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EXCHANGE RATE AND TRADE BALANCE IN VIETNAM: A TIME SERIES ANALYSIS

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ABSTRACT

The aim of the study is to investigate the relationship of exchange rate and trade balance in Vietnam by a time series analysis from 2001-2015. The study employs various models such as Autoregressive Distributed Lag Models (ARDL), Wald test, Error Correction Model (ECM), Granger Causality, Vector Autoregressive Model (VAR) and Impulse Response analysis. Estimation of the long-run model using quarterly data for the period 2001-2015 provides evidence that a real depreciation of VND will worsen the trade balance. In the short run, the VAR model shows evidence to support that there is no short-run relationship between exchange rate and trade balance and suggest that the whole model will get adjusted at the speed of 55.21% to get the long-run equilibrium. Besides, Granger Causality test shows that the trade balance also has the inverse impact on the exchange rate movements. Finally, the Impulse Response analysis implies that the J-curve pattern of the trade balance after a shock in real depreciation/devaluation does exist but is not very clear. These findings help the policymakers enhance exchange rate and trade policies based on specific Vietnam case to improve trade balance in future. The value of this study is that it opens new insights for subsequent researchers in which there might have more than three important factors that have mentioned in theory base affecting trade balance.

Contribution/ Originality: This study investigates the relationship between exchange rate and trade balance of Vietnam case based on a time series analysis over the period of 2001-2015.

1. INTRODUCTION

Economic theories suggest that exchange rate and trade balance have a permanent relationship. On the one hand, exchange rate volatility has a great impact on trade balance through relative price channel. Franke (1991) finds out that under very standard conditions, an enterprise might be beneficial from increased fluctuation and therefore result in a boost in the volume of their exports. Sercu (1992) also demonstrates that exchange rate fluctuation can improve trade since it enhances the prospect that the price a trader receives might outweigh trade costs. Broll and Eckwert (1999) draw a conclusion that volatility increases the value of a trader's option to export, as this risk raises the potential gains from trade, the trade volume will improve accordingly.

On the other hand, the volume of trade influences exchange rates through its effect on the supply of and demand for the foreign currency. According to supply and demand theory of foreign currency, Tien (2011)

concludes that any factor contributing to an increase in the demand for exports makes domestic currency appreciate and then causes the exchange rate to fall. By contrast, any factor contributing to an increase in the demand for imports makes domestic currency depreciate, and the exchange rate will rise as a result.

Several empirical studies are explaining the relationship between exchange rate and trade flows leading to different results. For methodology, by using various methods to test the relationship between exchange rate volatility and either export or import, the results has not been the same from country to country. Therefore, no any consensus could be generalised about the relationship between exchange rate and trade flows based on countries tested. For instance, Akhtar and Hilton (1984) find that exchange-rate volatility had a significantly negative effect on German exports, German imports, and US imports, but no effect on US exports over the period 1974-1981. While Klein (1990) arrives at a mixed result for his study in examining the value of US bilateral exports to G7 as a function of foreign income and real exchange rate; Tantatape (2002) finds that real bilateral exchange rate significantly impacts the bilateral trade balances between Thailand and its main trading partners over 1990-2000.

In the context of Vietnam economy, economic performance has improved remarkably over the recent years. Even though domestic economic activity remains weak, there are considerable signs of the recovery. Inflation has declined, the current account remains in the large surplus from 2011-2014, and international reverses have increased. However, from early 2015, current account tends to slip again into deficit. To cover the deficit on the current account, Vietnam mainly relies on FDI inflows despite the fact that in 2011, foreign investors lost confidence in the Vietnamese economy due to banking sectors and weak domestic economic activities. As an effort of the government in exchange rate policy to reduce import growth and attract more investment inflows, the dong has been devalued multifold times in the past years.

There are very few empirical studies using time series to investigate the relationship between exchange rate and trade balance in Vietnam, especially in recent years. Trinh (2014) concludes that real exchange rate does have an impact on the trade balance in both short term and long term from 2000-2010. She also points out that the impact of real exchange rate on the trade balance is positive in the long term but negative in the short term. While many changes in exchange rate policies are implemented (in 2008-2011) to contribute to the surplus of Trade Balance since 2012, early studies were not able to cover this stage in their analysis as well as evaluate the impact of exchange rate on trade balance since then onwards.

Taking advantages of being a subsequent researcher, I carry out this analysis to investigate, (i) impact of exchange rate on trade balance in both short and (ii) that of the long term, (iii) inverse impact of trade balance on exchange rate, and (iv) effect of a shock to trade on the time-paths of exchange rate in the period of 2001-2015. This study is a quantitative research based on secondary data and time series analysis for the case of Vietnam in the stated period. A variety of analysing methods are employed and presented in the methodology section.

2. LITERATURE REVIEW

Concerning factors affecting trade balance, in the position of the United States where USD is seen as domestic currency, the factors influencing the exports value of goods and services (or increase the demand for US dollars) include: the foreign exchange value of US dollar, US prices versus the prices of foreign competitors, worldwide prices of products that the US exports, foreign incomes, and foreign import duties and quotas (Levi, 2005).

Firstly, Levi (2005) highlights that for a particular level of domestic and foreign prices of internationally traded goods, the higher are US export prices facing foreigners, and the lower is the quantity of US exports, resulting in a decrease in exports value. Secondly, he underscores the role of inflation in measuring prices in the United States and elsewhere. He supposes that if inflation in the United States exceeds inflation elsewhere then, ceteris paribus, US goods become less competitive, and the quantity of US exports will decline. US inflation, therefore, tends to reduce the demand for US dollars at each given exchange rate. Thirdly, he also notes that higher world prices shift the demand curve to the right, and vice versa. In addition, he believes that when foreign buyers experience an

increase in their real incomes, there will be an improvement in the export market for American raw materials and manufactured goods. Ceteris paribus, this increases US exports, and therefore also increases the demand for dollars. Finally, it is widely acknowledged in his study that higher foreign import tariffs and lower foreign import quotas as well as higher foreign nontariff trade barriers such as requirements and red tape, reduce US exports.

