG), Thai Bath (THB), Malaysian Ringgit (MYR), Korean Won (KRW), Russian rouble (RUB), Indian Rupee (IRP), New Zealand Dollar (NZD), British Pound (GBP), Hongkong Dollar (HKD), Swiss franc (CHF), Canadian Dollar (CAD).

CPI figures of the trading partners used in the study and of Vietnam, which is the CPI of this quarter compared with the same period of the previous year. The CPI of each country is adjusted to the base period. If the base period is Q1/2000, the CPI of the base period is 100, the adjusted CPI at time t is calculated by the following formula:

$$CPI_0^t = \frac{CPI_t}{CPI_0} \times 100 \quad (5)$$

where  $CPI_0^t$  is the adjusted CPI at time t,  $CPI_t$  is the actual CPI for period t,  $CPI_0$  is the actual CPI in the base period. Therefore, the formula for REER and NEER:

$$REER = \sum_{i=1}^n \left( \frac{e_t^j}{e_{base}^j} \cdot \frac{P_t^j}{P_t^{VN}} \right) \cdot w_t^j \text{ and } NEER = \sum_{i=1}^n \frac{e_t^j}{e_{base}^j} \cdot w_t^j \quad (6)$$

Which is

NEER, REER are the nominal, real effective exchange rate of selected currencies

$e_t^j$  is the bilateral nominal exchange rate of the j currency against VND in period t

$e_{base}^j$  is the bilateral nominal exchange rate of the currency of the jth country against VND in the base period

$w_t^j$  is the commercial proportion of j partner at time t

$P_t^{VN}$  is Vietnam's price index at time t.

$P_t^j$  is the j partner price index at time t.

i is the calculation period.

j is the order of the countries selected in the currency basket

TB: is representative of Vietnam's trade balance, is the ratio of export value to import value calculated by the following formula:  $(X/M)_t = \frac{X_t}{M_t}$  with X, M respectively are export value and import value in the t.

GDPVN and GDPw: respectively the GDPVN growth rate of Vietnam and the GDPw growth rate are the average GDP index of trading partners. GDPw is calculated by the following formula:  $GDPw_t = \sum_{j=1}^n GDP_j^t \cdot W_j^t$

M2: is Vietnam's M2 money growth, expressed as a percentage.

### **Research Model**

Combining the theory of elasticity approach and monetary approach presented above, the research model used in the research topic is the empirical equation modelled as follows:

$$TB = f(REER, GDP_{VN}, GDP_w, M_2) \\ = \beta_0 + \beta_1 REER_t + \beta_2 (GDP_{VN})_t + \beta_3 (GDP_w)_t + \beta_4 (M_2)_t + \varepsilon \quad (7)$$

Or equation (7) written in natural logarithm

$$\ln TB_t = \beta_0 + \beta_1 \ln REER_t + \beta_2 \ln (GDP_{VN})_t + \beta_3 \ln (GDP_w)_t + \beta_4 \ln (M_2)_t + \varepsilon_t \quad (8)$$

$\ln TB_t$  represents the trade balance at period t in the form of a natural logarithm, defined as the ratio of the value of merchandise exports to the value of merchandise imports (X / M ratio). This calculation was chosen instead of the absolute value of trade balance because trade balance is the difference between the value of exports and the value of imports facing the weakness of being sensitive to the unit of measurement if possible present in natural logarithm.

$\ln REER_t$  represents the real effective exchange rate at period t as a natural logarithm. Wang (2009) argues that increasing or decreasing REER is equivalent to the appreciation or depreciation of the local currency against the foreign currency. Therefore,  $\beta_1$  is expected to be positive to improve the trade balance.

$\ln GDP_{VN}$  represents the real GDP growth index of Vietnam at the t period in the logarithm form and the  $\ln GDP_w$  is the real GDP growth index of the trading partner in the t period in the logarithm form. Further,  $\beta_2$  is expected to be negative, while  $\beta_3$  is expected to be positive because Vietnam's GDP increases, the demand for imported goods increases and vice versa. The GDP of trade partners will change and help to increase the demand for goods export.

lnM2 is the M2 growth rate of Vietnam at period t in the logarithm form. From the theory of money access,  $\beta_4$  is expected to be negative because as the money supply increases, it will worsen the trade balance.

