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Эмпирическое исследование взаимосвязи между реальным валютным курсом, экспортом и экономическим ростом во Вьетнаме

В статье рассматриваются качественный и количественный анализ соотношения между реальным эффективным валютным курсом, экспортом и экономическим ростом во Вьетнаме. Результаты качественного анализа показали, что экономический рост, реальный эффективный валютный курс и экспорт во Вьетнаме, как правило, колеблются в одном и том же направлении. Кроме того, результаты оценки VECM показывают, что экономический рост способствует

росту экспорта за счет повышения производительности и конкурентных преимуществ продукции и реального валютного курса. Таким образом, экономический рост оказал положительное влияние на экспорт во Вьетнаме.

Ключевые слова: закон Verdoorn, экономический рост, реальный эффективный валютный курс, экспорт, Вьетнам.

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An empirical study of the relation between real effective exchange rate, export and economic growth in Vietnam

The article focuses on qualitative and quantitative analysis of the relation between real effective exchange rate, export and economic growth in Vietnam. The qualitative analysis results showed that economic growth, real effective exchange rate and export in Vietnam tend to fluctuate in the same direction. Besides, the estimation result of VECM indicated that economic growth promoted export growth

through higher productivity and competitive advantages of products and real exchange rate. Thus, economic growth had a positive impact on export in Vietnam.

Keywords: Verdoorn's Law, economic growth, real effective exchange rate, export, Vietnam.

1. Introduction

In 1949 Verdoorn P.J. [10] conducted the first quantitative research on relation between output growth and productivity growth, which was later referred to as "Verdoorn's Law". Verdoorn's law states that there is a relation between output growth and productivity growth, especially for production sector. The faster output growth will increase productivity because of economic efficiency by scale. Therefore, a fast-growing economy will also undergo productivity increase. If wages is not increased proportionately to productivity increase, the price will fall, increasing competitiveness of export goods and therefore promoting export. One of

factors representing international competitiveness is real effective exchange rate (REER).

In fact, the volatility of exchange rate has a close relation with performance of macro-economic activities. This is an important variable affecting the competitiveness of foreign trade goods and other variables in the economy. Change in exchange rate will change the relative prices of goods and services in domestic currency and foreign currencies, thus the rate will have a certain impact on export and import.

We can say that, Verdoorn's law is the basis for most of studies explaining the hypothesis on effect of economic growth on export. For instance, Helpman and Krugman's study (1985) suggested that [3], export may

increase through economic efficiency by scale which increases productivity. Increase in export continues to expand the scale, reduce costs and increase productivity. Bhagwati (1988) [1], economic growth will accelerate the formation of skills as well as technological advancements, contributing to improve production efficiency and competitive advantages of countries on the international market and thereby opening trade. Blecker (2009) [2] came up with the "Virtuous circle model" indicating the open circle of relationship in a positive direction between export and economic growth, in which the faster output growth will increase productivity of economic efficiency by scale. This will increase the competitive

advantages for countries' goods and export turnover.

Hence, on the basis of empirical researches, we can say that real effective exchange rate can be considered a channel transmitting impact of economic growth to export. Transmission mechanism of real effective exchange rate regarding impact of economic growth on export, especially: economic growth → increase in the competitiveness of goods (REER) → increase in export (X).

2. Current status of the relation between real effective exchange rate, export and economic growth in Vietnam

From 1992 to 1997, the exchange rate policy of the State Bank of Vietnam was operated by objectives against inflation and attraction of foreign investment. To accomplish this goal, the exchange rate policy was operated in the direction of ensuring stability in the nominal exchange rate VND/USD. As a result of maintaining almost fixed nominal exchange rate when inflation has been controlled but still higher than inflation in the US and other countries in commercial relation with Vietnam, VND tended to be evaluated at higher price than the actual price in the period 1996-1998 (Figure 1). This has negatively affected export performance in which export growth rate reduced from 36% in 1994 down to 1.9% in 1998. Besides, in 2001-2007 and 2012-2013, VND/USD exchange rate remained almost constant. However, as the exchange rate peg mechanism at these periods did not decline so much real exchange rate, export growth still showed good performance in these years. In the period of 2008-2011, powerful VND devaluations happened continuously in response to the global economic crisis and dramatically high inflation in 2007-2008. Thereby, the effective exchange rate increased in 2010-2011 contributing to

