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A Long-run and Short-run Analysis of the Macroeconomic Interrelationships in Vietnam

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Abstract

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Key words: VEC, FDI, Trade, Growth, Vietnam

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1. Introduction

The *Renovation* (Doi moi) reform launched in 1986 dramatically transformed Vietnam's war-torn economy. Notably, the country has been successful in curbing an inflation crisis by lowering the rate from 774% in 1986 to 67.5% in 1990 and 4.1% in 2014 (GSO, 2015). At the same time, Vietnam has experienced remarkable economic growth, being one of the fastest growing economies in Asia with the growth rate of GDP averaging 6.2 per cent per annum over the 2005-2014 period (World Bank, 2015). This impressive economic performance was largely attributable to the opening up of the economy to foreign markets and investors. Foreign direct investment (FDI) and foreign trade, particularly exports, are considered to be the key driving forces of economic growth in Vietnam over the past few decades.

As a part of the reform process, Vietnam has gradually developed a comprehensive institutional framework to lure foreign investment, notably the Foreign Investment Law introduced in 1987. As a result of government policies, Vietnam has now become one of the most favoured FDI destinations in Asia. FDI inflows surged markedly from 211 projects valued at US$1,603.5 million between 1988-1990 to 1,843 projects valued at US$21,921.7 million in 2014 (GSO, 2015). Moreover, the reform has considerably stimulated Vietnam's international trade, especially exports. The total exports rose from US$2,404 million in 1990 to US$150,172.1 million in 2014 (GSO, 2015). The rapid growth of exports can largely be attributed to foreign-invested firms that account for approximately 70% of total exports (GSO, 2015).

While FDI and foreign trade play an essential role in Vietnam's economic growth, the interrelationships among these key variables have not received much attention in the existing literature. By exploring the FDI-trade-growth nexus in Vietnam, this paper attempts to fill a gap in the existing literature. Using quarterly data from 2001 to 2011, we employ a vector error correction (VEC) model to examine the interrelationship among GDP, FDI inflows, exports, imports, inflation and state investment. Investigating the dynamic nexus among these key macro-economic variables is of considerable significance from both analytical and policy perspectives. While the bivariate linkages are well-documented, evidence on the interrelationships among all of these key economic variables is scant. The knowledge of these interrelationships can help policy makers develop more effective strategies that take into account possible causality and the strength of feedback among the key macroeconomic variables in the case of a shock to the economy. Such knowledge is crucial as the Vietnamese economy is rapidly integrating with the global economy and hence increasingly being exposed to external shocks.

The rest of this paper is organised as follows. Section 2 briefly reviews the existing literature on FDI-trade-growth linkages. Section 3 explains the data and methodology. Empirical results are presented and discussed in Section 4. Section 5 concludes the paper and discusses major policy implications.

2. Literature Review

The FDI-trade-growth relationship has stimulated considerable interest among the academic community as well as policy makers. A large number of empirical studies have investigated the bivariate causal links between FDI-growth, trade-growth or FDI-trade. However, the simultaneous analysis of the dynamic nexus of all three variables is scarce (Hsiao & Hsiao, 2006; Jayachandran & Seilan, 2010). The existing literature on the interrelationships among trade, FDI and growth does not provide clear results. Mixed findings can be partially attributed to the use of varying estimation techniques and samples that include countries at different stages of economic development. None of the available studies has considered the case of Vietnam.

2.1 FDI-Growth nexus

During the past few decades, a number of studies have considered the FDI-growth nexus. The neo-classical growth models suggest that FDI can channel required funds to the productive sectors of a capital shortage economy which, in turn, helps to increase the output growth rate. In addition, endogenous growth models suggest that FDI can generate a more profound and sustained impact on the long-term growth of host economies via not only direct capital funding but also through spillover effects (Grossman & Helpman, 1991; Lucas, 1990; Paul M. Romer, 1986). At the same time, rapid economic growth can facilitate FDI inflows. Generally speaking, high output growth leads to shortage of resources, which increases the demand for external funding (Shan, 2002). A rapidly expanding economy represents an increase in market size, which attracts more inward FDI (Meyer, 1999; Moore, 1993). In summary, both the neoclassical and endogenous growth theories suggest a mutually reinforcing relationship between FDI and economic growth.

Despite strong theoretical underpinnings, the empirical evidence on FDI-growth linkage is far from unanimous. Using the Toda-Yamamoto causality test (1995), Irandoust (2001) analysed the FDI-growth nexus for four OECD economies. Irandoust found evidence of a bidirectional causal link for Sweden; causality runs from FDI to GDP growth in the case of Norway; and the causal effect in Denmark and Finland was found to be insignificant. Using various estimation techniques,[1] some cross-country and country-specific studies have found bidirectional feedback between FDI and

[1] These techniques include Granger causality testing, simultaneous equations, bounds testing and VAR models.

economic growth (Anwar & Nguyen, 2010b; Hansen & Rand, 2006; Shan, 2002). However, several studies report only unidirectional causality (Kohpaiboon, 2003; Rodrik, 1999).

A substantial body of the existing literature suggests that FDI can stimulate economic growth in host economies through productivity spillovers, which validates the endogenous growth models (Anwar & Nguyen, 2010a; Blomström & Sjöholm, 1999; Javorcik, 2004; Sun, 2011; Suyanto, Bloch, & Salim, 2012). However, some studies have found insignificant or even negative FDI-induced productivity spillovers in both developed and developing host countries (Aitken & Harrison, 1999; Ruane & Uğur, 2005; Sadik & Bolbol, 2001).