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$  are the regression coefficients  
 $\varepsilon_t$  is the random error at period t.

## Empirical Results

### Stationarity Test

**Table 2:** Stationary Test

Variable	Explanation	t-Statistic	Prob.	Result
lnTB	Trade balance	-4.020542 At level	0.0022	Stationary at I(0)***
lnREER	REER	-5.730351 At first difference	0.0000	Stationary at I(1)***
lnGDPvn	GDP of Vietnam	-3.363621 At first difference	0.0158	Stationary at I(1)**
lnGDPw	GDP of partners	-5.986593 At level	0.0000	Stationary at I(0)***
lnM2	Broad money supply	-6.301238 At level	0.0000	Stationary at I(0)***

**Note:** I(0): level, I(1): first different  
(\*\*\*), (\*\*), (\*) significance level at 1%, 5%, and 10%

Source: Authors' calculations

The results of the ADF test show that the variables used in the topic are stationary with I (0) or I (1), that is, all variables stop at the original series or stop at the first stationary. According to Table 2 above, the variables REER, Vietnam GDP all stop at the first stationary and the variables trade balance, partner GDP, M2 money supply stop at the level. Therefore, the ARDL model can be used to test the short- and long-term relationship between variables in the research model.

### Optimal Lag Length and Bounds Test

To select the optimal lag length for the economic research model, according to Wooldridge (2013), the latency from 1 to 8 is consistent with quarterly data and for monthly data. The

latency can be 6, 12, or 24 when there is sufficient matching data. Thus, the optimal latency will correspond to the model with the smallest information standard value. For the ARDL model, we select the most optimal latency according to the Schwarts information standard (SIC) and select the optimal latency of 3.

**Table 3:** Optimal Lag Length Selection with Unrestricted VAR

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	512.565	NA	5.2e-13	-14.099	-14.0361	-13.9409
1	792.353	559.57	4.4e-16	-21.1765	-20.7988	-20.2279
2	861.275	137.84	1.3e-16	1.3e-16	-22.3965	-21.7042
3	898.913	75.277*	9.4e-17*	-22.7476*	-21.7405*	-20.218
4	915.515	33.204	1.3e-16	-22.5143	-21.1926	-19.1942

**Source:** Authors' calculations

Bounds test

The null hypothesis:  $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4$

The alternative hypothesis:  $\beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4$

The estimated F-test statistics have a statistical value of 5.164 given in Table 4, exceeding the upper boundary limit of 5.06 at 5% significant level. This resulted in the conclusion that rejected the null hypothesis and argued that there was a long-term relation between variables. This means that four variables used in research topics move together in the long term.

**Table 4:** F-statistic Test Results

k	F-statistic	Significance	Significance Bounds value of F-statistic	
			Lower-bound	Upper-bound
4	5.164	10%	2.45	3.52
		5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

**Source:** Authors' calculations

To perform the bounds test for cointegration, the conditional ARDL (l, m, n, p, q) is specified as follows:

$$\Delta \ln TB_t = \beta_0 + \beta_1 \ln REER_{t-i} + \beta_2 \ln(GDP_{VN})_{t-i} + \beta_3 \ln(GDP_W)_{t-i} + \beta_4 \ln(M_2)_{t-i} + \sum_{i=1}^l \beta_{1j} \Delta \ln TB_{t-i} + \sum_{i=1}^m \gamma_{2j} \Delta \ln REER_{t-i} + \sum_{i=1}^n \delta_{3j} \Delta \ln(GDP_{VN})_{t-i} + \sum_{i=1}^p \vartheta_{4j} \ln(GDP_W)_{t-i} + \sum_{i=1}^q \theta_{5j} \ln(M_2)_{t-i} + \varepsilon_t \quad (9)$$

Estimation results can be written as follows:

$$\Delta \ln TB_t = \beta_0 + \sum_{i=1}^l \beta_{1i} \Delta \ln TB_{t-i} + \sum_{i=1}^m \gamma_{2i} \Delta \ln REER_{t-i} + \sum_{i=1}^n \delta_{3i} \Delta \ln (GDP_{VN})_{t-i} + \sum_{i=1}^p \vartheta_{4i} \ln (GDP_W)_{t-i} + \sum_{i=1}^q \theta_{5i} \ln (M_2)_{t-i} + \lambda \cdot ECT_{t-1} + \varepsilon_t \quad (10)$$

$ECT = (\ln TB_{t-i} - \theta \cdot X_t)$ , the error correction term is the extracted residuals from the regression of the long-run equation.

