



The Impact of Exchange Rate Movements on Trade Balance between Vietnam and Japan: J-Curve Effect Test

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Abstract: This study clarifies the impact of the fluctuation of the VND/USD and VND/JPY exchange rates on the trade balance between Vietnam and Japan through testing the J-curve effect by using a vector autoregressive (VAR) model, Impulse Response Function (IRF), stationary test, Granger test and variance decomposition analysis. There are 5 variables including oil price (POIL), Gross Domestic Product (GDP), Consumer price index (CPI), Trade balance/Capital account (CA), Nominal exchange rate (NER) based on 67 observations from 2001Q1 to 2017Q3. The highlight of this study compared with previous studies is that we not only evaluate the effect of the exchange rate movements towards the total trade balance between Vietnam and Japan but also investigate how the fluctuations of the exchange rate affect the trade balance in each commodity group; therefore, we suggest more essence evaluation and policy implications for these sectors. The results show that the depreciation or the devaluation of VND will improve the trade balance of group 84 (Machinery, mechanical appliances, nuclear reactors, boilers) and group 94 (Furniture) in both the exchange rate VND/USD and VND/JPY, and group 27 (Mineral fuels, mineral oils and products of their distillation) and group 85 (Electrical machinery and equipment and parts thereof) in the VND/USD exchange rate. Besides, in total products and group 27, the VND/JPY exchange rate impacts on the trade balance in a J-curve effect.

Keywords: J-curve, VAR, exchange rate, trade balance, Vietnam, Japan.

1. Introduction

In the age of globalization and extensive integration, international trade plays a strategic role in the economic development of each country. The exchange rate is a crucial tool to

reach the final goals of monetary policy, enhancing the economic development and stabilizing the price. While an appropriate exchange rate policy will help stabilize the domestic currency, stimulate export and improve the current account, an unsuitable exchange rate policy, however, can lead a country to recession. As a result, in order to achieve economic goals, the administration of exchange rates always plays a vital role. As a

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small open economy, Vietnam has to pay close attention to the fluctuations of the exchange rates of VND vis-à-vis major currencies in the basket of currencies.

Japan was one of Vietnam's three largest trading partners in the period 2001-2017. In the trade exchange between Vietnam and Japan, both the US dollar and Japanese yen are used in commodity trade bills. However, while the exchange rates of VND/USD only fluctuated in the range of 2-3% over these years, the exchange rate of VND/JPY experienced many fluctuations in the period from 2001 to 2017. Particularly, the exchange rate of VND/JPY fluctuated continuously from 120 in the first quarter of 2001 to 273.5 in the fourth quarter of 2011, then dropped from 265.86 in the first quarter of 2012 to 179.59 in the second quarter of 2015, and then rebounded to 220 in the third quarter of 2016, finally reaching 203.117 in the last quarter of 2017. At the same time, the balance of trade between Vietnam and Japan also experienced many fluctuations, declining from \$4.37 billion (2012) to \$3.47 billion (2017), especially in 2010 when the deficit amounted to \$3.34 million (General Department of Customs). The question is whether such exchange rate movements are related to the fluctuation of the trade balance between Vietnam and Japan or not.

Up to now, the theory of the J-curve is one of many theories widely used to explain the effect of the exchange rate movements on trade balance. According to this theory the devaluation of the domestic currency is expected to have an impact on stimulating exports and improving the current account. Nevertheless, as soon as having a devaluation or depreciation of its current, the status of trade balance initially worsens then it recovers to a higher level due to the price effect. Moreover, after a period of time when the quantitative effect is over, the trade balance is improved gradually.

Because of these reasons, this paper investigates the effect of the J-curve that exists in the bilateral trade relationship between

Vietnam and Japan in the period 2001-2017 through quantitative analysis. If there is a J-curve effect, how will the nature of trade balance change? Research results may be a reference for policymakers as well as for managers of Vietnamese export and import enterprises trading with Japan.

