Asian Economic and Financial Review
ISSN(e): 2222-6737
ISSN(p): 2305-2147
DOI: 10.18488/journal.aefr.2019.92.257.266
Vol. 9, No. 2, 257-266

URL: www.aessweb.com

EXCHANGE RATE PASS-THROUGH (ERPT) AND ITS IMPLICATIONS FOR VIETNAM: VECTOR AUTOREGRESSIVE APPROACH FROM VIETNAM-KOREA TRADE DATA

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Article History
Received: 14 November 2018
Revised: 18 December 2018
Accepted: 24 January 2019
Published: 6 March 2019

Keywords
Exchange rate pass-through (ERPT)
Import price
Consumer price index
Vector Autoregressive model
Vietnam
Korea.

JEL Classification:
C32, E31, F31.

ABSTRACT

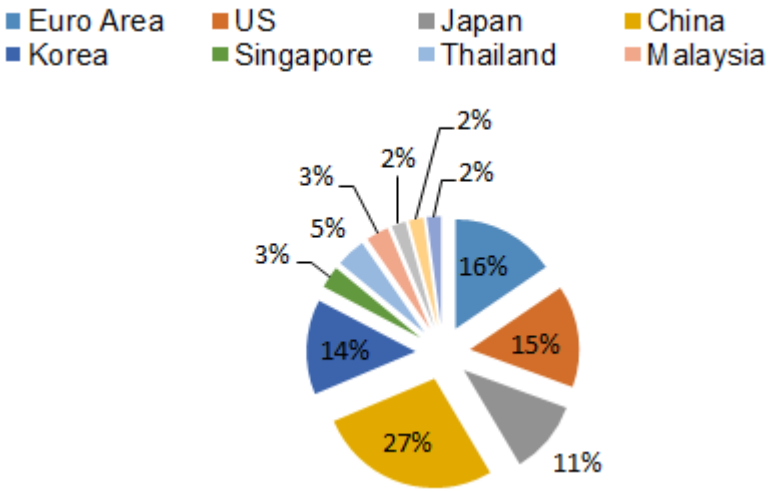
This article investigates the exchange rate pass-through (ERPT) into Vietnam's import price and consumer price index employing the trade data between Vietnam and Korea for the period from Jan 2008 – March 2017 on a monthly basis. From the empirical outcome of the Vector Autoregressive (VAR) model, the ERPT coefficients for import price are quite low and statistically insignificant, which implies that the price of importing goods from Korea might depend mainly on other factors rather than KRW/VND exchange rate. On the contrary, the transmission from exchange rate to Vietnam's consumer price index is so complete that a 1% shock in exchange rate can cause a change by 0.994% in consumer price index at lag order 2. This result is further confirmed by variance decomposition and Granger causality tests which reveal that the exchange rate shock builds the strongest influence on the fluctuation of Vietnam's inflation rate.

Contribution/ Originality: This study is one of the first time series studies using the trade data between Vietnam and Korea to investigate ERPT into import prices and inflation in Vietnam. It also contributes to the limited critical review in this domain for the developing countries in South East Asia.