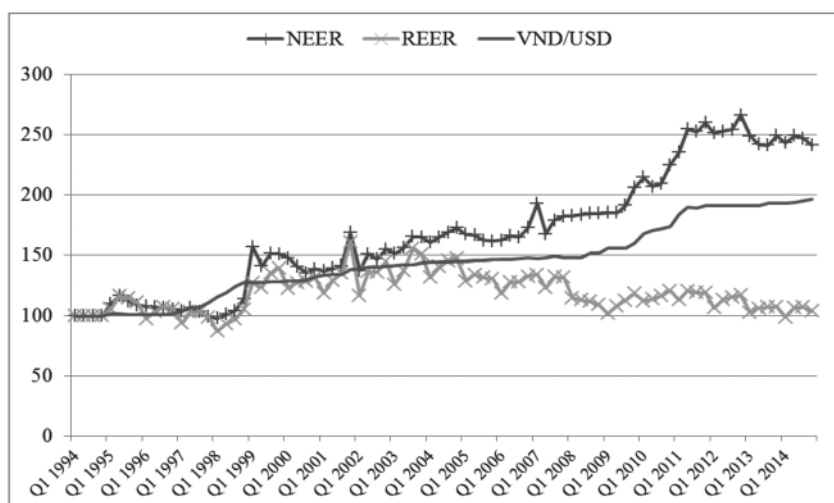


Figure 1. Exchange rates VND/USD, NEER and REER of Vietnam (Source: General Statistics Office of Vietnam [12] and authors' calculations)

powerful export growth after negative growth in 2009.

Generally, it can be seen that nominal exchange rate VND/USD tends to follow a cycle including two stages:

1) The stage corresponding to strong economic fluctuation such as: the impact of Asian financial crisis in the period 1997-2000; the global economic crisis in the period 2008-2011 and the efforts of macroeconomic stabilization. The pressure of the market in these periods has forced Vietnam to extend the exchange rate band or formal devaluation, making NEER of Vietnam increase significantly compared to the previous period.

2) The stage when Vietnam's economy went into stable development such as in the periods 1993-1996 and 2001-2007. During this time, the anchor exchange rate mechanism by USD was applied quite rigidly.

Figure 1 shows the correlation between NEER and REER in the period 1994-2014. Both showed a downward trend in the period 1994-1998 and increased gradually in the period 1999-2004. However, since 2005, the two indices have diverged markedly. While NEER continued an upward trend, REER showed a downward trend. The rise of NEER was mainly due to the sharp devaluation of VND against USD through rate adjustments of

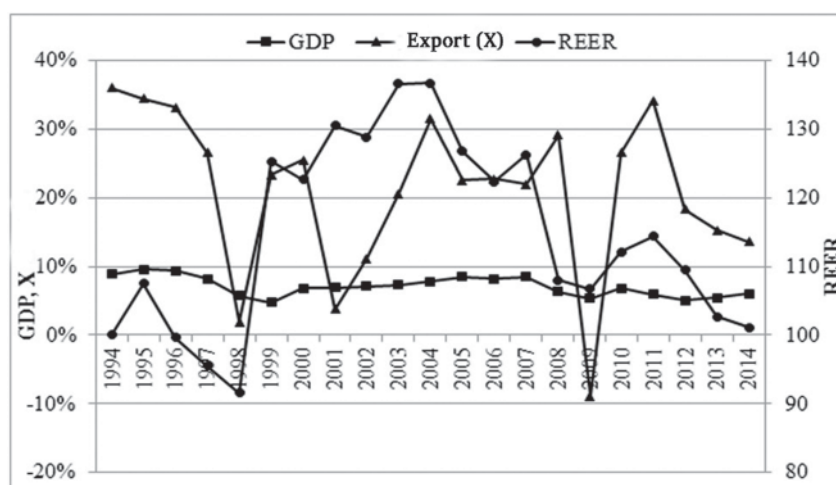


Figure 2. Real effective exchange rate, GDP growth (GGDP) and export growth (GX) (Source: General Statistics Office of Vietnam [12] and authors' calculations)

Table 1

Test result of stationarity for data strings

Variables	Value ADF (lag)	Critical value (1% significance level)
lnGDP	ADF(1) = -1,068297	-3,540198
D(lnGDP)	ADF(1) = -7,842268***	-3,542097
lnX	ADF(4) = -0,719503	-3,546099
D(lnX)	ADF(2) = -8,765850***	-3,544063
lnREER	ADF(4) = -1,268523	-3,546099
D(lnREER)	ADF(2) = -9,758012***	-3,544063