Similar to US exports, US imports respond to the same factors that affect exports, but the direction of response being reversed (Levi, 2005). With other factors held unchanged, the quantity of US imports of goods increases when the US dollar is worth more in the foreign exchange markets because a more valuable dollar makes imports cheaper. US imports are also higher when US prices are higher relative to competitors' prices of the same goods, when world prices of US imports increase, when US tariffs are reduced, and when US import quotas are increased. US imports of performed services also depend on exchange rates, relative prices, US incomes, and US import restrictions. In the case of income payments, which are payments by Americans of interest, dividends, profit and rent abroad, the principal relevant factor is past foreign investment in the United States; US income payments are higher the higher have been foreign investments in US government bonds, corporate bonds, stocks, and past foreign investments in the US real estate and operating business. Income imports also depend on the rates of return foreigners earn on their investments in the United States (Levi, 2005).

While Tien (2011) concurs with Levi's statements mentioned above, he also cautiously interprets the case of Vietnam where US dollar is seen as a foreign currency, different from the US position. Therefore, factors affecting the value of goods and services exports of Vietnam measured in USD (foreign currency) are explained in a little different way: For exchange rate (units of VND of one unit of USD), ceteris paribus, an increase in exchange rate stimulates a rise in the quantity of exports. However, a rise in the quantity of exports leads to uncertainty in the value of exports calculated by USD; that is, the value of exports denoted in the foreign currency may be increased or decreased. For inflation, the impact of inflation on the value of exports (denoted in foreign currency) is not clear, too. With regard to international price of exported goods, ceteris paribus, if there is a rise in a particular country exports' international price, it would make quantity of foreign currency supplied in the FOREX market increase. In other words, when global price of exports increases, the value of exports denoted in foreign currency will rise. Regarding non-residents' income, ceteris paribus, an increase in real income of non-residents raises their demand for imports. As a result, the supply of foreign currency will rise and the value of exports denoted in foreign currency will also increase. About overseas tariff and quotas, he agreed that the export value of specific country would decrease if foreign nations impose a high level of tariff, low import quotas or high non-tariff barriers such as quality requirement and red tape.

Similar to Vietnam exports, Vietnam imports respond to the same factors that affect exports, but the direction of response is reversed. He highlights that trade balance is improved when net impact of determinants of the value of exports and imports is positive, and vice versa. When net impact of determinants of the value of exports and imports is negative, trade balance is deteriorated.

There is a variety of theoretical background trying to explain the influence of exchange rate variability on trade balance. On the one hand, some believe that in the absence of any mechanism to lessen this risk, volatility will reduce the volume of trade. Ethier (1973) shows that, if traders were unsure as to how the exchange rate influences their firms' revenue, the volume of trade would be reduced. It is possible to mitigate this uncertainty; however, Clark (1973) notes that while risk-aversion among traders might depress the volume of a country's exports, perfect forward markets might reduce this effect (Bahmani-Oskooee and Hegerty, 2007). Baron (1976) notes that forward markets may not be adequately developed and traders may still be uncertain of how much foreign exchange they wish to cover. On the other hand, others try to show that increased exchange-rate volatility might have the opposite effect and boost the trade volume. Viaene and de Vries (1992) note that, as foreign buyers and local sellers are on the opposite sides of a risky-taking relationship, their primary roles are converse, causing a positive coefficient on the variable of volatility for one partner. Franke (1991) demonstrates that, under very strict

conditions, businesses might benefit from increased fluctuation and thus improve their export volume in response. Sercu (1992) also points out that volatility can improve trade, as it increases the probability that the price a trader receives might overweigh trade costs. Broll and Eckwert (1999) come to the conclusion that volatility raises the interest of exporters; since this risk helps increase the potential gains from trade, the volume and the value of trade will increase accordingly.

One of the theories which can not be overlooked when considering the impact of exchange rate volatility on trade balance is the J-curve effect.

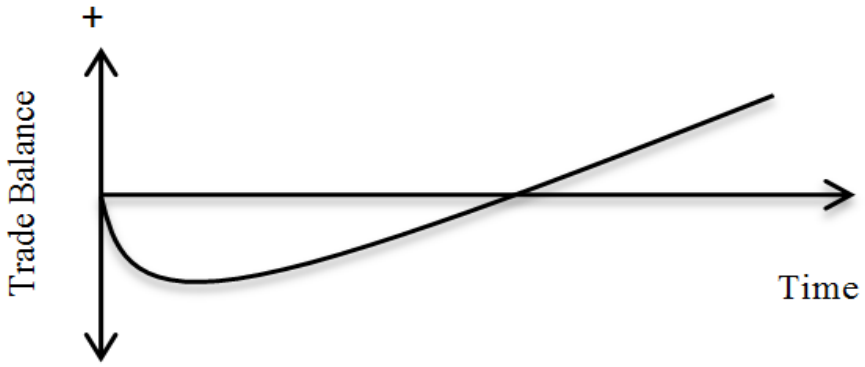

Figure-1. J-curve effect
Source: International Finance, Levi (2005)

The phenomenon of an initial deterioration and subsequent recovery of the trade balance after depreciation or devaluation of the local currency is known as the J-curve effect (Levi, 2005).

According to theory base, the trade balance will deteriorate in the short run because of two main reasons. Firstly, it takes time for local consumers to change their preferences from imported goods to domestically produced ones. Therefore, it is widely believed that demand is more inelastic in the short run than that in the long run. Secondly, the domestic goods could not replace foreign goods right after the home currency depreciates. Thus, only after suppliers begin to produce what were previously imported as well as consumers switch their preferences to local goods, can import demand goes down after the depreciation. Also, exports will expand only after producers can supply more for selling abroad as well as after international consumers switch their references to these substitutes.

The Figure 1 presumes that depreciation appears at time 0 on the time line, the balance of trade worsens shortly after the depreciation. When import and export elasticities increase, the trade balance does turn round and ultimately improve.