2.2 Trade-growth nexus

The trade-growth nexus has also been the subject of a number of studies. The Heckscher-Ohlin theory of international trade suggests that trade based on relative factor endowments can potentially increase the GDP of all trading partners. A number of studies have shown that openness to trade (usually measured by the ratio of the sum of exports and imports to GDP) is an important determinant of economic growth, notably for developing countries (Dawson, 2006; Dutta & Ahmed, 2004; Estrada & Yap, 2006). The export-led-growth hypothesis asserts that exports can alleviate foreign exchange constraints and increase long-run growth through innovation (Esfahani, 1991; Lucas, 1990; Paul Michael Romer, 1989).

The findings of empirical studies on the trade-growth nexus are also mixed. Ramos (2001) examined the trade-GDP relationship for Portugal using Johansen's cointegration technique. Ramos found two-way causation between GDP and exports, GDP and imports but no link was found between imports and exports. Similarly, Hye and Boubaker (2011) tested the export-led-growth, import-led-growth and foreign deficit sustainability hypotheses in the case of Tunisia. Their analysis, based on the bounds testing technique, revealed a unidirectional link from exports to growth and two-way causality between imports and growth. Additionally, exports and imports reinforce each other, with a one per cent increase in exports enhancing imports by 1.02 per cent and a one per cent increase in exports boosting imports by 0.86 per cent. A number of empirical studies that focus on the export-growth-GDP linkage reported varying results (Giles & Williams, 2001; Mah, 2005; Mbaku, 1989; Shan & Sun, 1998).

2.3 FDI-trade nexus

The FDI-trade link has received relatively less attention in the existing literature. The literature suggests that, as exporting to a foreign market (i.e., trade) is easier and less risky than investing in a foreign market (i.e., FDI), firms tend initially to trade in a foreign market and establish subsidiaries or partnerships in that market only after gaining necessary experience and knowledge about the country's economic, political and social environment (Xiaming Liu, Wang, & Wei, 2001; Vernon, 1999). Empirical evidence suggests that local firms in host economies benefit from spillover effects that arise from export-oriented foreign subsidiaries (Aitken, Hanson, & Harrison, 1997; Anwar & Nguyen, 2011; Nguyen & Sun, 2012). Conceptually, a two-way causal relationship exists between trade and FDI in that trade induces FDI and FDI may then stimulate trade. In the case of market-seeking FDI, trade and FDI tend to be substitutes for each other but in the case of efficiency-seeking FDI, trade and FDI tend to be complementary (Dunning, 1988; Markusen & Venables, 1998).

The empirical studies on the FDI-trade nexus also report conflicting evidence. Xiaming Liu et al. (2001) investigated the FDI-trade nexus for China. They found that import growth causes the growth of FDI from a source country, which, in turn, causes the growth of exports from China to that country. Pacheco-López (2005) analysed the liberalisation of FDI in Mexico since the late 1980s and its relationship with trade, finding evidence of a significant bidirectional causal relationship between exports, imports and FDI. Soubaya, Mucchielli, and Chédor (2000) examined the determinants of trade of French multinationals. They found that inward FDI has a positive influence on foreign trade and this positive impact was stronger for exports than imports. Aizenman and Noy (2006) decomposed causality between trade and FDI for a sample of more than 200 economies. They found that most of the feedback between trade and FDI could be accounted for by causality from FDI inflows to trade openness and from trade to FDI.

As mentioned earlier, only a few empirical studies have simultaneously examined the FDI-trade-growth nexus. Xiaohui Liu, Burridge, and Sinclair (2002) and Shan (2002) investigated the causal links between GDP, FDI and trade in China, but they did not include exports in their VAR model. Xiaohui Liu et al. (2002) found bidirectional causality among GDP, FDI and exports but only unidirectional causality was found from GDP, FDI and exports to imports. Shan (2002) also found two-way FDI-GDP causality. While examining the strength of causality, output was found to explain a higher proportion of the variance in FDI compared to the opposite situation. Similarly, Constant and Yue (2010) and Jayachandran and Seilan (2010) examined all possible linkages between FDI, trade and growth for the Ivory Coast and India, respectively. For the Ivory Coast, they found a unidirectional causal effect from FDI and trade to output and from output and FDI to trade. In the case of India, all three variables were found to be mutually reinforcing under that country's open-door policy.

3. Data and Methodology

In order to examine the interrelationship among trade, FDI and GDP growth in Vietnam, we use quarterly data from March 2001 to December 2011 obtained from the CEIC database (2014). The variables included in the model are GDP (*lnGDP*), FDI inflows (*lnFDI*), exports (*lnEXPORT*), imports (*lnIMPORT*), state investment (*lnSTATE_INVEST*) and the inflation rate (INF_RATE). All variables, except for inflation rate, are converted into natural logarithms. Except for the inflation rate, all variables are measured in Vietnamese Dong (VND) at constant prices and are deseasonalised using the X12-ARIMA seasonal adjustment program. The data analysis presented in this paper is conducted using the statistical software EViews.

Prior to carrying out any time series analysis, it is desirable to test all variables for stationarity. In this paper, we rely on the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The KPSS test differs from the ADF and PP tests in that it involves testing the null hypothesis that the relevant time series is stationarity. Therefore, inference from the KPSS test is complementary to unit root testing based on the ADF and PP tests.