Notes: Symbol D is the first variance; (***) statistic significance level 1% (Source: Results from model estimations)

Table 2

Results of optimal lag test for variables

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-113,2153	NA	0,014856	4,304271	4,414770	4,346886
1	182,8393	548,2493	3,59e-07	-6,327382	-5,885386	-6,156922
2	215,3793	56,64368	1,51e-07	-7,199234	-6,425740	-6,900927
3	240,0852	40,26143	8,49e-08	-7,780933	-6,675942	-7,354781
4	376,3471	206,9162	7,74e-10	-12,49434	-11,05785*	-11,94034
5	391,0706	20,72199*	6,43e-10	-12,70632	-10,93833	-12,02448*
6	400,7622	12,56311	6,52e-10	-12,73193	-10,63245	-11,92224
7	411,8023	13,08463	6,39e-10*	-12,80749*	-10,37651	-11,86996
8	418,7423	7,454082	7,46e-10	-12,73120	-9,968720	-11,66582

Notes: * indicates lag order selected by the criterion
 LR: Sequential modified LR test statistic
 FPE: Final prediction error
 AIC: Akaike's information criterion
 SC: Schwarz criterion
 HQ: Hannan-quinn criterion

(Source: Results from model estimations)

State Bank of Vietnam from 2008 to the first half of 2011. Furthermore, the continuous devaluation of US dollar compared to currencies of some major trade partners of Vietnam such as Australia, China, Japan, Thailand, etc. also resulted in significant devaluation of NEER of Vietnam. Meanwhile, as Vietnam's inflation has gone far beyond trade partners, REER of Vietnam has fallen since 2005, which fell sharply in 2008-2009, then increased in 2010-2011 and continued to decline in 2012-2016. This also explained to some extents why Vietnam's export had negative growth in 2009 and then recovered powerfully in the next two years before declining in 2012-2015.

In addition, Figure 2 shows that although there are certain deviations, real effective exchange rate, export and economic growth of Vietnam tend to fluctuate in the same direction, especially during the period from 1995 to 1999 and from 2002 to 2012. This indicates a certain relationship between real effective exchange rate and economic growth of Vietnam in recent years. In 1996-1998, 2005-2009 and 2012-2016, real exchange rate tended to decline, which is consistent with the decline of export in the same years. Especially in economic crisis periods from 1997 to 1998 and from 2008 to 2009, economic growth, real effective exchange rate and export dropped sharply. However, as a result of increase in economic growth rate in 2002-2004 and 2010-2011, real effective exchange rate tended to rise and theoretically increase the competitiveness of international trade of Vietnam and strong export growth in those years has proven to some extents this relation.

3. Methods and results of research

For the purpose of an empirical study on the relation between economic growth, real effective exchange rate and export in Vietnam, the authors use Vector Error Correction Model (VECM) with

three variables on quarterly basis namely natural logarithm base of export (lnX), real effective exchange rate (lnREER) and Gross Domestic Product (lnGDP). Accordingly, the stationarity of lnX, lnREER and lnGDP is inspected through ADF test. The optimal lag of the model's variables is selected according to FPE (Final Prediction Error) criteria and AIC (Akaike Information Criteri-

on). Next, the Impulse Response Functions are also estimated with Variance Decomposition in order to assess impact of economic growth on Vietnam's export through the transmission channel known as real effective exchange rate. Real exchange rate representing export's competitiveness is the mediate variable of transmission channel from economic growth to export.

Table 3

Results of co-integrating test between lnGDP, lnREER and lnX

Hypothesis H ₀	Eigenvalue	Trace Statistic	The critical value 10%	Prob***
r = 0 *	0,381738	41,46519	39,75526	0,0693
r <= 1	0,194413	14,53795	23,34234	0,6130
r <= 2	0,042493	2,431669	10,66637	0,9361
Hypothesis H ₀	Eigenvalue	Max-Eigen Statistic	The critical value 5%	Prob**
r = 0 **	0,381738	26,92724	25,82321	0,0356
r <= 1	0,194413	12,10628	19,38704	0,4053
r <= 2	0,042493	2,431669	12,51798	0,9361

Notes: *, ** denotes rejection of the hypothesis at the 5%, 10% level
 *** MacKinnon-Haug-Michelis (1999) p-values

(Source: Results from model estimations)

The authors use Eview software in model estimation. In particular, the statistics of gross domestic products GDP and export are taken from General Statistics Office of Vietnam (GSO) [12], figures of exchange rate are taken from International Monetary Fund IMF [13]. Data series have quarterly basis for the period from 1999 to 2014, including 64 observations.