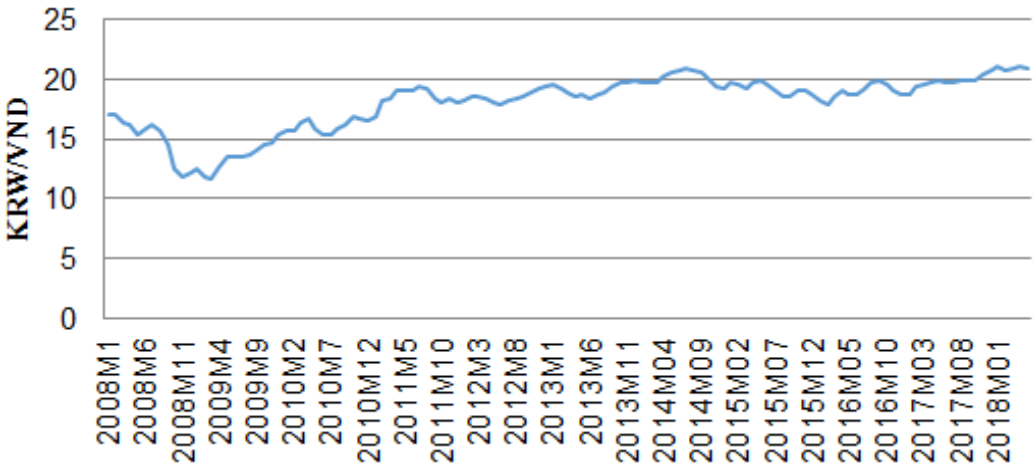
1. INTRODUCTION

In an open and highly integrated economy, exchange rate is one of the most vital macroeconomic factors having both external and internal impacts. The influence of exchange rate changes on import price, as well as on inflation, known as exchange rate pass-through (ERPT) has been studied in various research Beirne and Bijsterbosch (2009); Faruquee (2006); McCarthy (2000); Ihrig *et al.* (2006). It is commonly seen that most of these studies have focused on developed countries like the United States, the Euro area, Japan and OECD economies but less is discussed for developing countries. In Vietnam, while there have been a few writings using data from its main trading partners like Japan, no data however can be found in the case of Korea in spite of its having fifth rank in the list of Vietnam's top trading partners over the last five years. Therefore, this is a major gap in research literature to study the impact of ERPT on import prices and inflation with empirical evidence from Korean trade.

In January, 2016, State Bank of Vietnam (SBV) announced that that flexible exchange rate mechanism shall be applied, in which exchange rate shall be pegged to eight strong currencies: USD, Bath, Euro, CNY, SGD, JPY, KRW and TWD. Known as one of the five largest trading partners of Vietnam, KRW is added into this basket. Thus, it is vital to make a closer analysis of the import prices and the inflation response to exchange rate shocks. This study will also suggest how controlling inflation effectively is always the top priority of policymakers in regulating monetary policy and main concerns of all economic researchers.



Graph-1. Vietnam 's top eleven main trading partners over the past five years.



Graph-2. Monthly KRW/VND exchange rate from 2008 to 2017.

The research framed two main objectives. First, the study aimed to measure the level and timing of pass-through from exchange rate into import price index in the case of KRW/VND. Second, it aimed to analyze the result to see how it contributed to pricing decision strategy for imported firms of Korean exporters. Knowing the impact of exchange rate changes on import, it was hoped that trading companies would know how to mark up their selling prices including exchange rate shocks. This means that if the ERPT is high, these firms should adjust the price in response to exchange rate shock and vice versa. Moreover, for the macro aspect, the results would reveal how ERPT influenced Vietnam inflation compared to other studies. This information may help policymakers in regulating monetary policy. This means that if ERPT is high, the inflationary effect of exchange rate changes should be concerned and included in determining suitable targets in monetary policy.

2. LITERATURE REVIEW

There are a few studies that have revealed how the magnitude and speed of exchange rate pass-through may change across countries varying on size and openness. For example, a recent study estimating the dynamic exchange rate pass-through to consumer prices for Nigeria (Zubair *et al.*, 2013) suggests that ERPT is found incomplete, low, and fairly slow due to the large share of import in Nigeria's consumption basket. This implies that importers should practice pricing to market strategy for this market. This also suggests that money supply contributes more to inflation compared to the exchange rate. Bangura *et al.* (2012) presented a result of their study which revealed that although ERPT is incomplete but significant, suggesting that exchange depreciation is a potential significant source of inflation in this country. In another research (Bussière *et al.*, 2014; Oloba, 2014; Prempeh *et al.*, 2017) conclude that import price elasticity tends to be correlated across countries and is found higher in emerging market economies than in advanced economies. These studies overall emphasizes upon an enhanced understanding of exchange rate pass-through, particularly highlighting the role of external factors in economic management in almost countries.

In Asia region, there are only a few studies on ERPT. Cortinhas (2007) investigates the degree of exchange rate pass-through to domestic price in all five members of ASEAN. While there is no evidence of exchange rate pass-through to import prices in Philippines, Thailand exhibits a clear case of exchange rate pass-through to import prices. In the case of Singapore and Malaysia, there appears to be a case of exchange rate disconnect. Another study by Ghosh and Rajan (2007) suggests that since Asian economies are highly trade-dependent they are potentially susceptible to ERPT into domestic inflation via import price. Parsons and Sato (2004) estimate ERPT for four Southeast Asian countries, Indonesia, Thailand, Malaysia and the Philippines in terms of Japanese goods. The study reveals empirically that aggregate changes in the US dollar surpasses the import prices in these countries, while very little evidence is seen of ERPT of Japanese yen making an impact on the import prices in the ASEAN economies.