We start by specifying a VAR model as follows:

$$Z_t = A_0 + \sum_{i=1}^{p} A_i Z_{t-i} + \varepsilon_t \quad (1)$$

where Z_t is a 6x1 vector that includes $lnGDP_t$, $lnFDI_t$, $\mathrm{lnEXPORTS}_t$, $lnIMPORTS_t$, INF_RATE_t *and* $lnSTATE\_INVEST_t$; A_0 is a 6×1 vector of constants; A_i is a 6 × 6 matrix of population regression coefficients; ε_t is a 6×1 vector of error terms (white noise processes); and p is the lag length.[2]

If all of the time series in equation (1) are integrated of order 1 then one can test for the presence of a long-run relationship among the relevant variables. This involves testing for cointegration using the Johansen (1988) methodology. Johansen's maximum likelihood method of testing for cointegration involves finding the rank (r) of the error correction matrix (π). This method consists of two tests: (i) the trace test and (ii) the maximum eigenvalue test. The relevant test statistics are as follows:

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[2] In estimating a VAR model, it is necessary that an optimal lag length (*p*) is selected. Lütkepohl (1985) suggest that over-fitting the lag length could lead to an increase in a VAR's mean-square-forecast errors and under-fitting might lead to autocorrelated errors. Furthermore, Hafer and Sheehan (1989) indicate that the accuracy of the forecasts based on VAR models varies substantially across the lag lengths. To ensure the robustness of our estimates, the optimal lag length is determined by three selection-order statistics, namely Akaike's Information Criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC). Each criterion selects the smallest lag length. A sequence of likelihood-ratio (LR) test statistics for all the full VARs of order less than or equal to the highest lag order is also computed to further validate the choice of the optimal lag length.

Test statistic 1: $\lambda_{Trace}(r) = -T \sum_{i=r+1}^{n} \ln\left(1-\hat{\lambda}_i\right)$

Test statistic 2: $\lambda_{Max}(r, r+1) = -t \ln\left(1-\hat{\lambda}_{r+1}\right)$

where $\hat{\lambda}s$ are the estimated values of the characteristic roots (i.e. eigenvalues) obtained from the estimated error correction matrix (π) and T is the number of observations.

Test statistic 1 is used to test the null hypothesis that the number of cointegrating vectors is less than or equal to r against a general alternative. Test statistic 2 is used to test the null hypothesis that the number of cointegrating vectors is r against the alternative that the number of cointegrating vectors is $r+1$.

Once the cointegration hypothesis has been confirmed (i.e., at least one cointegrating vector exists), the relationship among the relevant variables can be represented by means of a Vector Error Correction (VEC) model as follows:

$$\begin{bmatrix} \Delta lnGDP \\ \Delta lnFDI \\ \Delta lnEXPORTS \\ \Delta lnIMPORTS \\ \Delta lnINF_{RATE} \\ \Delta lnSTATE\_INVEST \end{bmatrix}_t = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \\ \alpha_{51} \\ \alpha_{61} \end{bmatrix} [\beta_{11} \quad \beta_{12} \quad \beta_{13} \quad \beta_{14} \quad \beta_{15} \quad \beta_{16}]$$

$$\times \begin{bmatrix} lnGDP \\ lnFDI \\ lnEXPORTS \\ lnIMPORTS \\ lnINF\_RATE \\ lnSTATE\_INVEST \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \end{bmatrix}_t$$

where α_{ij} are the adjustment coefficients (i.e., the loading factors) and β_{ij} are the parameters of the cointegrating vectors. Weak exogeneity of the cointegrated variables is crucial in the formulation and estimation of an ECM model (Johansen, 1992). The *i*-th endogenous variable is said to be weakly exogenous with respect to the parameters β, if the *i*-th row of the matrix α is a null vector (Johansen, 1995). This is equivalent to testing the null hypothesis of zero loading factors $\left(\text{i.e.}, H_0 : \alpha_{ij} = 0\right)$. Failure to reject the null hypothesis of weak exogeneity implies that the variable is not adjusting to its long-run equilibrium state for the parameters of the cointegrating vector (Hachicha, 2003).

In addition to testing for weak exogeneity, we also conduct multivariate Granger causality/Block exogeneity Wald tests to examine the short-run dynamics among the variables of interest. The variable *X* is said to 'Granger-cause' the variable Y, if the past values of X are useful in forecasting the future values of Y (Granger, 1969). The null hypothesis to be tested is that the exogenous (i.e., the excluded) variables do not 'Granger-cause' the endogenous (i.e., the dependent) variable in the short-run. The Wald test results can be used to identify the temporal causal directions between pairs of variables. Causality can be bidirectional or unidirectional or there may be no causality.

Finally, we use the variance decomposition and impulse response function analysis to investigate the dynamic interrelationships among the selected variables. Such computations are useful in assessing how potential shocks to economic variables reverberate through the system. The forecast error variance decomposition allows inference over the proportion of the movement in a time series due to its own shocks versus the shocks to other variables in the system (Enders, 2010). This allows one to gain some useful insights into the determinants of each variable as well as the causal directions among the variables included in the model. The impulse response function analysis traces out the time path of various shocks to the variables in the system (Shan, 2002), which allows us to determine how each endogenous variable responds over time to a shock to that variable and other variables.

4. Empirical Results and Discussion

4.1 Unit Root Testing and Optimal Lag Length

We use the ADF, PP and KPSS tests to test whether or not the variables included in the model are stationary. The results of these test are reported in Table 1. As far as the variables in levels are concerned, both the ADF and PP tests do not reject the null hypothesis that the series are non-stationary, and the KPSS test rejects the null hypothesis that the series are stationary. In the case of first differences of the variables, both the ADF and PP tests reject the null hypothesis of non-stationarity and the KPSS test does not reject the null hypothesis of stationarity. Therefore, we can conclude that all six variables included in the VAR model are integrated of order one or *I*(1).