For empirical studies in other countries such as Mexico, Brian and Subarna (2003) examines the relation between exchange rate uncertainty and foreign trade in volume of Mexican case during 1980-2000. He used the regression model that relevant economic variables including export volume, real exchange rate (peso against USD), Mexican real GDP, and real GDP of the United States were found non-stationary. However, by testing the stationary property of residuals from the estimated regression model, he found that the residuals were satisfied to be stationary. Therefore the regression models were still carried out with those variables. The results of his study demonstrated that the Mexican economy provided limited evidence that exchange rate risk can affect the volume of export and import in foreign trade significantly. It was supposed that the impact of exchange rate might be indirect and hidden in other factors such as interest rates. Nevertheless, the study highlighted that the GDP of the US had a substantial influence on the export value of Mexico. Accordingly, he suggested that Mexico should exploit its export potential by increasing economic ties to other trading partners in which the United States is the priority.

In the approach of methodology, Akhtar and Hilton (1984) use a polynomial distributed lag method in their OLS estimate of the impacts of exchange-rate volatility. With data for the USA and Germany, they estimate their

models by quarterly data in 1974-1981. The authors find that volatility had a considerably negative effect on German exports, German imports, and US imports, but there is no effect on the exports of the US. Thus their conclusion conforms to the theory that increased risk reduces trade flows.

For more recent studies, Tantatape (2002) selects independent variables including the real exchange rate, the domestic income, and the foreign income in his trade-balance equation to investigate the impact of real bilateral exchange rate fluctuation on trade balances in Thailand from 1990-2000. He uses tests proposed by Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) to check time-series properties of the data. Then, the co-integration test was used in his study to prevent spurious results due to time-series characteristics of data. The results from his study showed that real bilateral exchange rate significantly impacts the bilateral trade balances between Thailand and its main trading partners. He also finds that foreign real income seems not to be a significant factor influencing Thailand's trade balance over the time period.

Kanchana (2010) uses the regression model with the dependent variable is the quarterly rate of change in Sri Lanka's aggregate exports and imports to and from China. The independent variables include the quarterly change of real bilateral exchange rate between the Sri Lankan rupee and Chinese RMB, the quarterly change in income in the importing country captured by its real GDP growth, and the quarterly variance of the exchange rate. Their finding is that bilateral exchange rate volatility does play a major role in trade, while income growth changes have less impact on determining the volume of exports and imports between the two countries.

With regards to J-curve effect, several researchers release analyses based on their country-specific situation. Specifically, Onafowora (2003) employs a combination of methods including Generalized IRFs and cointegration to examine short-term and long-term relationship of bilateral trade between Thailand, Indonesia, and Malaysia with Japan and the USA. There are mixed results in his study. While trade balance improves in the long run for the six country pairs, Thailand illustrates the J-curve shape in trade only with the USA. Malaysia and Indonesia show a J-curve shape with both trading partners.

Regarding to Asian countries' aggregate trade, Akbostanci (2004) finds no evidence of a J-curve pattern for Turkey's trade balance over the period of 1987-2000. De Silva and Zhu (2004) employ traditional impulse-response functions (IRFs) to attempt various orderings of different combinations of variables and overall they find that the trade increases, but the GDP does not response positively to depreciation.

Other studies examining different countries all over the world also use similar models and techniques. Hacker and Hatemi (2004) inspect bilateral trade between Hungary, the Czech Republic, and Poland with Germany, employing monthly data for 1993 - 2002. The shape of the generalized IRFs along with long-run Johansen coefficients, obtain evidence that there is an improvement in trade balance after four months. Narayan and Narayan (2004) use three newer regression-based cointegration tests – the dynamic OLS, ARDL approach, and fully modified OLS – to assess the aggregate trade of Fiji. The result is that if the regressions have negative coefficients before positive coefficients, the J-curve is demonstrated by the IRF shape.

With a combination of different approaches, Rahman and Islam (2006) employ the Engle-Granger cointegration approach and IRFs to analyze trade balance of Bangladesh; Halicioglu (2007) studies Turkey's trade with nine top-trading partners by using the generalized IRFs, Vector Error Correction model, and the Johansen cointegration. Despite their effort, these researchers found no evidence of the J-curve phenomenon.

In later studies, the ARDL model is used to develop the approach studying the J-curve effect rather than traditional methods. For example, Rehman and Afzal (2003) use the short-run coefficients, finding that the coefficients' direction at a long lag is opposite to those at shorter lags. Although they find the evidence for the J-curve pattern in Pakistan, they advise that readers should disaggregate the data as an additional practice. Another example is the study of Arora *et al.* (2003) she examines India's trade with seven developed countries. He could find only the effects in the long term for four partners and therefore no J-curve demonstrated. However, Bahmani-Oskooee *et al.* (2006) show strong evidence of dynamic effects between the UK and its twenty top-trading partners

in 1973-2001. Specifically, Canada-US trade performs a shape similar to a J-curve, while three other countries displays oscillating effects similar to a W-curve.

There is not much quantitative study about the case of Vietnam, Trinh (2014) uses a logarithm regression model to explore the impact of exchange rate fluctuation on the trade balance in short and long run by quarterly data from 2000-2010. She finds that real exchange rate does have a positive impact on trade balance in the long-term; that is, a dong devaluation can result in an improvement of trade balance and vice versa. In addition, in the short-run, a real depreciation/devaluation of VN dong can cause immediately adverse impact on trade balance but these consequences do not last long; the trade balance will be improved after four quarter since the devaluation of Vietnam dong. Although she employed a variety of methods in her research, the number of observations is limited at only 40 quarters, which may lead to bias in her results.

In the earlier study of Thach and Kaliappa (2005) they use the Error Correction models (ECM) to analyse the effects of exchange rates and prices on trade flows in the short and long term in Vietnam during 1992-1998. Their result shows that exchange rates and world income movements have more significant effects on exports than prices in the long term during the 1990s. In other words, devaluation could stimulate exports in the long run. However, price effects on exports are more significant than the exchange rate effects in the short run. Meanwhile, responses of import demand to variation in relative import prices are obviously larger than that in exchange rates, for both short and long run in the period given. Therefore, they point out that the Marshall-Lerner condition for a successful devaluation of Vietnam dong to encourage exports and trade balance in Vietnam was held during the 1990s.