2. Literature review

The study of assessing the impact of exchange rates on trade balance has attracted concern from researchers and policymakers such as Junz and Rhomberg (1973), Connolly and Taylor (1972), Bahmani (1985), Noland (1989), Lal and Lowinger (2002), Marwah and Klein (1996), Peter Wilson (2001), Trinh Pham (2010), Nguyen Nhat Mai (2014), Truong Thi Ngan (2014), Hoang Huong Lan (2016), etc. Marshall-Lerner stated that: to reach a balance of current account, the devaluation of domestic currency will help improve trade balance in the case where the total coefficient of elasticity between import demand and export demand equals 1, and there will be a deficit in trade if the sum of these two coefficients is smaller than 1. Davies (1969) explained the short-term constraints of the Marshall-Lerner conditions using the J-curve. The theory indicates that a short-term currency devaluation will cause the nation's trade balance to fall and it will take a while for the trade balance to improve. Since there have been a number of empirical studies analyzing the impact of currency devaluations on trade balance in the J-curve, these research papers are divided into two main groups.

The research team Junz and Rhomberg (1973) using aggregate trade data initially found that there was a lag in timing, inventory and material handling decisions when prices went down [1]. Consequently, they used annual trade data from 1953 to 1969 for 13 industrialized countries (Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, and the USA) to calculate the

elasticity of the export price by market share and the elasticity of export prices by export bias. Other studies, such as Cooper (1971), Connolly and Taylor (1972), Laffer (1976) and Salant (1976) tested the J-curve, but they all suffered from one of the following errors: (1) The currency devaluation of trade balance in the long and short term; (2) not yet analyzed the time before and after depreciation; (3) did not take into account the effects of variables such as monetary policy or fiscal policy. Bahmani-Oskooee (1985) introduced a non-linear ARDL method and applied a four-country approach to J-curve testing, with different exchange regimes (Greece, India, Korea, and Thailand) for the period 1973-1980. The analysis has confirmed there is a J-curve for Greece, India and South Korea [2]. Noland (1989) used the model of Goldstein and Khan (1985) to test the J-curve for Japan. Noland estimated a late model for the Japanese trade between 1970 and 1985 and used the analyzed data to construct the J-curve for Japan. He suggested that in order to maintain the trade balance the impact on economic activity would be more effective than working through the exchange rate and finding evidence for a Japanese J-curve [3]. In recent years several studies have tested the J-curve by using impulse response features for aggregate trade data. Backus (1993) examines the impact of depreciation on the real trade balance in Japan during the period 1955Q2-1993Q2. The paper uses a self-regression vector (VAR) model and pulse response features to show a Japanese J-curve [4]. Gupta-Kapoor and Ramakrishnan (1999) used an error correction model (ECM) and dummy variables to investigate the flexible exchange rate regime, 1975Q1-1996Q4. Pulse response analysis shows that there is a Japanese J-curve under the floating exchange rate regime [5]. Lal and Lowinger (2002) examine the experiences of seven East Asian countries (Indonesia, Japan, Korea, Malaysia, Philippines, Singapore and Thailand). Use of Johansen's co-ordinate test and correction model Vector errors (ECM) show that the positive change of trade balance

follows the J-curve effect and significant differences in the duration and extent of the J-curve effect between countries [6].

However, Bahmani-Oskooee and Brooks (1999) realized the aggregate trade data of a country in a world that does not exhibit real movement at the bilateral level [7]. Therefore, the recent research group on this topic usually uses bilateral trade data. Rose and Yellen (1989) examined the effect of the J-curve on trade between the United States and some of its key business partners during the period 1963-1988 but did not find the J-curve in the case of the United States [8]. Olugbenga Onafowora (2003) used the vector error correction model (VECM) to measure the relationship between trade balance and real exchange rates [9].

In the case of three countries in ASEAN with the US and Japan in both the short and long-term, the research has verified that there is a J-curve for the case of Indonesia and Malaysia in their bilateral trade with both the United States and Japan and Thailand in bilateral trade with the United States. Marwah and Klein (1996) used analytical data to test but there was no indication that a J-shaped phenomenon between the United States and a major business partner was observed [10]. Peter Wilson (2001) examines the relationship between actual trade balance and real exchange rates for trade in goods between Singapore, Korea and Malaysia with the United States and Japan using the ECM. The results show the J-curve in the case of Korea with both Japan and the United States [11].