In Vietnam, there are a few studies in this field including Vo (2009); Nguyen and Nguyen (2010); Nguyen and Luc (2012). "Using diverse methods including VAR, VECM, and OLS, the researchers demonstrate that the pass-through to domestic prices is incomplete, but does not address the pass-through inflation linkage". Nhung and Huyen (2017) use 7 main trading partners' trade data at a highly disaggreated HS-9 digit that results in full pass-through exchange rate movements to Vietnam imports except for electronic industry. However, there are very few studies focusing on the ERPT in the context of Vietnam import prices from Korea trade in spite of the fact that Korea has been the fifth largest trading partners over the past five years.

In terms of methodology, the estimation of pass-through is usually both single equation and system based approach. This includes 3 methods to measure ERPT: linear, Vector Error Correction Model (VECM) and VAR. Ihrig *et al.* (2006) and Campa and Goldberg (2005) have used the linear approaches model. VECM method to measure ERPT was used in studies such as Beirne and Bijsterbosch (2009). Finally, the VAR approach has proved to be the most popular method used by many researchers. According to Faruquee (2006) the VAR approach has several advantages compared with single-equation methods. In fact, after running VAR model, Cholesky variance decomposition can be applied to identify specific structural shocks affecting the system. Using this identification scheme, one can map the empirical results into a well-defined shock in an economic model of incomplete pass-through.

Hence based on these trends in previous literature, this study too will also employ the VAR approach to measure the ERPT into Vietnam imports from Korean trade.

3. RESEARCH METHODOLOGY, EMPIRICAL FRAMEWORK AND DATA DESCRIPTION

3.1. Methodology

The study is developed upon two basic concepts including Purchasing Power Parity (PPP) Theory and Pricing to Market by Krugman (1986). PPP presents the direct channels of transmission of ERPT into import prices. The Pricing to Market may be used as the theoretical explanation of degree of exchange rate pass-through found in countries with high percentage of imported goods.

Purchasing power parity (PPP) is the theory that is used to conduct empirical framework. The theory shows two currencies are in equilibrium or at par when a market basket is priced the same in both countries. The equation is described as follows:

$$P_h^m = EP_f^x \tag{1}$$

Where h denotes the home country, f is the foreign country; P_h^m is the imported price measured in home country; currency. P_f^x is the export price measured in foreign country currency, E is the nominal exchange rate between home currency and foreign currency.

Based on this law, one to one relationship between the exchange rate and domestic prices occurs which suggests a complete pass-through. However, Krugman (1986) provides additional explanation of the empirical findings of incomplete pass-through. His theory postulates that because of market and product segmentations, exporting firms discriminate prices across destination market. Exporting firms set their prices as the sum of marginal cost and destination specific mark- up. These destination specific mark-ups are adjusted in response to exchange rate changes, there by absorbing part, or all, of the exchange rate change. The markup is presented as follows:

$$P_f^x = markup^x C_f^X \tag{2}$$

$$Markup^* = \left(\frac{P_h}{EC_f^x}\right)^{\propto} Y^{\beta} \tag{3}$$

Where $\left(\frac{P_h}{EC_f^x}\right)^{\propto}$ shows competitive pressure in the home country market and Y^{β} represents demand pressure in both home and foreign market. From there above equations, we get:

$$P_h^m = (EC_f^x)^{1-\propto} p_h^{\propto} Y^{\beta} \tag{4}$$

We take logarithm equation:

$$lnP_m^h = (1-\propto)lnE + (1-\propto)lnC_f^x + \propto lnP_h + \beta lnY \tag{5}$$

Equation (5) can be rewritten as simple linear by generating variables as follows:

$$p_h^m = (1-\propto)e + (1-\propto)c_f^x + \propto p_h + \beta y) \quad (6)$$

This equation shows that import price is affected by the exchange rate e, marginal cost of production of foreign firms c*, the home price level p and market demand for both home and foreign country y. The elasticity of import price with respect to the change of exchange rate is called ERPT shown as $(1-\propto)$. If $(\propto = 0)$, there are complete pass-through effects. If $(\propto = 1)$, we have zero pass-through and if $(< 0 \propto < 1)$ we have limited or incomplete pass-through.