Table 1: Unit root and Stationarity Test Results

Variables	ADF test		PP test		KPSS test	
	Level	First Difference	Level	First Difference	Level	First Difference
lnGDP	–1.102 (0.714)	–6.084*** (0.000)	–1.515 (0.526)	–6.242*** (0.000)	0.986*** (0.000)	0.266 (0.192)
lnFDI	–1.160 (0.690)	–5.221*** (0.000)	–1.401 (0.582)	–5.186*** (0.000)	0.598*** (0.006)	0.283 (0.168)
lnEXPORTS	0.343 (0.979)	–6.672*** (0.000)	0.357 (0.980)	–6.666*** (0.000)	0.941*** (0.000)	0.102 (0.712)
lnIMPORTS	–0.351 (0.918)	–4.970*** (0.000) ***	0.376 (0.914)	–4.887*** (0.000)	0.939*** (0.000)	0.050 (0.994)
lnSTATE_INVEST	–1.999 (0.287)	–10.479*** (0.000)	–1.526 (0.521)	–17.734*** (0.000)	0.952*** (0.000)	0.065 (0.941)

Note: "***" denotes significance at the 1% level; *p*-values are in parentheses.

Table 2 reports the test results for lag order selection criteria, using the AIC, SBIC, HQIC and the *LR* test. Given that the estimated test statistics for all three information criteria are minimised at lag order 1, lag order 1 is considered as optimal. Furthermore, the *LR* statistic is also statistically significant at the 1% level for lag order of 1 and hence we can reject the null hypothesis that all the coefficients on the first lag of the variables are zero. Accordingly, the lag order of 1 is selected as the optimal lag length for the specified VAR model.

Table 2: Lag Order Selection Criteria

Lag	Selection-order criteria Sample period: 2001 Q1 to 2011 Q4				
	Log Likelihood	*LR*	*AIC*	*SBIC*	*HQIC*
0	17.144	NA	-8.727	-8.45	-8.637
1	194.717	59.083***	-8.3106*	-6.368*	-7.677*
2	222.318	70.509	-8.262	-4.654	-7.086

Note: In the case of the *LR*, "***" indicates significance at the 1% level; In the case of the selection criteria, "*" denotes the smallest value and the corresponding optimal lag order.

4.2 Cointegration, Weak Exogeneity and Causality Testing

As all of the variables in our VAR system are integrated of order one, it is imperative that we test for the presence of a long-run (i.e., cointegrating) relationship. Table 3 presents the Johansen cointegration test results based on the data assumption of a deterministic trend.[3] Accordingly, we fail to reject the null hypothesis of the Trace test (H_0: $r \leq 1$) and the Max test (H_0: $r = 2$) at the 1% level of significance. As the Trace and the Maximum Eigen values test provide slightly different results, we can apply Pantula's principle (Pantula 1989), which suggests that one can stop at the point where either of the two tests fails to reject the null. Therefore, based on the results of the Trace test, we conclude that there exists one cointegrating vector. In other words, there is evidence of a long-run linear relationship among the variables included in equation (1), which can be represented by a VEC model. Accordingly, we use the VEC model for further analysis.

Table 3: Johansen Cointegration Test Results

Trace test				Max test			
H_0	H_1	Trace statistic	*p*-value	H_0	H_1	Max-Eigen statistic	*p*-value
$r = 0$	$r > 0$	116.705***	0.000	$r = 0$	$r = 1$	51.674***	0.002
$r \leq 1$	$r > 1$	65.032	0.114	$r = 1$	$r = 2$	40.350***	0.007
$r \leq 2$	$r > 2$	24.68	0.0927	$r = 2$	$r = 3$	16.211	0.648
$r \leq 3$	$r > 3$	8.471	0.995	$r = 3$	$r = 4$	6.990	0.954
$r \leq 4$	$r > 4$	4.482	0.999	$r = 4$	$r = 5$	1.480	0.998
$r \leq 5$	$r > 5$	0.002	0.960	r = 5	$r = 6$	0.002	0.960

Note: "***" and "**", respectively, denote significance at the 1% and 5% levels.

Given that a long-run relationship exists among the variables, the next step involves testing each variable for weak exogeneity by imposing the zero restrictions on the adjustment coefficients $\left(\text{i.e., } H_0 : \alpha_{ij} = 0\right)$. Table 4 shows the results of the weak exogeneity test. We can reject the null hypothesis of weak exogeneity for GDP, the inflation rate and state investment but fail to reject the null for the other three variables. This implies the presence of pairwise bidirectional and unidirectional causalities among the variables.

[3] We also tested for cointegration using the Johansen method on alternative models (i.e. no intercept or trend; intercept and no trend; linear intercept and trend; quadratic intercept and trend) and found largely similar results.

Table 4: Weak Exogeneity Test Results

The null hypothesis	*LR* statistic	*p*-value
lnGDP is weakly exogenous to the system	4.690**	0.030
lnFDI is weakly exogenous to the system	0.420	0.517
lnEXPORTS is weakly exogenous to the system	0.361	0.548
lnIMPORTS is weakly exogenous to the system	2.397	0.122
INF_RATE is weakly exogenous to the system	4.202**	0.040
lnSTATE_INVEST is weakly exogenous to the system	8.326***	0.004

Note: "***" and "**", respectively, denote significance at the 1% and 5% levels.

We now examine the short-run dynamics among the variables by employing the multivariate Granger causality/Block exogeneity Wald tests for the estimated VEC model. The null hypothesis is that the excluded variables do not 'Granger-cause' the dependent variable. Table 5 presents the test results, indicating a number of bidirectional and unidirectional causalities among the variables. Notably, FDI is found to Granger cause GDP but reverse causality is not supported in the short-run. As the null hypothesis of 'no Granger-causality' from the inflation rate to both GDP and FDI can be rejected, we conclude that the inflation rate exerts a significant influence on GDP and FDI. In addition, one-way causality is found from imports to GDP because we can reject the null at the 5% level of significance. Finally, based on the rejection of the null hypothesis of 'no Granger-causality' in both directions at the 5% and 10% level of significance, respectively, there is evidence of a two-way causal link between imports and state investment.