3. DATA AND METHODOLOGY

3.1. Source of Data

Data are collected quarterly from 2001(1) to 2015(4) to estimate the relationship between exchange rate and trade balance. The reason for selecting this time period is due to the availability of data, as known the quarterly GDP data of Vietnam was just revealed from 2000, and the year of 2000 is chosen to be the basic year in some computation. Also, the quarterly period is preferable to the yearly period to make sure that the observations are greater than thirty that is known as a key requirement in econometric models.

Data used in the analysis are taken from the following reliable sources:

- From International Financial Statistics (IFS): average-period nominal exchange rate of all currencies against USD, exports and imports of goods and services of Vietnam with top trading partners, CPI data of Vietnam and top trading partners, real GDP growth for top 10 trading partners in percent form
- From General Statistics Office of Vietnam (GSO): Real GDP growth of Vietnam in percent form

The trade balance is defined in this study as the ratio of exports value to imports value (EM/IM).

Real effective exchange rate (REER) is computed based on Nominal Effective Exchange Rate (NEER) after being adjusted by CPI of Vietnam and that of top trading partners.

3.2. Stationarity

Stationarity is a primary test used in time series analysis to examine whether all variables included in the equation are stationary or not. A stationary variable is one that is not explosive, nor trending, and nor wandering aimlessly without returning to its mean. To test the stationarity of these variables, the Augmented Dickey-Fuller (ADF) test is carried out with the null hypotheses that: (1) LNTB has a unit root; (2) LNREER has a unit root; (3) LNGDP has a unit root; and (4) LNGDPFR has a unit root. The first tests are for variables in levels and the second tests are for variables in 1st difference.

The result is summarised as below:

Table-1. Dickey-Fuller (ADF) test in levels and in 1st difference

Variables	ADF test statistic	Critical values at 5%	Prob*.	Stationarity
LNTB	-4.1335	-3.4878	0.0097	Yes
LNREER	-2.4457	-3.4892	0.3531	No
LNGDP	-3.2832	-3.4937	0.0798	No
LNGDPFR	-4.7185	-3.4907	0.0018	Yes
D(LNTB)	-9.7961	-3.4892	0.0000	Yes
D(LNREER)	-6.7117	-3.4892	0.0000	Yes
D(LNGDP)	-5.0937	-3.4987	0.0006	Yes
D(LNGDPFR)	-5.9278	-3.4921	0.0000	Yes

Source: the author's calculation based on the data

According to the results in levels, the two variables LNREER and LNGDP are non-stationary in levels (as the absolute values of ADF test statistic are lower than the absolute value of critical values) while LNGDPFR and LNTB are stationary in levels (as the absolute values of ADF test statistic are higher than the absolute values of critical values).

In the 1st difference, the null hypotheses given here are: (1) D(LNTB) has a unit root, (2) D(LNREER) has a unit root, (3) D(LNGDP) has a unit root, and (4) D(LNGDPFR) has a unit root. The report shows that all variables given are stationary under 1st difference (as the absolute values of ADF test statistic are higher than the absolute values of critical values).

2.3. Model Specification

The variables employed for the model to investigate the impact of exchange rate on Trade Balance includes: Real effective exchange rate (REER), the domestic income (GDP), and the foreign income (GDPFR) based on economic theories.

$$TB = f(REER, GDP, GDPFR)$$

REER is the best representative for exchange rate because it represents the average exchange rate index of the Vietnam dong compared to top-trading-partners' currencies, adjusted by domestic inflation and these partners' inflation.

The trade-balance function is a function of real effective exchange rate, domestic income, and foreign income as follows:

$$LNTB_t = \beta_0 + \beta_1 LNREER_t + \beta_2 LNGDP_t + \beta_3 LNGDPFR_t + \varepsilon_t \qquad (1)$$

where:

$LNTB_t$ – trade balance in logarithm form;

$LNREER_t$ – real effective exchange rate in logarithm form;

$LNGDP_t$ –real domestic output, percent, in logarithm form;

$LNGDPFR_t$ – real foreign output, percent, in logarithm form;

ε_t –error term;

Trade balance is equal to the ratio of exports to imports. This measure is chosen instead of the absolute value of trade balance because it will address the problem of logarithm form when there is a trade deficit. In this model, β_1 is expected to be positive ($\beta_1 > 0$), meaning that a depreciation or devaluation of the dong will improve exports and deteriorate imports, and therefore the ratio increases. Similar to β_1, β_3 is expected to be positive ($\beta_3 > 0$), because a rise in foreign income will boost the need for importing goods from Vietnam, and therefore exports is predicted to improve and no influence is anticipated in imports change. In the opposite sign to β_3, β_2 is expected to be negative ($\beta_2 < 0$) in the explanation that when domestic income increases, the demand for goods from foreign countries will increase too. Therefore, imports will increase and no influence on exports is expected in this case, then the ratio will decrease.

However, after checking the properties of the data, in the cointegration analysis, the model (2) will be applied since it meets the requirements of stationarity and non-serial correlation for time-series.

$$\Delta LNTB_t = \beta_0 + \beta_1 \Delta LNREER_t + \beta_2 \Delta LNGDP_t + \beta_3 \Delta LNGDPFR_t + \varepsilon_t \quad (2)$$

Note that Δ denotes the first difference in variables.

4. RESULTS AND DISCUSSION

4.1. Long Run Relationship between Exchange Rate and Trade Balance: ARDL Model

The developed Autoregressive Distributed Lag Models (ARDL) is applied in this analysis based on its advantages in considering lagged values of both dependent and independent variables. This is a valuable tool for testing the presence of long-term relationships between economic time-series.