3.2. Empirical Framework

Initially, this study used VAR approach in E-views 9 to measure the level of ERPT. Second, Impulse Response test, Variance Decomposition and Granger Causality test were used to identify specific structural shocks to the system. The study followed the matrix of VAR approach by McCarthy (2000):

$$Y_t = \omega_0 + \sum_{i=1}^{n} \beta_i Y_{t-i} + u_t \quad (7)$$

Where Y_t denotes 6 vectors of variables [IMP, NEER, OPI, CPI, OUTPUT GAP, TRADE OPENNESS], ω_0 is intercept, β_i is coefficient of matrices 6x6 and u_t is error term.

IMP: Import price index. OPI: oil price index, NEER: nominal effective exchange rate between KRW and VND, CPI: consumer price index, Output gap and Trade openness.

3.3. Data Description

In order to estimate ERPT into import price and domestic price index, this study employed monthly time series data from January 2008 to March 2017. The data was collected from International Financial Statistics (IFS) by IMF and Vietnam's General Statistics Office (GSO). For consistent and effective results, all the variables except for the output gap were taken in the natural logarithms and seasonally adjusted to remove seasonal effects.

The description of data components is as follows:

NEER is monthly nominal exchange rate between KRW and VND. This is calculated by applying exchange rate between USD/KRW and USD/VND, taken from IFS.

Import price index (IMP) is obtained from Korea's export price index assuming that the export prices of commodities from Korea are the same across all importing markets.

CPI is consumer price index, available from IFS.

Output Gap is used as a proxy for domestic demand pressure. It is defined as the difference between real output and potential output (Output gap = Real GDP – Potential GDP). If the real output is larger than the potential output or the output gap is positive, the economy is growing beyond its full capacity. Hence the output gap is used to measure the excess demand in the economy. Due to the constraint of data availability of monthly GDP, this study used Industrial Production Index (IPI) as a replacement. The Hodrick-Prescott filter in E-views was employed to calculate Output gap.

Oil price is used to capture the foreign demand pressure. This study used UK Brent oil price indices obtained from IFS.

Trade openness is the ratio of total sum of export and import to GDP, obtained from IFS.

4. EMPIRICAL RESULTS

4.1. Unit Root Tests

The Augmented Dickey-Fuller test (ADF) is conducted to examine whether the time-series data are stationary or not. The results are shown in Table 1. As can be seen from the results of unit root tests, Output gap is stationary while all other variables are integrated series of order one, i.e. I(1) at 1% or 5% level of significance.

Table-1. Unit root tests.

Variables	ADF test with Intercept		ADF test with Intercept and Trend	
	t- statistic	p –value	t- statistic	p –value
Dlnneer	-5.105980*	0.0000	-5.338322*	0.0001
Dlnimp	-9.073221*	0.0000	-9.066785*	0.0000
Dlncpi	-5.198068*	0.0000	-5.417100*	0.0001
outputgap	-5.746012*	0.0000	-5.717739*	0.0000
Dlnoil	-6.459865*	0.0000	-6.436315*	0.0000
Dlntrade	-4.130180*	0.0014	-4.009481**	0.0114

*: statistical significance at 1%.
**: statistical significance at 5%.

4.2. VAR Estimation

The optimal lag length is selected based on different criteria: LR (sequential modified LR test statistic), AIC (Akaike information criterion), HQ (Hannan-Quinn information criterion). The result from lag length selection criteria in Table 2 reveals that the optimal lag order should be 2.