To test the stationarity of figure series, the authors use Augumented Dickey Fuller (ADF) test. The results shows that all data strings in form of first variance logarithm are stopped (table 1).

Before testing whether the non-stop data strings have co-integrate relation or not, it is required to determine the optimal lag of model variables. Results of optimal lag test in Table 2 show that optimal lag selected for the model is 7 under FPE and AIC criteria.

As logarithmic variables for estimation do not stop, it is required to test the possibility of co-integrating vectors in time sequences by the method of Johansen and Juselius (1990). The results in table 3 show that both tests given by Johansen and Juselius namely matrix trace test and maximal eigenvalue test refute the hypothesis of not existing co-integrating vectors and claim that there are at least one co-integrating vector at the significance level of 5%.

VECM with lnGDP, lnREER, lnX variables is estimated with 7 lags in each variable in the general form as follows:

$$\begin{aligned}
 D(\ln GDP) = & \sigma_1 + \\
 & + \sum_1^7 (\alpha_{1i} D(\ln GDP(-i)) + \\
 & + \beta_{1i} D(\ln REER(-i)) + \\
 & + \gamma_{1i} D(\ln X(-i))) + \\
 & + \lambda_1 EC(-1) + D2007 + e_1 \quad (1)
 \end{aligned}$$

$$\begin{aligned}
 D(\ln REER) = & \sigma_2 + \\
 & + \sum_1^7 (\alpha_{2i} D(\ln GDP(-i)) + \\
 & + \beta_{2i} D(\ln REER(-i)) + \\
 & + \gamma_{2i} D(\ln X(-i))) + \\
 & + \lambda_2 EC(-1) + D2007 + e_2 \quad (2)
 \end{aligned}$$

Result of VECM estimation

Independent variables	Dependent variables		
	D(lnGDP)	D(lnREER)	D(lnX)
EC(-1)	-0,054537** [-1,99323]	0,078145 [1,16315]	-0,423375*** [-2,50833]
D(lnGDP(-1))	-1,006414*** [-5,48566]	0,489461 [1,08651]	0,239742 [0,21183]
D(lnGDP(-2))	-0,720429*** [-3,02692]	0,578957 [0,99065]	0,788476 [0,53702]
D(lnGDP(-3))	-0,224906 [-1,02811]	-0,123955 [-0,23076]	1,491219 [1,10503]
D(lnGDP(-4))	0,839781*** [4,72488]	-0,657989* [-1,50767]	2,888757*** [2,63468]
D(lnGDP(-5))	0,938473*** [3,76894]	-1,295394** [-2,11867]	2,628094** [1,71092]
D(lnGDP(-6))	0,622421** [2,28386]	-1,377075** [-2,05782]	1,892270 [1,12554]
D(lnGDP(-7))	0,054442 [0,26963]	-0,661590* [-1,33440]	1,211857 [0,97292]
D(lnREER(-1))	-0,027492 [-0,29402]	0,230124 [1,00230]	-0,681549 [-1,18157]
D(lnREER(-2))	-0,088571 [-0,97894]	0,150055 [0,67543]	-0,419969 [-0,75244]
D(lnREER(-3))	-0,055152 [-0,62609]	0,006885 [0,03183]	-0,318140 [-0,58545]
D(lnREER(-4))	-0,061609 [-0,77833]	0,490980*** [2,52606]	0,161179 [0,33008]
D(lnREER(-5))	-0,205352*** [-2,46869]	0,146421 [0,71686]	-0,252851 [-0,49275]
D(lnREER(-6))	-0,158269** [-1,95174]	-0,001344 [-0,00675]	-0,506456 [-1,01242]
D(lnREER(-7))	-0,020787 [-0,29281]	0,142264 [0,81611]	0,082164 [0,18761]
D(lnX(-1))	0,076788** [1,90534]	-0,167310** [-1,69068]	0,023965 [0,09639]
D(lnX(-2))	0,059435* [1,56255]	-0,237440*** [-2,54218]	0,020754 [0,08845]
D(lnX(-3))	0,044484 [1,22546]	-0,071575 [-0,80300]	0,088786 [0,39649]
D(lnX(-4))	-0,010749 [-0,34621]	-0,037671 [-0,49415]	-0,214359 [-1,11924]
D(lnX(-5))	-0,008136 [-0,31751]	-0,008889 [-0,14128]	-0,176014 [-1,11352]
D(lnX(-6))	0,026197 [1,11819]	-0,061092 [-1,06196]	-0,125109 [-0,86565]
D(lnX(-7))	-0,011329 [-0,50010]	-0,116556** [-2,09528]	0,043792 [0,31335]
D2007	0,003494 [0,64450]	-0,029188** [-2,19285]	0,079615** [2,38079]
LM Test	Lags	LM-Stat	Prob
	1	4,565529	0,8704
	2	3,689794	0,9306
	3	15,36943	0,0813
	4	15,89765	0,0690
	5	10,63776	0,3014
	6	3,196400	0,9560
White Test	e₁²	Chi-sq (45)	Prob
	e ₁ ²	51,42800	0,2366
	e ₂ ²	34,56300	0,8702
	e ₃ ²	43,38464	0,5405
	e ₁ * e ₂	45,17343	0,4647
	e ₁ * e ₃	50,77594	0,2565
e ₂ * e ₃	40,21560	0,6745	