To determine the maximum lags, the study applies Schwarz (Bayes) Criterion (SC) among the information criteria as it is a consistent model-selector. The result shows that the lag 1 is the optimal lag because the SC value is smallest.

In addition, the model of lag 1 is checked for stability by CUSUM test and revealed that the model is dynamically stable (see in appendix A)

As a result, the ARDL model under lag one meet all requirements of non-serial correlation and stability, and presented in model (3):

$$\Delta LNTB_t = \propto + \beta_1 \Delta LNTB_{t-1} + \gamma_1 \Delta LNREER_{t-1} + \delta_1 \Delta LNGDP_{t-1} + \theta_1 \Delta LNGDPFR_{t-1} + \varphi_0 LNTB_{t-1} + \varphi_1 LNREER_{t-1} + \varphi_2 LNGDP_{t-1} + \varphi_3 LNGDPFR_{t-1} + e_t \quad (3)$$

Now it is ready to perform the Bounds Testing to test whether LNTB, LNREER, LNGDP, and LNGDPFR have a long-run relationship or not.

The null hypothesis (H0): $\varphi_0 = \varphi_1 = \varphi_2 = \varphi_3 = 0$

The alternative hypothesis (H1): $\varphi_0 \neq 0, \varphi_1 \neq 0, \varphi_2 \neq 0, \varphi_3 \neq 0$

The null hypothesis implies that there is no cointegration between variables or no long-run relationship in other words. By contrast, the alternative hypothesis rejects the absence of long-run relationship, meaning that there is a long-run relationship.

The appropriate test employed is Wald-test based on F-statistic:

Table-2. F-statistic from Wald-test

Test statistic	Value	df	Probability
F-statistic	5.9963	(4,49)	0.0005

Source: the author's computation based on the data

The Table 3 shows that the lower bound and upper bound for F-statistic at 5% significance level are 3.23 and 4.35 respectively. As the value of F-statistic in Table 2 (i.e 5.996254) exceeds the upper bound (i.e. 4.35) at 5% significance level, we can conclude that there is evidence of a long-run relationship between time-series (Pesaran *et al.*, 2001). In other words, the null hypothesis is rejected, meaning that there is cointegration. It means that the four variables are not jointly equal to zero and move together in the long run.

Table-3. Lower and Upper Bounds for the F-test statistic at 5% level of significance

k	0.050	
	I(0)	I(1)
0	8.21	8.21
1	4.94	5.73
2	3.79	4.85
3	3.23	4.35

Source: Pesaran *et al.* (2001) Table CI(iii) case III

From the bounds test taken, we can conclude that there is cointegration between variables in the model (2), and we can meaningfully estimate the long run relationship between these four variables based on ARDL (1,1,1,1) in the equation (3).

Table-4. Estimated ARDL (1, 1, 1,1) model

Variable	Coefficient	t-statistic
D(LNTB(-1))	-0.0434	-0.3256
D(LNREER(-1))	-0.0717	-0.1975
D(LNGDP(-1))	0.0482	0.7960
D(LNGDPFR(-1))	-0.0390	-3.4993
LNTB(-1)	-0.5324	-4.0368
LNREER(-1)	-0.1104	-2.7217
LNGDP(-1)	-0.0214	-2.5957
LNGDPFR(-1)	0.0198	2.3823

Note: R2 = 0.45; Adj. R2 = 0.37; Sum sq. resides = 0.35; SE of regression = 0.07; Log likelihood = 74.81; AIC = -2.30; SC= 2.019842; Mean dependent = 0.00; Durbin-Watson stat = 1.94

Source: the author's computation based on the data

Because the estimated coefficient of the intercept is not statistically significant with p-value >0.05 (low t-statistic value), we have to eliminate the intercept to obtain a better model. The Table 4 represents estimated coefficients in the model (3) without the intercept. The model is serially independent, homoscedastic, and stable.

The long-run coefficients for LNREER, LNGDP, LNGDPFR are determined by dividing $\varphi_1, \varphi_2, \varphi_3$ (estimated in Table 4) by φ_0. It can be summarized in the Table 5 as follows:

Table-5. Estimated long-run coefficients

Coefficient from eq. (4)	Coefficients estimated from eq.(4)	Long-run coefficients	Long-run coefficients estimated
φ_0	-0.5324		
φ_1	-0.1103	$-\frac{\varphi_1}{\varphi_0}$	-0.21
φ_2	-0.0213	$-\frac{\varphi_2}{\varphi_0}$	-0.04
φ_3	0.0198	$-\frac{\varphi_3}{\varphi_0}$	0.04

Source: the author's computation based on the data

$$LNTB_t = -0.21\ LNREER_t - 0.04LNGDP_t + 0.04LNGDPFR_t \quad (4)$$

The equation (4) shows the long-run relationship between real exchange rate, domestic GDP, foreign GDP and trade balance. Specifically, it shows that real exchange rate and domestic GDP have a negative impact on trade balance; by contrast, foreign GDP has a positive impact on trade balance. While the signs of coefficients of domestic GDP and foreign GDP are same as expected, the sign of real exchange rate movements is opposite to the expectation.

In the relationship between real exchange rate and trade balance, the equation represents that a real depreciation/devaluation of the home currency (VND) will lead to deterioration in trade balance in the long run. The coefficient of -0.21 is also the elasticity between real exchange rate and trade balance. It means that one percent of VND real depreciation (REER increases) results in 0.21 percent deterioration in trade balance; similarly, one percent of VND real appreciation (REER decreases) causes 0.21 percent improvement in trade balance.

Besides, the domestic output shows a negative impact on trade balance. In particular, an increase in GDP by 1% leads to 0.04 percent of a decrease in trade balance; and a decrease in GDP by 1% causes 0.04% of an increase in trade balance.

Regarding foreign output, the long-run regression result shows that there is a positive relationship between foreign output growth and trade balance as expected in the theory. To be more specific, when foreign output growth goes up by 1%, it will contribute to improving trade balance by 0.04%; and in the opposite direction, it will worsen the trade balance position. Noticeably, the result reveals that the magnitude of impact of domestic GDP and foreign GDP is approximately the same (both absolute coefficients equal 0.04).