Which is:

$\theta$ : long-run coefficient

t: time

l, m, n, p, q: lag lengths. In which, l, m, n, p, and q show the optimal latency of each related variable in the model and is determined by AIC or SIC information standards. Thus, the model can be of the form ARDL (l, m, n, p, q) and long-term correlation coefficients can be calculated when estimating the ARDL model (l, m, n, p, q). The results of the ARDL model (3,2,0,0,2) and the long-term correlation coefficients are shown in Table 5 below.

**Table 5:** Estimation of Long and Short-term Coefficient in ARDL (3,2,0,0,2) Model

Variables	Coefficient	Std. Err.	t-Statistic	Prob.*
LnREER	0.1503833	.1282318	1.17	0.245
LnGDPVN	-2.310835	2.393496	-0.97	0.338
LnGDPW	0.9874919	1.5968	0.62	0.539
LnM2	-0.1304639	.0738892	-1.77	0.082*
ECM <sub>t-1</sub>	-0.4699124	0.1035544	-4.54	0.000***
$\Delta \ln TB(-1)$	-0.2001994	0.1211777	-1.65	0.104
$\Delta \ln TB(-2)$	0.1336672	0.1161837	1.15	0.255
$\Delta \ln REER$	0.1282538	0.3918245	0.33	0.745
$\Delta \ln REER(-1)$	-1.058506	0.4077515	-2.60	0.012**
$\Delta \ln GDP_{vn}$	1.409087	1.239126	1.14	0.260
$\Delta \ln GDP_w$	-1.244669	1.227334	-1.01	0.315
$\Delta \ln M2$	0.0906543	0.0575801	1.57	0.121
$\Delta \ln M2(-1)$	-0.1047773	0.0637184	-1.64	0.095*
_cons	2.80142	4.073579	0.69	0.494
R <sup>2</sup>	0.5786			
Adjusted R <sup>2</sup>	0.5026			
Root MSE	0.0691			

**Note:** (\*\*\*), (\*\*), (\*) are respectively 1%, 5%, and 10% significance level

**Source:** Authors' calculations

The results can be explained that more than 57% of the long-term change from the variables REER, Vietnam's GDP, trade partner's GDP, and M2 money supply growth with R2 coefficient of 0.5786. However, only M2 money supply growth could significantly explain the variation in trade balance at the 10% significant level in the long run.

To ensure the convergence of the dynamics to the long-term equilibrium, the sign of the late correction error coefficient (ECMt-1) must be negative and statistically significant. Table 6 clearly shows that the error correction coefficient ( $EC_{t-1}$ ) is negative and statistically significant. This result again provides evidence of consolidation among the variables in the model. This shows the speed of adjustment from the short term to the long term. Specifically, the estimated value of  $EC_{t-1}$  is -0.469 (about 46.9%) which indicates the speed of adjustment to balance after short-term shocks. Further, the REER variable has a short-term negative relationship with trade balance with a high level of statistical significance. Table 6 also indicates that the immediate effect of REER devaluation is an immediate enhancement of the trade balance at the first lag. As such, Vietnam's REER effective real exchange rate has a negative short-term impact on trade balance in the short run only. This is consistent with the theory of J curve phenomenon and does occur with J curve phenomenon. Theoretically, a depreciation of the domestic currency could negatively affect export performance in the short run, but positively in the long run, consistent with the J curve effect. The result of the study is as similar as this of Bahmani-Oskooee & Fariditavana (2015) and is also confirmed by another study of Stučka (2004).

In agreement with broad money supply, money supply growth M2 also has a positive impact on trade balance and has a high statistical significance in the short run and long run. However, this effect is quite weak. This conclusion is different from the research results of Khieu Van (2013). The conclusion of the topic makes sense that the 1% M2 growth in money leads to a negligible improvement in trade balance of 0.56% in the long run.

In addition, the remaining variables in the model are GDPvn, GDPw with no short-term impact on trade balance. Thus, there is different from the results that the GDP of the trading partners or foreign GDP has a positive long run impact (Ziramba & Chifamba, 2014), the results of the study are not supported by another study, Vietnam's GDP or domestic income negatively impact the trade balance (Le & Ishida, 2016).