Table-2. Lag length selection criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	740.0399	NA	1.70e-14	-14.68080	-14.52449	-14.61754
1	898.0542	293.9066	1.48e-15	-17.12108	-16.02691	-16.67825
2	1144.670	429.1118	2.21e-17*	-21.33340*	-19.30137*	-20.51100*
3	1157.065	20.07953	3.61e-17	-20.86130	-17.89140	-19.65933
4	1191.064	50.99875*	3.90e-17	-20.82128	-16.91353	-19.23974
5	1222.021	42.72099	4.59e-17	-20.72043	-15.87481	-18.75932
6	1252.597	38.52493	5.62e-17	-20.61193	-14.82846	-18.27126
7	1275.128	25.68551	8.44e-17	-20.34256	-13.62122	-17.62231
8	1307.879	33.40630	1.09e-16	-20.27758	-12.61838	-17.17777

* indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

Table-3. Exchange rate pass-through to import price.

Variable	Coefficient	Standard error
Constant	0.007**	0.003
dlnimp(-1)	0.268*	0.096
dlnimp(-2)	-0.348*	0.097
dlnneer(-1)	-0.239	0.375
dlnneer(-2)	0.386	0.426
dlncpi(-1)	0.006***	0.432
dlncpi(-2)	0.679l	0.360
dlnoil(-1)	-0.003	0.026
dlnoil(-2)	-0.005	0.026
outputgap(-1)	0.0004	0.0003
outputgap(-2)	0.0002	0.0003
dlntrade(-1)	0.0004	0.023
dlntrade(-2)	0.024***	0.016

*: statistical significance at 1%.
**: statistical significance at 5%.
***: statistical significance at 10%.

Table 3 and Table 4 indicate the exchange rate pass through coefficients to import price and consumer price index respectively. As can be seen from the results, in the case of Vietnam-Korea trade, there is almost a complete transmission of exchange rate to consumer price index. Specifically, at lag order 2, a shock by 1% in exchange rate leads to 0.994% change in consumer price index. The pass-through effect to import price is lower at 0.268% and 0.348% corresponding to 1% change in exchange rate. The coefficients of exchange rate pass-through to import price, however, are statistically insignificant.

Table-4. Exchange rate pass-through to consumer price index.

Variable	Coefficient	Standard error
Constant	0.0009	0.0008
dlnimp(-1)	-0.0006	0.003
dlnimp(-2)	0.0002	0.003
dlnneer(-1)	0.008	0.010
dlnneer(-2)	0.994*	0.011
dlncpi(-1)	0.007	0.011
dlncpi(-2)	-0.0005	0.010
dlnoil(-1)	0.0002	0.0007
dlnoil(-2)	-0.0004	0.0007
outputgap(-1)	3.35E-06	8.28E-06
outputgap(-2)	-2.12E-06	8.53E-06
dlntrade(-1)	-3.14E-05	0.0006
dlntrade(-2)	1.16E-05	0.0004

*: statistical significance at 1%.
**: statistical significance at 5%.
***: statistical significance at 10%.

4.3. Impulse Response Function

The next two graphs exhibit typical shocks of NEER and their impact on concerned variables including CPI and IMP through time.

The response of CPI to a shock of NEER is seen as nearly complete pass-through. The highest level can be seen at the third month period which decreases gradually until it comes to zero at the eighth month period.

Import price index reacts slightly to the change of NEER. But this movement is statistically significant from the second month, rather than the third month. It increases from the third month to the fifth month before reducing to nearly zero in the tenth month.