With the assumption that demand is relatively elastic, it is expected that a real appreciation would worsen the trade balance position, i.e we will get a fall in exports and an increase in imports and trade balance will fall into big deficit. However, in fact, the impact on trade balance also depends on the elasticity of demand. If demand for imports and exports is inelastic, meaning that it is not affected by price-related changes, the trade balance can even improve as shown in the sign of LNREER coefficient. Specifically, when REER goes down, hence VND appreciates, exports are more expensive. However, the fall in demand for VN goods will be insignificant due to the inelasticity of the demand from foreigners. As a result, the value of exports will increase and hence the trade balance can be improved.

Additionally, the unexpected sign of LNREER may be caused by the two possible reasons. Firstly, all the factors affecting trade balance according to the theory base are not supportive enough for the case of Vietnam; it is likely that there is a lack of an important factor that does affect trade balance in this period but not discovered yet in the study. If this supposition is true, the study is open to further studies that can prove that a significant factor must be included when testing the specific case of Vietnam. Secondly, although data are collected from reliable sources

from domestic to international, the accuracy of the data may not be perfect. For some certain reasons, the data recorded might not reflect the real situation in Vietnam.

4.2. Short Run Relationship between Exchange Rate and Trade Balance: ECM Model

To examine the short run relationship between exchange rate and trade balance, we use usual Error-Correction Model for the model of optimal lag at 1 lag.

$$\Delta LNTB_t = \propto + \beta_1 \Delta LNTB_{t-1} + \gamma_1 \Delta LNREER_{t-1} + \delta_1 \Delta LNGDP_{t-1} + \theta_1 \Delta LNGDPFR_{t-1} + \omega z_{t-1} + e_t \quad (5)$$

where zt-1 is lag 1 of the error term in the original model (1)

The estimated equation in the short run is that:

$$\Delta LNTB_t = -0.004 + 0.0297\Delta LNTB_{t-1} - 0.2213\Delta LNREER_{t-1} + 0.1049\Delta LNGDP_{t-1} - 0.0336\Delta LNGDPFR_{t-1} - 0.5521 z_{t-1} \quad (6)$$

The coefficient of z_{t-1} is the speed of adjustment, meaning that the whole system can get back to long-run equilibrium at the speed of 55.21%. The LM test is proceeded to check serial correlation and the result in Table 11 shows that there is no serial correlation existing in the model.

The CUSUM test (see in Appendix B) depicts that the model is stable. Thus, the estimated equation given (6) is a desirable model to estimate the relationship of variables in the short run.

Wald-test is used to test the short run effect of LNREER on LNTB.

The null hypothesis (H0): $\gamma_1 = 0,$

The alternative hypothesis (H1): $\gamma_1 \neq 0$

Table-6. Wald test for the coefficient of LNREER

Test statistics	Value	Df	Probability
t-statistic	-0.5991	52	0.5515
F-statistic	-0.3589	(1,52)	0.5517
Chi-square	0.3589	1	0.5491

Source: the author's computation based on the data

The result in the Table 6 shows that we fail to reject the null hypothesis. In other words, the coefficient representing the short run effect of real exchange rate on trade balance is zero and therefore, no short run effect between LNREER and LNTB. In addition, the whole model is getting adjusted at the speed of 55.21% to get the long-run equilibrium according to the coefficient of z_{t-1}.

4.3. The Inverse Impact of Trade Balance on Exchange Rate

In order to investigate the causal relationship between exchange rate and trade balance, the Granger Causality test is preferable because it allows us to analyse which variable precedes ore leads the other.

On the one hand, to test whether fluctuation in exchange rate causes trade deficit/surplus or not, Granger Causality test suggested running the model:

$$TB_t = \beta_0 + \beta_1 TB_{t-1} + \cdots + \beta_p TB_{t-p} + \alpha_1 REER_{t-1} + \cdots + \alpha_p REER_{t-p} + \varepsilon_t \quad (7)$$

On the other hand, to test whether trade deficit/surplus leads to exchange rate changes or not, Granger Causality test suggested running the model:

$$REER_t = \beta_0 + \beta_1 REER_{t-1} + \cdots + \beta_p REER_{t-p} + \alpha_1 TB_{t-1} + \cdots + \alpha_p TB_{t-p} + \varepsilon_t \quad (8)$$

However, after checking stationarity of TB and REER variables, LNTB is stationary but LNREER is non-stationary. Thus, it is necessary to convert REER into the first difference before proceeding with causal test. The converted models are as follows:

$$LNTB_t = \beta_0 + \beta_1 LNTB_{t-1} + \cdots + \beta_p LNTB_{t-p} + \alpha_1 D(LNREER)_{t-1} + \cdots + \alpha_p D(LNREER)_{t-p} + \varepsilon_t \quad (9)$$

And,

$$D(LNREER)_t = \beta_0 + \beta_1 D(LNREER)_{t-1} + \cdots + \beta_p D(LNREER)_{t-p} + \alpha_1 LNTB_{t-1} + \cdots + \alpha_p LNTB_{t-p} + \varepsilon_t \quad (10)$$

Note: D represents the first difference, t is trend, and p is optimal lag length.

The null hypotheses in the Granger Causality test are: in model (9) all the coefficients of the lagged REERs jointly equal zero; and in model (10), all the coefficients of the lagged TBs jointly equal zero. In other words, Exchange Rate (REER) does not Granger cause Trade Balance (TB), and Trade Balance (TB) does not Granger cause Exchange Rate (REER) corresponding with model (9) and model (10).

In contrast, the alternative hypotheses are that: Exchange Rate (REER) does cause Trade Balance (TB), and Trade Balance does cause Exchange Rate (REER) in model (9) and model (10) respectively.