In Vietnam, there are also many studies examining the effect of J-curve in both multilateral and bilateral trade data. Trinh Pham (2010) used the autoregressive distributed lag (ARDL) model of Pesaran, Shin and Smith to estimate the long-term effect of real exchange rate devaluation on trade balance with multilaterally commercial data. Short-term effects examined by the ECM show the immediate decline of trade balance after

dumping. Pulse response functions based on the ECM model represent the J-curve of trade balance when long-term depreciation occurs [12]. Nguyen Nhat Mai (2014) applies the VAR model for the Vietnam-US bilateral data with four variables. The study showed that without the J-curve effect, the depreciation of the real exchange rate in Vietnam had a negative impact on trade balance [13]. Truong Thi Ngan (2014) implemented the ARDL regression model to test the J-curve effect in bilateral relations between Vietnam and ten trading partners including China, Japan, South Korea, Singapore, Thailand, the USA, Germany, Malaysia and Hong Kong. From the results of the analysis the authors find the sign of a J-curve in the case of trade balance between Vietnam and Australia.

It can be seen from the literature review that there has been no study investigating the impact of exchange rate fluctuations on trade volatility at the level of each sector. We analyze the effects of exchange rate movements on the trade balance and expand into five main trade sectors between Vietnam and Japan. Consequently, the study provides appropriate recommendations for each sector when the exchange rate fluctuates. This is a new feature of the research.

3. Overview of bilateral trade between Vietnam and Japan from 2001 to 2017

Having established diplomatic relations in 1973, trade relations between the two countries have developed. For Vietnam, Japan is a potential large-scale market and with over 127 million consumers there are many necessary advantages for industrialization and modernization including technology, capital and management skills. On the other hand, Vietnam has a dynamic economy with a stable political environment and abundant human resources. In terms of geographic and cultural proximity Japanese businesses consider Vietnam as a potential investment destination

for foreign direct investment projects to expand their manufacturing facilities in ASEAN. So far, Japan has always been the largest ODA source of Vietnam, one of the largest FDI investors and always in the top 4 trading partners of Vietnam. Especially, in 2014, the two countries raised the relationship to “comprehensive strategic partnership”.

For nearly 20 years, from 2001 to 2017, trade relations between Vietnam and Japan have made great strides and gained considerable achievements. This is reflected in the continuous increase in the value of Vietnam’s exports, which rose from \$4,384,647 million in 2001 to \$33,584,392 million in 2017. The average increase reached 14.5% per year which includes a very strong year in 2007 in which the increase was 25.3% compared with 2006; in 2008, it increased by 43.3% compared to 2007 and increased 29.7% in 2011 compared to 2010. In terms of the trade balance of the two countries, throughout the period, it always reached a surplus but constantly fluctuated in which, with the exception of 2010, Vietnam always exported to Japan. In particular, both countries tend to increase at a rate of 14.4% and 15.1%, respectively. From 2001 to 2017, the export turnover increased from \$2,606,585 million to \$18,526,817 million and the increase of export turnover from \$1,778,062 million to \$15,057,575 million. Nonetheless, Japan’s share in the total import turnover of Viet Nam is declining. This may be explained by the relative decline of Japan’s position when compared to Vietnam’s trade relations with China and the United States in recent years. However, Japan remains one of the three largest export markets and one of the four largest import markets of our country.

When it comes to the economic structure between the two countries, the distinguishing feature is the complementary and less direct competition nature of business. Vietnam exports to Japan mainly crude oil, textiles, electrical wire and cable, wood and wood products, computers and components, coal, seafood and shoes of all kinds. In contrast,