Notes: value in brackets [] is t-statistic (***) (**), (*) (***) statistic significance level 1%, 5%, 10% (Source: Results from model estimations)

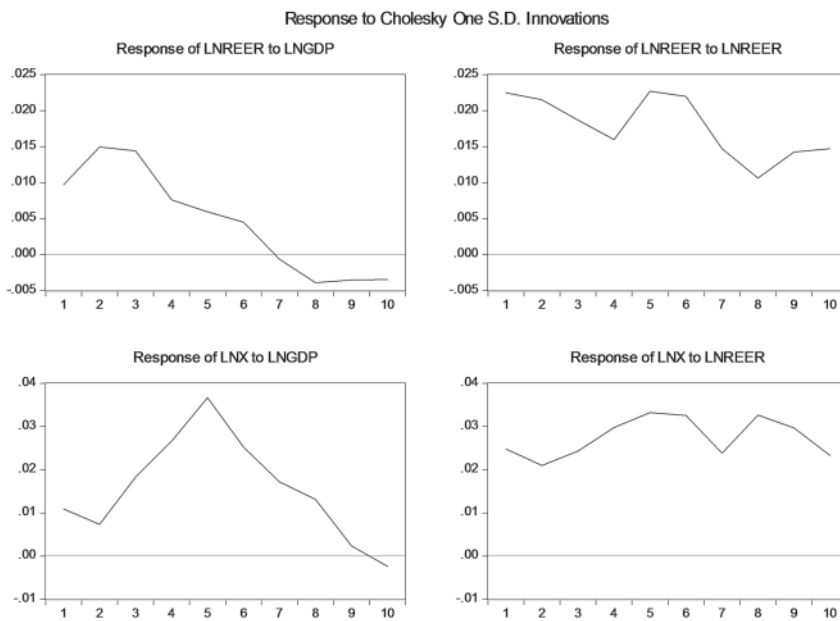


Figure 3. Response of variables to shocks
(Source: Results from model estimations)

$$\begin{aligned}
 D(\ln X) = & \sigma_3 + \\
 & + \sum_1^7 (\alpha_{3i} D(\ln GDP(-i)) + \\
 & + \beta_{3i} D(\ln REER(-i)) + \\
 & + \gamma_{3i} D(\ln X(-i))) + \\
 & + \lambda_3 EC(-1) + D2007 + e_3 \quad (3)
 \end{aligned}$$

In which: $\lambda_i EC(-1)$ is the imbalance between short-term value and long-term value.

$EC(-1)$: is error correction variable;

λ_i : is the coefficient of error correction variable which indicates the speed of access to long-term equilibrium. In particular, the average lag of adjustment to long-term equilibrium is $-1/\lambda_i$. It means that the higher absolute value of λ_i is, the faster adjustment process takes place.