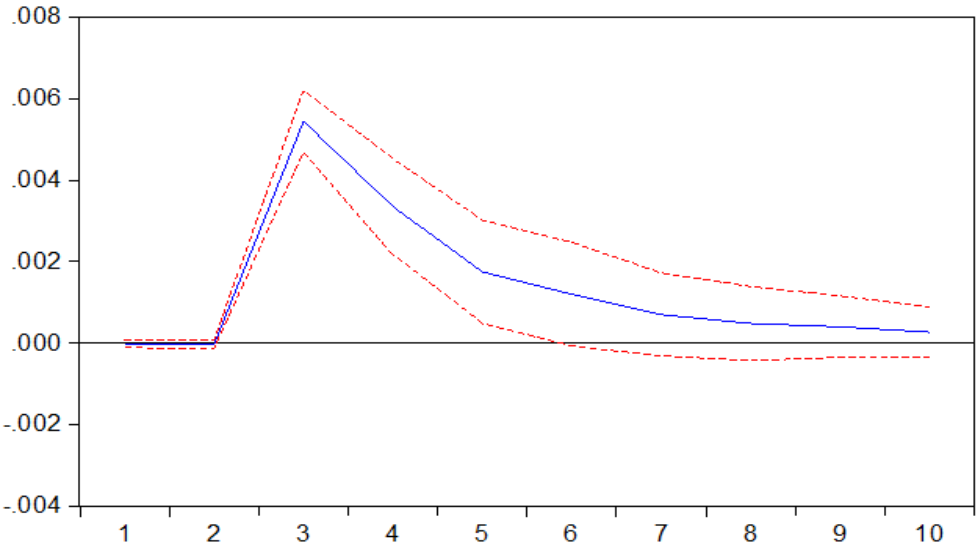


Figure-1. Response of DLNCPI to DLNNEER.

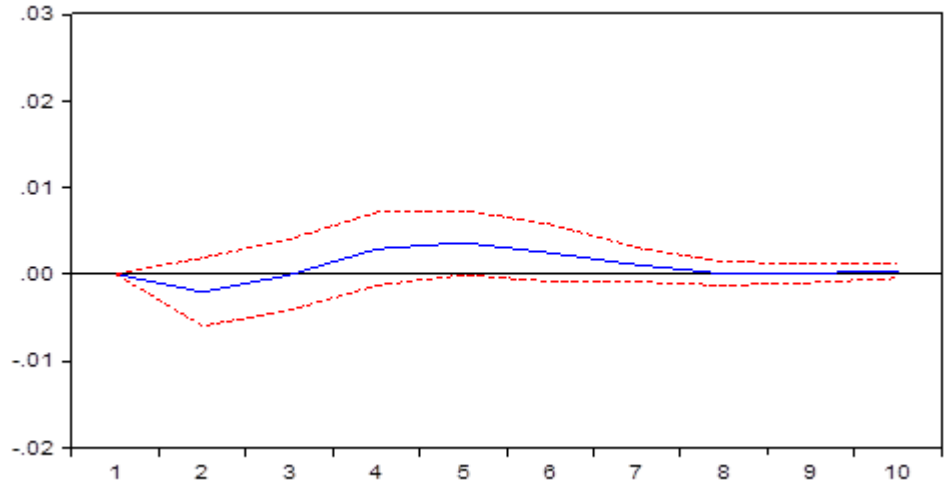


Figure-2. Response of DLNIMP to DLNNEER.

When comparing between the response of import price index and the reaction of CPI to the shock of NEER, it is found that NEER can have greater influence on inflation (CPI) than on import price (CPI).

4.4. Variance Decomposition

Variance decomposition shows which shock is the greatest contributor in explaining the change of a variable through time (in a ten-month period).

Table 5 illustrates that NEER is the most important factor contributing to the movement of CPI variable, accounting for around 93% during this period. This confirms above results. On the other hand, the movement of IMP is mostly explained by its own change in the previous phase, followed by NEER around 6% as shown in Table 6.

Table-5. Variance Decomposition of DLNCPI.

Period	S.E.	DLNIMP	DLNNEER	DLNCPI	DLNOIL	OUTPUT GAP	DLNTRADE
1	0.000531	0.155683	0.040790	99.80353	0.000000	0.000000	0.000000
2	0.000533	0.162928	0.500565	99.02747	0.023240	0.272144	0.013657
3	0.005673	6.882113	92.24145	0.873048	0.000837	0.002429	0.000123
4	0.006615	5.203475	93.51834	0.643865	0.526226	0.066883	0.041212
5	0.006849	4.901691	93.77490	0.600566	0.492066	0.191152	0.039621
6	0.006965	4.830544	93.66838	0.581974	0.496489	0.362425	0.060185
7	0.007008	4.888713	93.51425	0.575329	0.524690	0.437416	0.059598
8	0.007029	4.901351	93.43838	0.572005	0.563449	0.465563	0.059249
9	0.007042	4.891341	93.42130	0.569903	0.582150	0.476023	0.059287
10	0.007048	4.885009	93.41573	0.568961	0.590234	0.480638	0.059428

Source: Authors' calculation using Eviews 9.0.

Table-6. Variance Decomposition of DLNIMP.