imports from Japan are goods for industrial production, light industry production and domestic demand, mainly including machinery, equipment, tools, spare parts, all kinds of fabric, automobile parts, plastic materials, chemicals, raw materials for textiles, garments, leather, shoes and metals. Within the framework of the study the authors went into 5 high value commodity categories in the trade balance - first of all the three sectors with the highest export share. The first is garment and clothing. In trade relations with Japan this is the main export sector of our country, the export value contributes over 90% of the trade balance value of the sector. In the period 2001-2017, the export value of this sector always increased, except in 2002, with an average annual growth rate of 9.82%. It is expected that in the future the export value of this item will continue to increase. The second is furniture. In the period of 2001-2017, the export turnover of wood products always increased and the average annual growth rate of export turnover reached 11.4%. Currently Vietnamese wood products exported to Japan account for 13.3% of Vietnam's wood exports and account for about 9.5% of Japanese furniture imports. The third category is mineral fuel, mineral oils and products of their distillation: bituminous substances and mineral waxes. The export sector continuously fluctuated due to the impact of world oil prices. From 2017, the export value of this sector has started to show signs of improvement but the volume is still small. Next, the sector that has the largest import value in Vietnam's total import turnover: machinery, including mechanical equipment, nuclear reactors, boilers and parts of them. During the research period, this industry is always in a state of deficit as Vietnam increasingly imports many items of this category to serve the process of industrial modernization. Industry turnover reached a record 2.95 billion USD (2015). The final one is the field of machinery, electrical equipment and their parts; sound recording and reproducing sound and television. Although it is

not a traditional export item, electronic components and televisions, computers and computer components have brought significant foreign exchange earnings with rapid growth and promises of good development in the future. Export and import turnover of the industry increased rapidly over the period from 2001 to 2017.

Trade relations between Vietnam and Japan have also made a contribution to the bilateral trade agreements between the two countries such as the Vietnam - Japan Economic Partnership Agreement (VJEPA) (2008) and the Free Trade Agreement Encourage and Protect Investment (BIT) (2003) to create a favorable business and investment environment for the businesses of the two countries. In addition Vietnam and Japan are members of the ASEAN-Japan Comprehensive Economic Partnership Agreement (AJCEP) and the World Trade Organization (WTO), therefore they have rights and obligations towards each other within the framework of the commitments of the Agreements. Based on those agreements, the economic relations between Vietnam and Japan have been strengthened and tightened, which creates the premise for the economic development of the two countries.

4. The empirical model

To estimate the relationship between exchange rate and trade balance we use a VAR model, which was introduced by Christopher H. Sim (1980).

4.1. Stationary test

Before running the VAR model, time series data needs to test the stationary. This test is expressed through the Augmented Dickey-Fuller (ADF) Unit test to find out the long-term characteristics of variables in this study.

4.2. VAR model

The Vector Autoregressive model is a general form of the Single-dimensional

self-regression model. Each variable has a linear dependence on other ones.

The equation of the model:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + e_t$$

Inside:

$$Y_t = [\text{POIL}, \text{GDP}, \text{CPI}, \text{CA}, \text{NER}]$$

e_t : error vector

p : latency of variables in the model

4.3. Granger test

The Granger test in the study was used to examine the causal relationship between the two variables. In other words, changes of a variable in a model are due to the influence of which variable.

4.4. Impulse response function (IRF)

IRF shows the response of a variable when another variable increases by 1%. Results are expressed as a chart describing how exchange rate (NER) impacts on trade balance (CA).

4.5. Variance decomposition

Variance decomposition is an approach to structurally analyzing the VAR model. It analyzes the variation of a variable by its shock and the shock of other endogenous ones. This study uses the variance decomposition method to evaluate how much the variability of the CA is influenced by the shocks of it and other variables, including POIL, GDP, CPI, NER.

5. Data and empirical results

5.1. Data description

This paper employs 5 variables including oil price (POIL), Gross Domestic Product (GDP), Consumer price index (CPI), Trade balance/Capital account (CA), Nominal exchange rate (NER) based on 67 observations from 2001Q1 to 2017Q3. The data is collected from available sources listed in Table 1. The changes of the variable POIL affect the product activities in the world in general. The others are some of the main factors having direct impacts on the variable CA. Thus, they are applied to this model.

5.2. Estimating VAR model

The order of the independent variables is arranged based on their influence on the dependent variable according to the above equation. The order of variables in the model is POIL, GDP, CPI, CA, NER.

Lag Length Selection

By choosing a maximum of 3 lags to accommodate the not-too-large number of observations of the sample, the team received an optimal lag of 3 for all cases.