The results of Granger Causality are given in the Table 7:

Table-7. Granger Causality test

Null hypothesis	F-Statistic	Prob.
DLNREER does not Granger Cause LNTB	5.0938	0.0095
LNTB does not Granger Cause DLNREER	3.4129	0.0405

Source: the author's computation based on the data

As can be seen from the Table 7, the p-values of F-statistic in both cases are less than 0.05, meaning that we reject the null hypotheses stated. In other words, changes in exchange rate Granger do cause changes in trade balance and vice versa.

4.4. J-Curve Effect Test

To test whether the effect of devaluation in Vietnam dong on trade balance follows the J-curve or not, the impulse response function is employed. The impulse response function shows the effects of shocks on the adjustment path of the variables. In the study, the impulse response function analysis with two time series (trade balance and exchange rate) based on a bivariate VAR system of stationary variables is considered as follows:

$$\Delta LNTB_t = \delta_{10} + \delta_{11}\Delta LNTB_{t-1} + \delta_{12}\Delta LNREER_{t-1} + v_t^{lntb} \quad (11)$$

$$\Delta LNREER_t = \delta_{20} + \delta_{21}\Delta LNREER_{t-1} + \delta_{22}\Delta LNTB_{t-1} + v_t^{lnreer} \quad (12)$$

There are two possible shocks to the system- one to LNTB and the other to LNREER. However, for the purpose of examining the J-curve; we are interested in the effect of a shock to LNREER to the time paths of LNTB, Fig. 2.

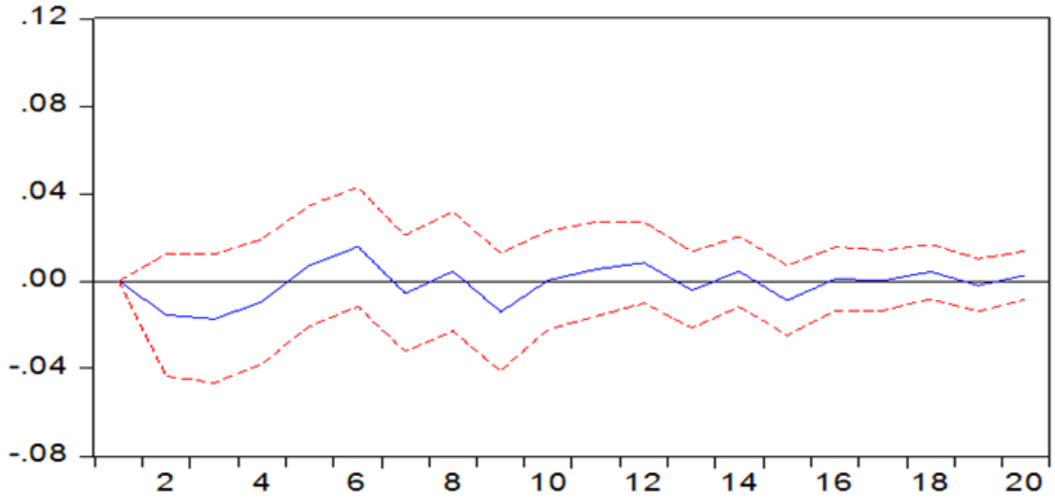

Figure-2. Evolution of trade balance following real depreciation, Response to Cholesky One S.D Innovation +/- 2S.E
Source: the author's computation based on the data

Fig. 2 shows that right after a shock in real devaluation, the trade balance would worsen in two first quarters. After that, the trade balance starts improving to get the peak in the 6th quarter. As observed, from the 5th quarter the trade balance obtains surplus but it does not last for long until quarter 6th. During later quarters, the trade balance experiences fluctuation in both surplus and deficit. Eventually, the trade balance will get the new equilibrium from quarter 13th based new market conditions. It also means that after three years from the shock in a real depreciation, the trade balance is able to get the new balance where exports and imports are seemly equal. The impulse response result also implies that the existence of J-curve effect in the relationship between exchange rate and trade balance. However, the J-curve pattern is still not really clear. In particular, the J curve only last for 6 quarters, equivalent to 18 months in which there are 12 months is in deficit and only 6 months in surplus after that, followed by ambiguous patterns.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

With regards to the long run, real exchange rate and trade balance do have a negative long-run relationship. The result revealed in the study is quite different from previous studies for Vietnam case. While past studies usually show the positive impact of exchange rate on the trade balance, this result shows the opposite. Specifically, a real appreciation of dong can lead to an improvement in trade balance position, and a real depreciation can give rise to a deterioration of trade balance in the long run. The coefficient of -0.21 is also the elasticity between real exchange rate and trade balance. It means that one percent of VND real depreciation (REER increases) results in 0.21 percent deterioration in trade balance; similarly, one percent of VND real appreciation (REER decreases) causes 0.21 percent improvement in trade balance.

However, the impact of real exchange rate on the trade balance is very limited due to the magnitude of REER coefficient which is just 0.21. It means that trade balance is influenced by not only exchange rate but also other factors. It is also important to note that exchange rate regime in Vietnam is *de jure* managed floating exchange rate regime but *de facto* is a simple US dollar peg system that not market-driven. Thus, the intervention of the government into FOREX leads to distortion of foreign exchange market.

Additionally, the unexpected sign of LNREER may be caused by the two possible reasons. Firstly, all the factors affecting trade balance according to the theory base are not supportive enough for the case of Vietnam; it is likely that there is a lack of an important factor that does affect trade balance in this period but not discovered yet in the study. If this supposition is true, the study is open to further studies that can prove that a significant factor must be included when testing the specific case of Vietnam. Secondly, although data are collected from reliable sources

from domestic to international, the accuracy of the data may not be perfect. For some certain reasons, the data recorded might not reflect the real situation in Vietnam.

Regarding domestic output and foreign output, the two economic variables also have an impact on the trade balance in the direction as expected. While domestic output demonstrates a negative impact on trade balance, foreign output demonstrates a positive impact on the trade balance. Specifically, one percent increase in domestic output will lead to 0.04 percent decrease in trade balance; and one percent increase in foreign output will contribute to 0.04 percent increase in the trade balance. However, the magnitude of the effect of the two indicators on the trade balance is still very small.