Table 5: Granger Causality Test Results

Dependent variable	Excluded variables					
	ΔlnGDP	ΔlnFDI	ΔlnEXPORTS	ΔlnIMPORTS	ΔINF_RATE	ΔlnSTATE_INVEST
ΔlnGDP		5.157** (0.023)	0.322 (0.570)	3.846** (0.050)	5.691** (0.017)	0.061 (0.805)
ΔlnFDI	0.154 (0.695)		0.873 (0.350)	0.000 (0.992)	3.691* (0.055)	0.043 (0.835)
ΔlnEXPORTS	0.473	0.049		0.038	0.481	0.251

	(0.492)	(0.824)		(0.845)	(0.488)	(0.616)
ΔlnIMPORTS	0.060 (0.807)	0.010 (0.920)	1.449 (0.229)		2.298 (0.130)	2.889* (0.089)
ΔINF_RATE	0.147 (0.702)	2.705 (0.100)	0.503 (0.478)	0.049 (0.826)		0.346 (0.556)
ΔlnSTATE _INVEST	1.225 (0.269)	1.194 (0.275)	0.003 (0.959)	3.994** (0.046)	0.919 (0.338)	
Causality inference	Bidirectional: Inflation↔State investment Unidirectional: FDI→GDP, Imports→GDP, Inflation→GDP, Inflation→FDI					

Note: "**" and "*", respectively, denote significance at the 5% and 10% levels.

4.3 Variance decomposition analysis

The Cholesky forecast error variance decomposition technique is applied to measure the contribution of each shock to the innovations of each variable in the VEC system over a 10-period forecast horizon. The results presented in Table 6 indicate that the variance of real output growth (measured by *lnGDP*) in Vietnam is largely explained by shocks to its own past performance (78.947%), followed by state investment (7.546%). The shocks to international trade (4.903%) and FDI (4.345%) appear to exert minimal influence on output growth. This result suggests that the current performance of the economy plays a crucial part in forecasting the future output growth of Vietnam.

Table 6: Cholesky Variance Decomposition

Forecast Error Variance *(%)*	Typical shock in					
	lnGDP	lnFDI	lnEXPORTS	lnIMPORTS	INF_RATE	lnSTATE_INVEST
lnGDP	78.947	4.345	4.900	0.031	4.232	7.546
lnFDI	8.106	72.444	1.847	6.985	8.820	1.799
lnEXPORTS	0.427	2.216	94.408	2.462	0.782	0.761
lnIMPORTS	0.976	1.353	4.395	83.774	9.418	0.084
INF_RATE	1.869	2.486	0.043	30.409	59.768	5.425
lnSTATE_INVEST	29.342	2.511	4.338	9.510	32.216	21.697

We now turn our attention to the forecast error variance of inward FDI. The results presented in Table 6 suggest that 72.44% of the fluctuations in FDI are caused by shocks to its own past values. A shock to the inflation rate is the second largest impact factor, accounting for 8.820% of the volatility in FDI. As suggested by Fischer (1993), a higher inflation rate implies a lack of commitment and discipline in monetary policy, which may discourage foreign investors. A shock to GDP accounts for 8.106% of the variance in FDI, which is relatively small but higher than the impact of fluctuations in FDI on output growth (4.345%).

Table 6 also shows some similarities in terms of the factors that contribute to the volatility in exports and imports. Notably, the past values of exports and imports, respectively, account for 94.408% and 83.774% of the fluctuations in the current values. Moreover, a shock to the inflation rate seems to have a stronger impact on imports (9.418%) than on exports (0.782%). In fact, the inflation rate is the second most important factor explaining the variance of imports. Changes in output growth appear to make a relatively small contribution to fluctuations in both exports and imports. A shock to FDI inflows appears to have a stronger impact on exports (2.216%) than on imports (1.353%).

Furthermore, nearly 60% of the variance in the inflation rate is caused by changes in its past values. This result is expected when consumers and investors in the economy rely on information on past inflation rates to form their expectations about future inflation rates. The shocks to imports and state investment, respectively, account for 30.409% and 5.425% of the variations in the inflation rate.[4]

The inflation rate accounts for about 32.216% of the forecast error variance in Vietnam's state investment, which re-confirms the important role that inflation plays in Vietnam's economy. Approximately 29.342% and 21.697% of the variance in state investment, respectively, can be attributed to changes in GDP and its past values. FDI inflows exert the least significant influence on variance in state investment (2.511%). This result appears to reject the crowding-out effect of FDI on domestic investment in Vietnam, suggested by Adams (2009) and Backer and Sleuwaegen (2003).

4.4 Impulse Response Analysis

In this section, we use impulse response functions (IRFs) to examine the dynamic feedback of the VEC system to unexpected shocks as impulses to exogenous variables. Figures 1-6 plot the impulse responses for each of the six variables to a Cholesky one-standard-deviation (SD) shock to

[4] The chronic trade and the state budget deficits, not included in our VEC model, may also account for significant volatility in Vietnam's inflation rate.

itself and other variables in the system over a 10-period forecast horizon. The solid lines indicate the point estimates of the dynamic response functions. Notably, except for state investment, the self-responses account for the highest proportion of the variation in most of the variables. In other words, the past volatility of a variable plays a dominating role in explaining its current volatility, which supports the conclusions of the forecast error variance decomposition analysis.