VAR model and IRF

Case of total product

CA changed in the same way with NER VND/USD. Currency devaluation improved CA immediately by a small amount. Therefore, there was no appearance of a J-curve in this case.

The response of CA to NER of VND/JPY is like a J-curve, however, the improvement was extremely small, about 1%.

Table 1. Information on variables and sources of data collection

No.	Variable	Name of variable	Unit	Source
1	POIL	Oil price	Index (2001=100)	FRED
2	GDP	Gross domestic product	Billion VND	GSO
3	CPI	Consumer price index	Index (2010=100)	IMF
4	CA	Trade balance	CA=EX/IM	Trademap
5	NER	Nominal Exchange Rate	VND/JPY VND/USD	Oanda

Stationary test

Case of group 27 (Mineral fuels, mineral oils and products of their distillation: bituminous substances and mineral waxes)

In the first 3 quarters after the exchange rate shock, CA27 fluctuated slightly, then there was a similar variation in both CA27 and NER VND/USD. As a result, the response of CA27 to NER of VND/JPY did not follow a J-curve.

In the first 2 quarters after the shock of the VND/JPY exchange rate, CA27 was not affected. J-curve effects have appeared at CA27 after one quarter since the VND devalued against JPY. The devaluation of NER VND/JPY has a positive impact on exports, improving the trade balance of this group at a high level.

Case of group 62 (Articles of apparel and clothing accessories)

Table 2. Results of stationary test

Variable	At level			At 1st difference			At 2nd difference		
	ADF test	5 % level	Prob.	ADF test	5 % level	Prob.	ADF test	5 % level	Prob.
CA	-4.349072	-2.90766	0.0009	-11.8345	-2.906923	0			
CA27	-5.527127	-2.90621	0	-9.087621	-2.90766	0			
CA62	-0.422941	-2.909206	0.8982	-4.311327	-2.909206	0.001			
CA84	-2.90134	-2.90621	0.0506	-10.55369	-2.906923	0			
CA85	-2.732034	-2.90842	0.0743	-8.137527	-2.90842	0			
CA94	-1.88401	-2.90766	0.3377	-8.675183	-2.90766	0			
CPI	0.129439	-2.90766	0.9656	-4.54565	-2.90766	0.0005			
GDP	2.116025	-2.909206	0.9999	-0.634455	-2.909206	0.8547	-597.557	-2.909206	0.0001
VND/JPY	-1.856046	-2.90842	0.3506	-2.638575	-2.90842	0.0908	-11.8897	-2.90842	0
VND/USD	-0.415001	-2.906923	0.8998	-4.983937	-2.906923	0.0001			
POIL	-2.138053	-2.90621	0.2308	-7.306132	-2.90766	0			

Source: Authors' estimation.

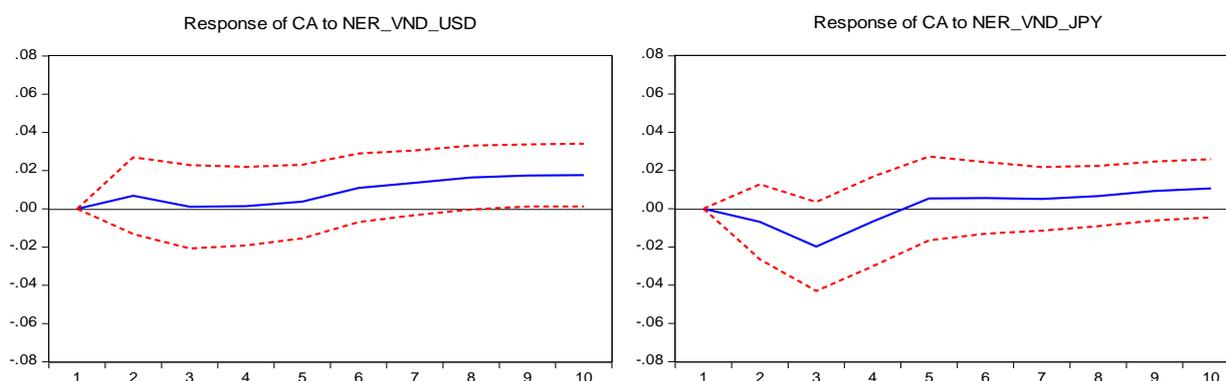


Figure 1. Results of the impulse response functions (IRF) in the VAR model.