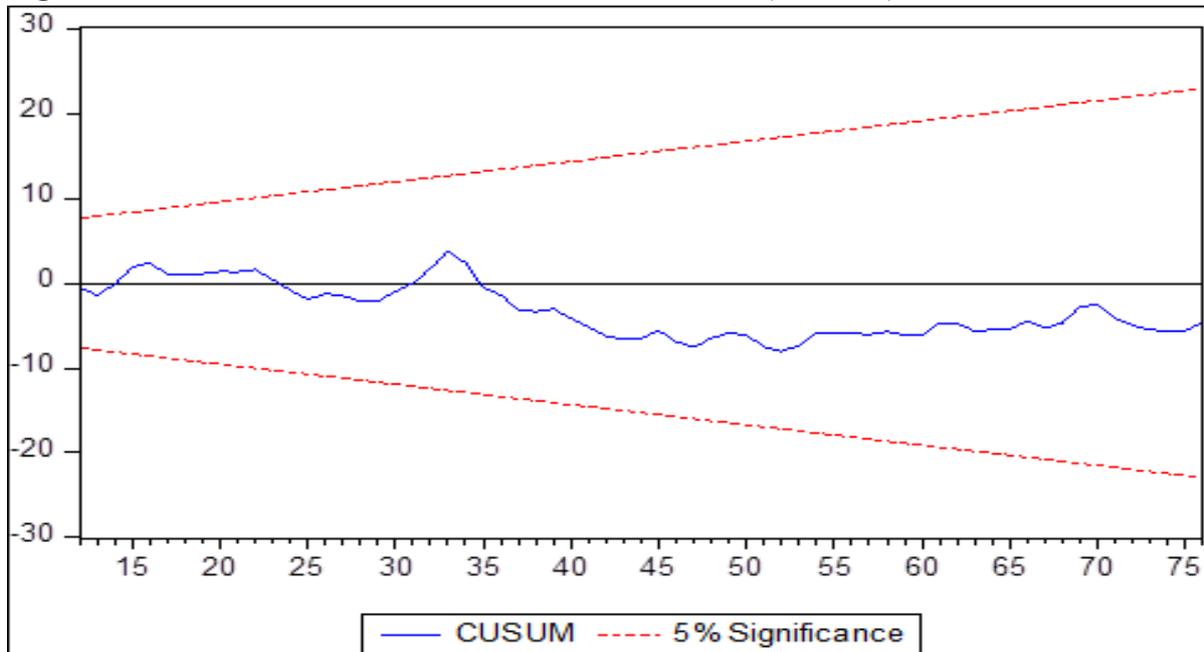
### ***Diagnostics Test***

#### ***Stationary Test***

CUSUM test cumulative total test - CUSUMSQ and CUSUMSQ are used as a measure to evaluate the stability of the coefficients in the model. CUSUM and CUSUMSQ depend on