Figure 1 shows the response of GDP to shocks to its own past values and other variables. The overall feedback of aggregate output is immediate and most significant in the first four quarters before staying steady in the remaining periods. The shocks to the GDP (in the past) and the current period shocks to inward FDI and exports result in positive changes in GDP. However, current period shocks to the inflation rate and state investment elicit negative responses from GDP. Finally, a shock to imports appears to exert a minimal effect on GDP as the response of GDP is negligible and quickly dies out after the fourth quarter. In fact, the variance decomposition analysis shows that the import variable is the least important factor explaining the volatility of GDP (only 0.031%).

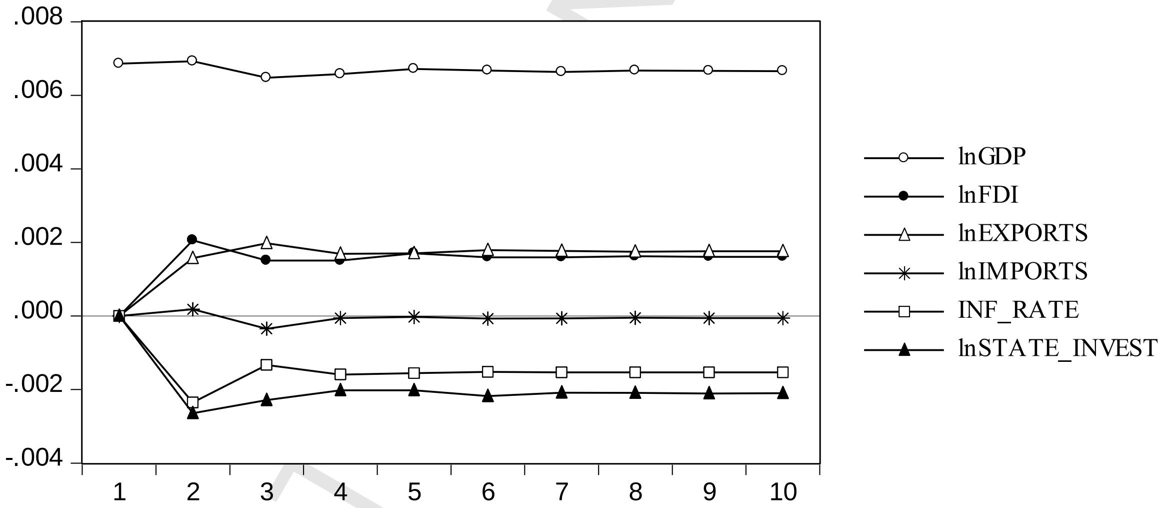

Figure 1: Responses of lnGDP to Cholesky One S.D. Innovations

The response of FDI to impulses in all variables is shown in Figure 2. Once again, the past values appear to contribute to the largest variance in FDI. The response of the FDI is negative in the first two quarters and remains steady afterwards. The feedback of the FDI to other shocks is mostly positive in the first 2-3 quarters and remains roughly steady afterwards.

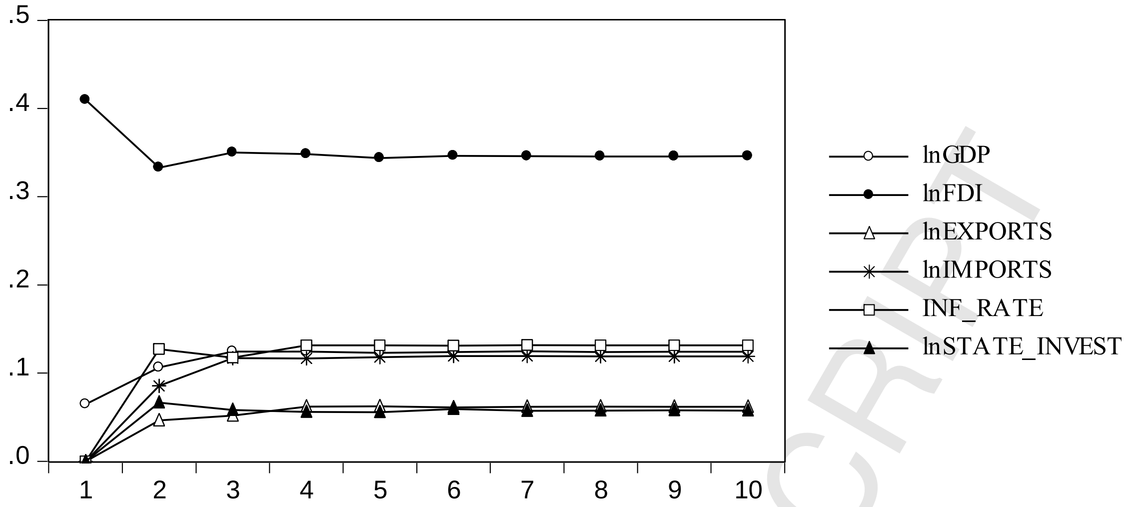

Figure 2: Response of lnFDI to Cholesky One S.D. Innovations

Figure 3 shows the response of exports to the disturbances in each of the six variables. The self-shock exhibits the largest changes in point estimates over the entire forecast horizon. This result confirms the findings of the variance decomposition analysis, indicating that 94.4% of the fluctuations in exports can be explained by its own past values. Compared to the responses of the GDP and FDI, the feedback of exports to various shocks is less volatile. Except for the first period response to the GDP, most of the changes in exports are positive. Furthermore, exports fluctuate mostly in the first two quarters.