Source: Authors' estimation.

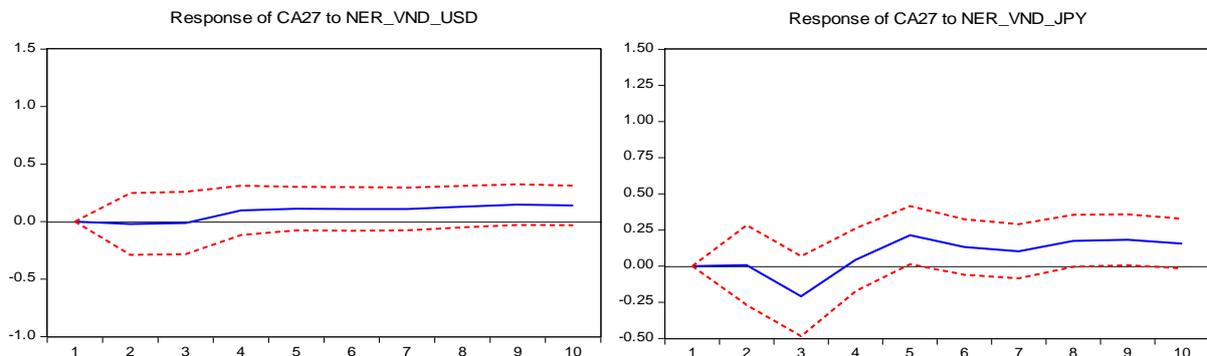


Figure 2. Results of the impulse response functions (IRF) in the VAR model.
 Source: Authors' estimation.

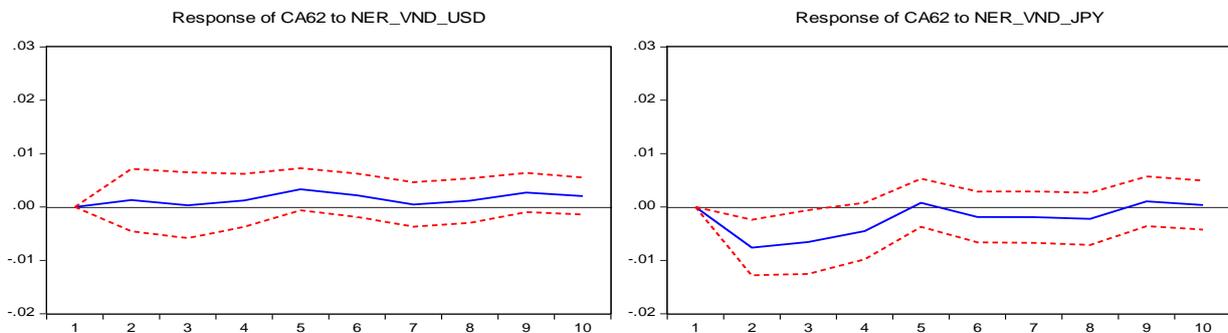


Figure 3. Results of the impulse response functions (IRF) in the VAR model.
 Source: Authors' estimation.

If VND devalued against USD (VND/USD increased), CCTM 62 was improved immediately and maintained for a long time but was not large (0.3%).

Fluctuations of trade in group 62 when there was a shock of VND/JPY were in the opposite direction. In fact, the devaluation of VND/JPY did not improve CA62 and caused a small deficit. There is no J-curve in this case.

Case of group 84 (Machinery, mechanical appliances, nuclear reactors, boilers and parts thereof).

The devaluation of the VND against the USD stimulated exports and improved the trade balance of this commodity group but it did not follow the J-curve theory.

The shock of NER VND/JPY has a positive impact on CA84. In general devaluating

VND/JPY has stimulated exports and improved the trade balance but the improvement was low and did not follow a J-curve.

Case of group 85 (Electrical machinery and equipment and parts thereof: sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles).

The shocks of both VND/USD and VND/JPY exchange rate were mostly negative for CA85. The variation of trade balance in this case did not follow the J-curve theory.