Period	S.E.	DLNIMP	DLNNEER	DLNCPI	DLNOIL	OUTPUT GAP	DLNTRADE
1	0.020337	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.021649	96.83690	0.919896	0.001289	0.011382	2.229978	0.000553
3	0.022739	95.46779	0.835554	0.055877	0.183274	2.158992	1.298517
4	0.023344	93.95833	2.349361	0.053853	0.188034	2.101249	1.349173
5	0.023657	91.50214	4.632430	0.055809	0.186772	2.233786	1.389067
6	0.023833	90.52089	5.600676	0.055531	0.203271	2.227927	1.391705
7	0.023862	90.31859	5.785371	0.055535	0.211063	2.231968	1.397472
8	0.023870	90.30764	5.781920	0.055944	0.211369	2.245767	1.397357
9	0.023875	90.29970	5.781587	0.055945	0.216266	2.249176	1.397323
10	0.023878	90.27375	5.806079	0.055952	0.218358	2.248553	1.397303

Source: Authors' calculation using Eviews 9.0.

4.5. Granger Causality Test

The above outcomes are further confirmed by the results of Granger causality test shown in Table 7. As indicated, DLNEER Granger causes DLNCPI, which suggests that the domestic inflation rate is directly affected by the fluctuation in exchange rate. Together with DLNOIL, DLNNEER also has direct Granger causality on OUTPUTGAP. DLNNEER, once again, does Granger cause DLNTRADE, implying that the level of trade openness is influenced by the exchange rate trend. The oil price and output gap are also found to have Granger causality on the level of trade openness.

Table-7. Granger Causality test.

Dependent variable: DLNIMP			
Excluded	**Chi-sq**	**Df**	**Prob.**
DLNNEER	0.849916	2	0.6538
DLNCPI	4.776532	2	0.0918
DLNOIL	0.060224	2	0.9703
OUTPUTGAP	1.281715	2	0.5268
DLNTRADE	2.594410	2	0.2733
All	15.36215	10	0.1194
Dependent variable: DLNCPI			
Excluded	**Chi-sq**	**Df**	**Prob.**
DLNIMP	0.063430	2	0.9688
DLNNEER	10371.34	2	0.0000
DLNOIL	0.238691	2	0.8875
OUTPUTGAP	0.191259	2	0.9088
DLNTRADE	0.014768	2	0.9926
All	12767.55	10	0.0000
Dependent variable: OUTPUTGAP			
Excluded	**Chi-sq**	**Df**	**Prob.**
DLNIMP	1.578519	2	0.4542
DLNNEER	6.689200	2	0.0353
DLNCPI	1.721248	2	0.4229
DLNOIL	5.697766	2	0.0579
DLNTRADE	4.582672	2	0.1011
All	20.48135	10	0.0250
Dependent variable: DLNTRADE			
Excluded	**Chi-sq**	**Df**	**Prob.**
DLNIMP	1.462313	2	0.4814
DLNNEER	6.993001	2	0.0303
DLNCPI	1.678055	2	0.4321
DLNOIL	9.412862	2	0.0090
OUTPUTGAP	11.37348	2	0.0034
All	44.54673	10	0.0000

Source: Authors' calculation using E-views 9.0.

5. CONCLUSION

Findings of this study reveal that the response of import price index to exchange rate change is so slight that figures for the first two-month period are statistically insignificant, almost zero after eight months. On the other hand, with consumer price index, the response is quite clear and ERPT is almost complete in the third month period. Subsequently, it is observed that the exchange rate between KRW and VND does affect consumer price, but has slight impact on import price. In other words, the effect on consumer price is stronger and longer than that of import prices. With respect to importing firms from Korea, due to a slight ERPT to import price, these firms do not need to take ERPT much into their consideration in setting up prices in domestic markets. It can be assumed that the price of importing goods from Korea depends more on other factors rather than KRW/VND exchange rate. This can be partly explained by stable exchange rate regime shown in Graph 2. The result of variance decomposition shows that exchange rate has the greatest effect on the movement of inflation compared to other factors like domestic economic growth, external shocks. From these findings, we can conclude that exchange rate does not make pass-through to consumer prices via import price. In addition, the ERPT may come from another channel, which should be investigated in future studies.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Contributors/Acknowledgement: Both authors contributed equally to the conception and design of the study.

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