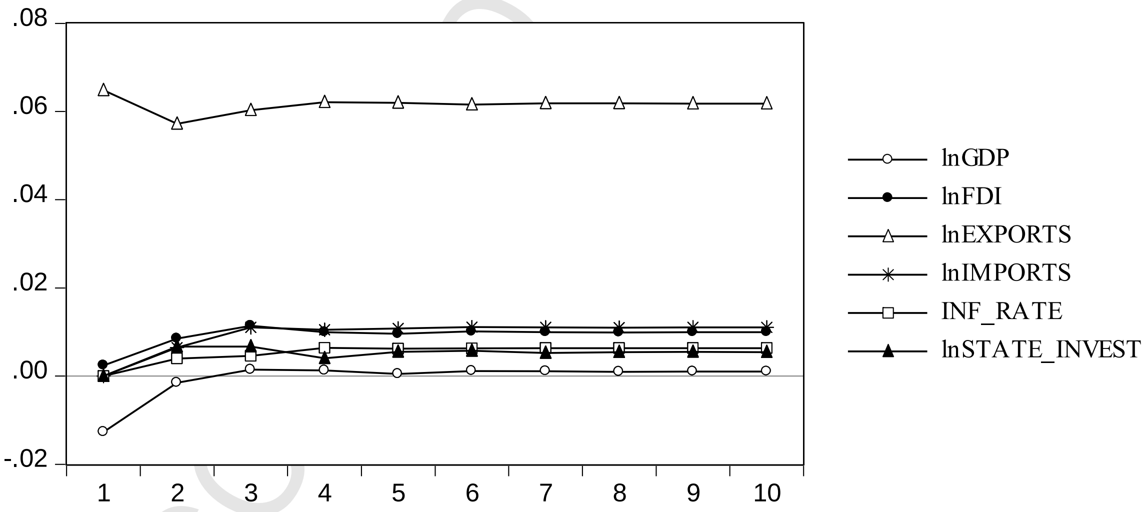

Figure 3: Response of lnEXPORTS to Cholesky One S.D. Innovations

The response of the imports to fluctuations in its past values and current values of other variables is shown in Figure 4. Compared to GDP, FDI and exports, the feedback of imports to various shocks is relatively diverse. Innovations in GDP, exports and the inflation rate exert a positive effect on imports but the impact of FDI and state investment is mostly negative. There is significant volatility in imports during the first four quarters. The feedback to an impulse in state investment is the least significant in that its effect quickly dies out from the fifth quarter. The self-shock exerts the strongest impact in that the past values account for nearly 84% of the changes in imports.