Case of group 94 (Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated nameplates and the like; prefabricated buildings).

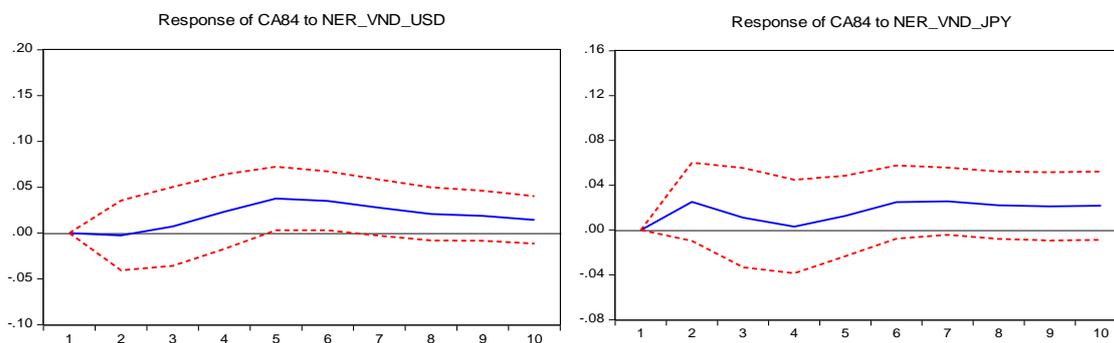


Figure 4. Results of the impulse response functions (IRF) in the VAR model.

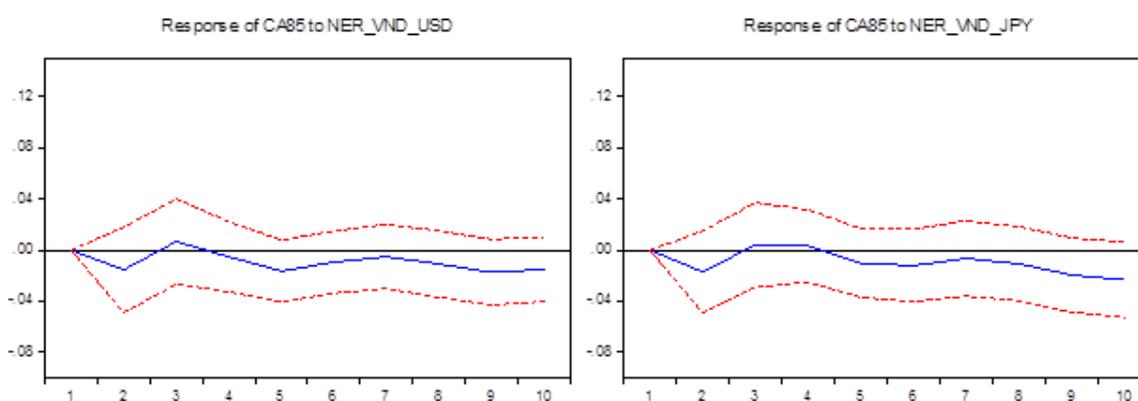


Figure 5. Results of the impulse response functions (IRF) in the VAR model.

Source: Authors' estimation.

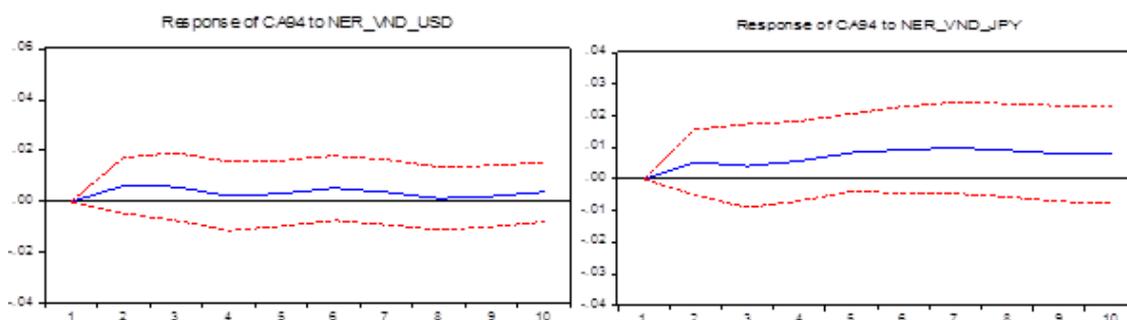


Figure 6. Results of the impulse response functions (IRF) in the VAR model.