Summary of estimation results shown in table 4 prove the existence of error correction mechanism for $\ln GDP$ and $\ln X$ variables. This proves the existence of the long-term relation between export real effective exchange rate and economic growth of Vietnam. Besides, there is a two-way short-term relation between export and economic growth which have effect on real effective exchange rate. In addition, the estimation results show that WTO accession in 2007 had a positive impact on export promotion of Vietnam. For economic growth, the coefficient of $D2007$ has no statistical significance, but the sign of this coefficient is positive. Results of model defect inspection indicate that the estimation model is free from defects of autocorrelation and error variance change.

Figure 3 shows response functions to shocks during the period of 10 terms (quarters) of research. Cholesky of sequence of impulse variables in the model follows the transmission channel of economic growth to export, $\ln GDP$, $\ln REER$, $\ln X$ respectively. Accordingly, real exchange rate responds immediately to GDP shocks with the strongest response level in the

Table 5

Results of variance decomposition

Variance Decomposition of $\ln GDP$										
Quarter	1	2	3	4	5	6	7	8	9	10
S.E.	0,0100	0,0104	0,0112	0,0128	0,0173	0,0176	0,0180	0,0189	0,0224	0,0226
$\ln GDP$	100,000	93,1683	92,2408	89,8754	89,7907	88,5300	88,9559	84,6885	87,0167	86,1252
$\ln REER$	0,0000	6,7552	6,1228	6,3148	3,5791	3,5645	3,4078	3,4005	2,4310	2,4315
$\ln X$	0,0000	0,0766	1,6364	3,8097	6,6302	7,9056	7,6363	11,9110	10,5524	11,4433
Variance Decomposition of $\ln REER$										
Quý	1	2	3	4	5	6	7	8	9	10
S.E.	0,0245	0,0360	0,0438	0,0472	0,0528	0,0578	0,0598	0,0610	0,0637	0,0663
$\ln GDP$	15,7738	24,6115	27,5174	26,2338	22,2128	19,1868	17,9176	17,6019	16,4678	15,4578
$\ln REER$	84,2262	74,8014	68,8279	70,5571	74,7763	77,0020	77,9142	77,8115	76,4577	75,4455
$\ln X$	0,0000	0,5871	3,6547	3,2091	3,0109	3,8113	4,1682	4,5865	7,0745	9,0967
Variance Decomposition of $\ln X$										
Quarter	1	2	3	4	5	6	7	8	9	10
S.E.	0,0616	0,0689	0,0756	0,0855	0,1005	0,1094	0,1135	0,1191	0,1233	0,1260
$\ln GDP$	3,1392	3,6364	8,8663	16,6129	25,3599	26,6840	27,0836	25,8066	24,1021	23,1167
$\ln REER$	16,1924	22,2083	28,7702	34,6012	36,0058	39,2217	40,8519	44,6113	47,3926	48,8003
$\ln X$	80,6684	74,1553	62,3635	48,7859	38,6343	34,0943	32,0645	29,5821	28,5053	28,0830

Notes: Cholesky Ordering: $\ln GDP \ln REER \ln X$
(Source: Results from model estimations)

second and the third quarter and declining thereafter. GDP shocks have prompt impact on export with the strongest and fullest effect in the fifth quarter and then declining significantly. Export also has immediate response to long-term and short-term real exchange rate shocks.

Variance decomposition results in table 5 indicate that, in the first quarter, the past values accounted for over 80% of volatility of all variables, especially the GDP volatility is affected nearly 100% by shocks of itself. Also, GDP shocks explain over 15% of real exchange rate volatility, in which the highest is in the

third quarter with the explanatory factor of 27.5%. Similarly, in terms of export, GDP shocks has relatively high explanatory factor which rises gradually from 3.13% in the first quarter to 27% in the seventh quarter. Especially, the volatility of export is greatly influenced by short-term and long-term exchange rate shocks with the explanatory factor increasing from 16.19% in the first quarter to 36% in the fifth quarter and 48.8% in the tenth quarter.

4. Conclusion

Exchange rate has a close relation with macro-economic per-

formance. This is an important variable affecting the competitiveness of foreign trade goods and other variables in the economy. Qualitative analysis showed the correlation between real effective exchange rate, export and economic growth. This statement is strengthened when VECM analysis results also indicates that economic growth contributes to export promotion through increase in productivity and competitive advantage of products and real effective exchange rate represents the competitiveness of international trade and transmits effects of economic growth to export in Vietnam.

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