In the short run, there is no evidence of any impact caused by real exchange rate on the trade balance. However, regarding the J-curve effect, in response to the shock from an increase in REER (VND depreciates), trade balance deteriorates in first two-quarters and then start improving till the 6th quarters. However, it takes four quarters to be in deficit and the surplus only last for two quarters. After the 6th quarter, the trade balance again falls into deficit and followed by rises and falls unexpectedly. According to economic theories, the J-curve effect suggests that after a devaluation or depreciation of the home currency (exchange rate increases), it takes a while from two to eight quarters for the trade deficit; and then followed by a long-term surplus of trade account. Therefore, with responses observed from the analysis, trade balance has a sign of J-curve but the time of impact does not last long enough to assure that it follows a proper J-curve pattern.

Also, the trade balance has an inverse impact on changes in exchange rate through the supply of and demand for foreign currency. When there is a trade deficit, it will lead demand to be greater than supply, and hence exchange rate tends to increase. Similarly, if trade balance is improving, exchange rate tends to decrease. However, with limitations of Granger Causality test, the term of the inverse impact has not been determined yet. It is open further research about the impact of trade balance on exchange rate in short and long term

5.2. Recommendations

Firstly, it is necessary to promote the transformation from low value-added products to high value-added products. The export production still relies largely on imported inputs. If there is an increase in export of import-based products, it would lead to an increase in import for raw materials as a matter of course. Thus, the value added in exported products remains low and hardly improve trade balance. In order to cut down importation of raw materials, the authorities should encourage investors to engage more in manufacturing and processing industry to produce raw materials itself instead of importing from abroad.

Secondly, the export market should be extended and diversified not to be affected by some economies when there are shocks in such economies. As known that the United States, Japan, Europe are the main markets for exporting goods from Vietnam. Thus, when they are directly affected by economic recession, the demand for goods and services from Vietnam will decrease correspondingly, leading to a significant decline in the values of exports of Vietnam. Exploring new markets for exports are seen as the new target in the upcoming years to contribute to improving trade balance.

Thirdly, policy makers should take into account inflation rate of Vietnam and other trading partners before deciding to adjust nominal exchange rate. One of the main purposes of adjusting nominal exchange rate is to improve trade balance through relative price channel. However, the relative price channel depends on real exchange rate rather than the nominal exchange rate. Considering inflation and the nominal exchange rate of various countries and currency will help to estimate the trend of the real effective exchange rate and avoid unanticipated trends that may worsen the trade balance.

Fourthly, the study suggests that there is no short-run relationship between real exchange rate and trade balance. Therefore, exchange rate policy managers should not aim to use the exchange rate as the main tool in improving trade balance in the short run. Inflation, monetary policy, capital management, and interest rate policy

are those that need to be taken into consideration jointly instead of solely exchange rate in the trade deficit situation. The study also points out that there exists a long-run relationship between real exchange rate and trade balance, but this relationship is not really strong shown by the magnitude of the impact. Thus, if policymakers wish to improve trade balance in the long run, real exchange rate should not be considered alone, but have to combine and analyse jointly with the macroeconomic variables to make sure the policy implemented will obtain the target in the real economic situation in Vietnam.

Fifthly, the J-curve analysis indicates that a real depreciation/devaluation of the dong would not help to improve trade balance for long. If the policymakers want to sacrifice other targets to obtain trade-surplus target by generating a real depreciation/devaluation of the dong, they should be aware of the time length that a surplus can maintain following the real depreciation. If the surplus can offset the loss from sacrificing other targets, it is worthwhile to do so; otherwise, it is better to look for other solutions.

Finally, there is a need to limit the intervention of the government on foreign exchange market to make the exchange rate more flexible. A more flexible exchange rate regime would also help improve the country's relatively-low foreign exchange reserves. Sandeep - the lead economist of the Word Bank office in Vietnam explained that "If you try to fix the exchange rate, which means you will have to spend your foreign reserves to keep the rate at certain level" (Anh, 2016). Since April 2016, Vietnam decided to adopt a more flexible exchange rate mechanism compared with the previous one. Specifically, while in the previous system, the dong was allowed to trade around a fixed rate that the State Bank only adjusted a few times each year, in new mechanism the State Bank of Vietnam sets the official mid-point rate of the dong against US dollar on a daily basis. The current mechanism calculates the daily exchange rate based on the basket of eight foreign currencies including USD, CNY, EUR, JPY, TWD, KRW, THB, and SGD. Vietnam should keep refining the exchange rate system in a more flexible and transparent way towards a floating freely system to reduce the pressure on foreign reserves as well as to reflect more accurately the supply of and demand for foreign currencies.

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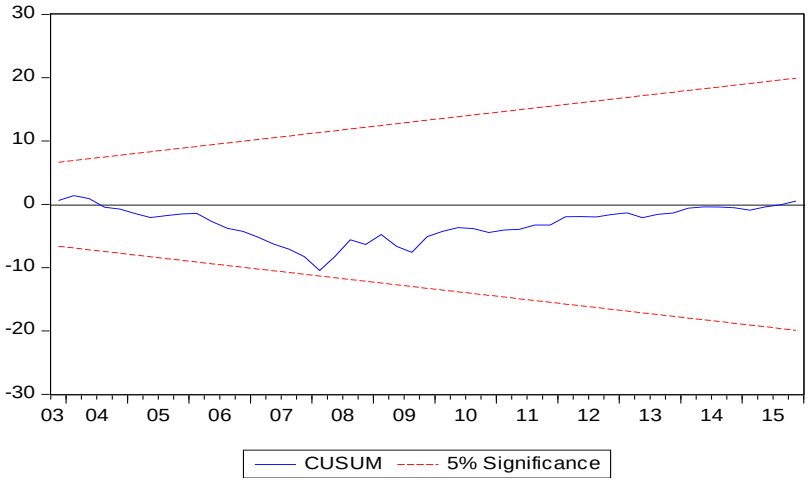
Appendix-A. Stability Testing, Cusum Test



Appendix-B. Stability Testing, Cusum Test