Source: Authors' estimation.

The VND/USD and VND/JPY shocks had positive impacts on the commodity group 94. The devaluation of the VND against either USD or JPY could stimulate exports and improve CA94 at a small level and this effect did not follow the J-curve theory.

Granger test

In the case of total sectors and JPY exchange, POIL had no causal relationship with CA, the other variables GDP, CPI, NER VND/JPY had a causal relationship with CA. While exchanging in USD, POIL and CPI were

not causal with CA, and GDP, NER VND/USD had a causal relationship with CA.

In groups 27, 84, 94, all four variables had no direct influence on the CA when exchanging in JPY and USD.

In group 62, when traded in JPY, NER and GDP have a causal relationship with CA, while POIL and CPI are opposite. When exchanged in US dollars, only the GDP variable has a causal relationship with CA.

In group 85, GDP and CPI have the same-way effect on CA when exchanged in JPY, while exchanging in US dollars, only GDP has the same-way effect on CA.

Variance decomposition

In total groups and group 85, compared to three variables POIL, GDP, CPI, the influential levels of NER (VND/JPY and VND/USD) were not significant at the beginning and gradually increased over time, but were always low.

In group 27, when exchanging in JPY, if it does not matter CA that has a major influence on the change of CA itself, NER will be the most influential variable in later periods. In exchange for USD, NER had the same effect as POIL, CPI, below 10%.

Group 62 showed a difference between the two types of exchange rates. While the NER VND/JPY had an impact on the trade balance less than 15% of GDP, the NER VND/USD only accounted for less than 5% of the CA62 changes.

Both types of exchange rates had the greatest impact on variables except CA in group 84. The level of impact increased gradually and reached around 10% in the long run.

In group 94, NER VND/USD did not account for much of the change in CA94, below 5%. This level was higher with the use of JPY, NER VND/JPY which had a gradual increase of over 10% after POIL and GDP.

6. Conclusions

Regarding the relationship between the variables studied in the period from Q1/2001 to Q3/2017 with a latency of 3, the results

indicated the long-run relationship between VND/JPY and VND/USD with the trade balance between Vietnam and Japan. Currency devaluation will improve the trade balance of the machinery sector and the furniture sector in both types of exchange rate, and the mineral fuels sector and the machinery sector in the VND/USD exchange rate. In addition, the results of the study also demonstrated the occurrence of the J-curve in the case where the impact of the VND/JPY exchange rate on CCTM is low (0.3% increase in export/import ratio) and the mineral fuels sector is at a high level (export/import ratio increased by 22%). Nevertheless, after the devaluation, the total product and mineral fuels sector did not improve immediately; it took three quarters for the total product and two quarters for the group mineral fuels to make the mass effect over the price effect, which helped the trade balance improve.

6.1. Policy implications

For the Government, when exchanging in JPY, it is necessary to consider the current economic situation of the country because devaluation will cause decline in the trade balance in the short-run. With the US dollar, maintaining a stable and low increase in the VND/USD exchange rate will not only contribute to the growth of the trade balance but also avoid other shocks in the national economy. Apart from paying attention to the trade between Vietnam and Japan, it is necessary to further study the movements of VND with six other currencies, including EURO, TWD, RMB, KRW, THB and SGD, which will impact on bilateral trade between Vietnam and these countries in the coming time, especially big partners such as the US and China.

For import-export enterprises in the five sectors, if exchange rate fluctuations are low (about 1%), they should not be worried because the change of trade balance is low (less than 10%). The mineral fuels sector has

the biggest positive change: the biggest improvement is about 25% so they need to grasp the opportunity when the VND devalues; however, when paying in JPY, they need to consider the short-term impact because the trade balance will decline in the first four quarters. From that, it can be seen that importers and exporters can not only pay attention to the exchange rate policy of the Government but also care about other key factors affecting the trade balance of the industry.

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