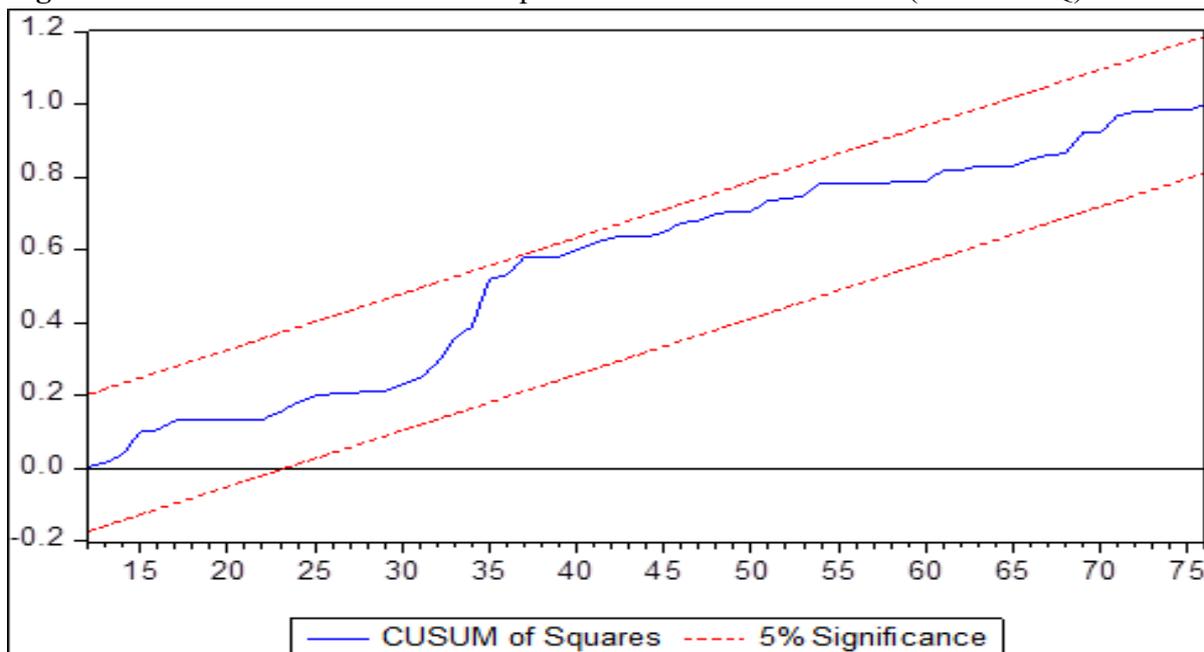
residual recursive regression and were developed by Brown in 1975. If the graph of the CUSUM and CUSUMSQ tests is within the boundary then we can conclude that the model is stable and gives Make best estimates. The results of CUSUM test and CUSMSQ test are shown in Figure 2 and Figure 3.

**Figure 2.** Plot of Cumulative Sum of Recursive Residuals (CUSUM)



**Source:** Authors' calculations

**Figure 3.** Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)



**Source:** Authors' calculations

Figures 2 and 3 show a CUSUM and CUSUMQ diagram for the model. As can be seen in Figure 2, the diagram of CUSUM is within the critical limit of 5% confirming the long-term relationship between variables and thus showing the stability of the coefficient. However, the CUSUMSQ diagram in Figure 3 does not exceed the critical limit of 5% of parameter stability. Thus, the author commented that the current research model, with an optimal latency of 2, is a stable model.

### ***Serial Correlation Test***

Using Durbin-Watson and Breusch-Godfrey Lagrange multiplier test (LM test) to check the autocorrelation phenomenon in the residuals of the model. The Durbin-Watson, and Lagrange multiplier test have the hypothesis is no autocorrelation phenomenon in the residuals of the model. The results of LM test and Q-statistics are presented in Table 6 and indicate that the autocorrelation phenomenon in the residuals of the model is absent. Thus, there is no autocorrelation phenomenon in the residual of the model and satisfies the assumption of the ARDL model.

**Table 6:** Estimation of Long and Short-term Coefficient in ARDL (3,2,0,0,2) model

<b>Method</b>	<b>Autocorrelation Test</b>
Durbin-Watson test	D-statistic (12, 73) = 2.000562
Breusch-Godfrey Lagrange multiplier test	Chi2 = 3.209 Prob > Chi2 = 0.2010

### ***Heteroskedasticity Test***

White's test for Ho: homoskedasticity  
against Ha: unrestricted heteroskedasticity  
chi2(72) = 73.00  
Prob > chi2 = 0.4449

The results show the resulting output, which suggests that the study does not reject the homoskedasticity hypothesis. There is no heteroskedasticity in the model.

### **Conclusion**

This paper aims to examine the effects of real effective exchange rate and the broad money supply on Vietnamese trade balance during the period from the first quarter of 2000 to the fourth quarter of 2018. The researchers used the ARDL-ECM approach to investigate this relationship. This method is appropriate for regressors of a mixture of I(0) and I(1), and real



exchange rate is computed by a weighted average of the nominal bilateral exchange rate of domestic currency against the basket of sixteen foreign currencies.

The result of the study found that a cointegration relationship exists between real exchange rate, broad money supply, and trade balance. Results indicate that real effective exchange rate has a negative relationship with trade balance with a high level of statistical significance in the short run. Further, broad money supply has a positive impact on trade balance and has a high statistical significance in the short run and long run, but this effect is quite weak. One anticipated finding is that real foreign income and local income have no effect on trade balance of Vietnam in both the long run and the short run.



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