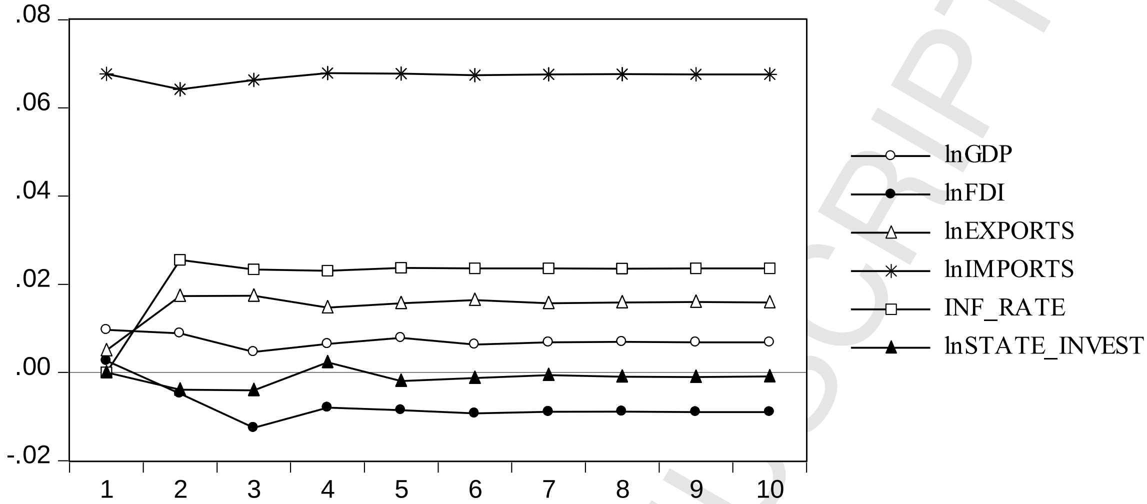

Figure 4: Response of lnIMPORTS to Cholesky One S.D. Innovations

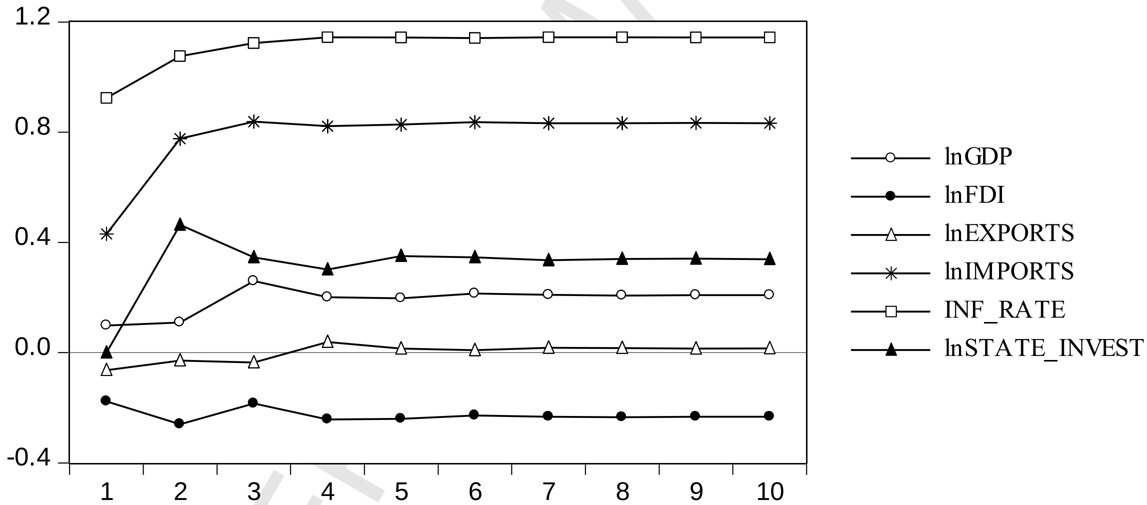

Figure 5: Response of INF_RATE to Cholesky One S.D. Innovations

Figure 5 shows that the response of the inflation rate varies considerably across the variables. Most fluctuations in inflation rate take place in the first three quarters before becoming persistent over the rest of the horizon. Notably, inflation responds sharply to a change in state investment and imports in the first quarter. Except for FDI, a shock to all other variables generates positive changes in the inflation rate. Furthermore, fluctuations in exports lead to negligible changes in the rate of inflation.

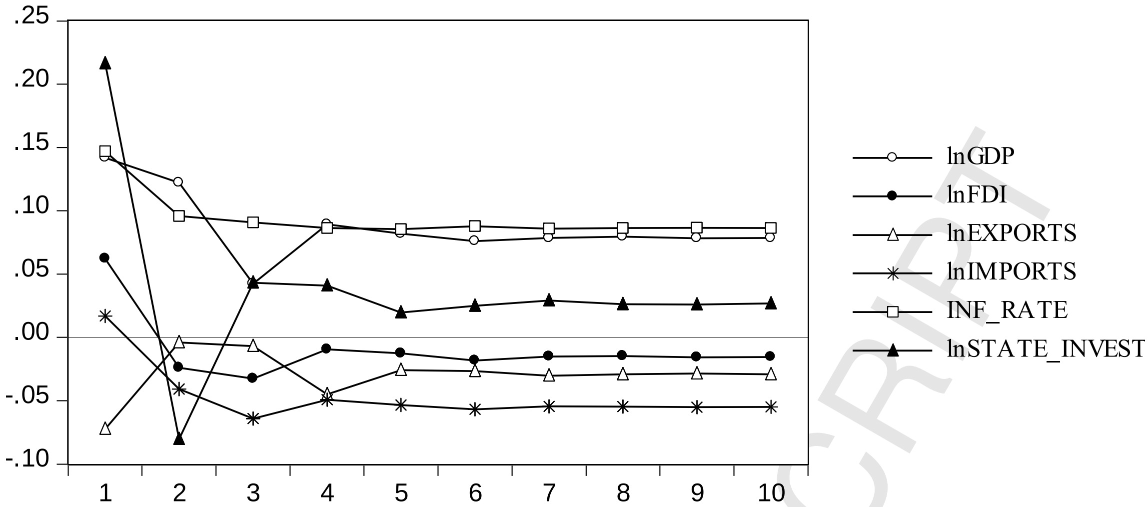

Figure 6: Response of lnSTATE_INVEST to Cholesky One S.D. Innovations

Figure 6 shows the response of state investment to fluctuations in all six variables. There is no clear pattern but the responses are substantial, notably to the self-shock, in the first three quarters. A shock to exports has a positive impact on state investment in the first two quarters but in the case of all other variables there is a decrease in state investment. A shock to imports leads to the largest decrease in state investment. In overall terms, the IRF analysis supports the results of the variance decomposition analysis.

5. Conclusions and Policy Implications

Using quarterly data from 2001 to 2011, this paper investigates the interrelationships among GDP, foreign direct investment (FDI), international trade, the inflation rate and state investment in Vietnam. The results of the Johansen cointegration test confirm the presence of a long-run relationship among the variables. Further analysis, based on variance decomposition and impulse response functions, shows that the strength of the short-run interrelationships varies considerably across the variables. A number of interesting conclusions and policy implications can be drawn from the analysis presented in this paper.

First, the impact of a shock to GDP on FDI is more significant than that of the impact of an FDI shock on GDP. Specifically, a shock to GDP explains a larger proportion of the forecast error variance in FDI than the impact of a shock to FDI on the GDP. Moreover, GDP was found to be more sensitive to shocks to its own past values and the inflation rate than to shocks to FDI and trade. This implies that the economic growth rate (or the market size) remains a key determinant of FDI in Vietnam. It is therefore suggested that policy makers in Vietnam continue prioritising measures that would result in sustainable economic growth. Strategic policies focusing on economic restructuring, economic efficiency and competitiveness, along with banking sector and state-owned enterprise reforms are highly desirable. Le, Cabalu, and Salim (2014) found that equitisation, particularly of medium and large state-owned enterprises, can significantly improve the productivity of domestic firms thereby stimulating long-run economic growth in Vietnam.

Second, we found that inward FDI exerts a stronger impact on exports than on imports, which is not surprising as the foreign-invested sector is a major contributor to Vietnam's exports. Nevertheless, the impact of FDI on international trade appears to be minimal, which is unexpected. This finding warrants further analysis as Vietnam has recently signed strategic free trade agreements (FTAs) with the European Union, South Korea and the Customs Union of Russia, Belarus and Kazakhstan. These FTAs are expected to exert a significant impact on Vietnam's trade and investment prospects.

Finally, the inflation rate seems to be a critical factor in determining the dynamics of several key macroeconomic variables in our vector error correction model. The inflation rate is the largest factor causing the variance in state investment and the second largest factor explaining the fluctuations in FDI and imports. A shock to the inflation rate can result in considerable fluctuations in other key economic variables. Therefore, keeping inflation to a moderate rate is highly desirable. Keeping inflation in check can also help to stabilise Vietnam's economy and promote sustainable economic growth, notably in the context of stronger integration of the Vietnamese economy with regional and global markets.

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