Dynamics of Business Cycles in Vietnam: A comparison with Indonesia and Philippines

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Abstract: The objective of this paper is to analyze the dynamics of business cycle features and investigate the main source of macroeconomic fluctuations in Vietnam, and then make comparison to Indonesia and the Philippines. In the first task, the business cycle features are evaluated by properties of data, including volatility, persistence and co-movement after taking Hodrick-Prescott (HP) filter in 2 periods: before and after the global financial crisis in 2008. Results indicate that these properties mostly concentrate on second period (2008-2013) in Vietnam, whereas the Asian Financial Crisis leads to a high volatility and persistence in Philippines and Indonesia. In order to identify the sources of macroeconomic fluctuations, the study adopts the Structural Vector Autoregression (SVAR) with data covered from 1996 to 2013. The evidence for countries suggests that (i) the main source of output variance is domestic supply shocks but there is a significant decrease in long-run; (ii) The fluctuations of trade balance are mostly due to external shocks, especially term of trade shocks in Vietnam, as opposed to Philippines and Indonesia where IS shocks play an important role; (iii) The fluctuations of real exchange rate are mainly driven by the domestic shocks but internal causes of each country are different; (iv) the most two important sources of price's movements are domestic shocks, especially IS and nominal shocks in Vietnam.

Keyword: Structural Shocks, Business Cycles, Fluctuations, SVAR

JEL Classification: E12, E32

1. Introduction

Understanding and distinguishing among factors that affect macroeconomic fluctuations in the short-run and the long-run have been among the main area of quantitative macroeconomic research. Lucas (1977) argued that understanding business cycle is so important for designing appropriate stabilization policies. The term *business cycle* refers to source of the deviations from trend occurs because of the wavelike motion of real economic activity. Over three decades, a large body of empirical business cycle analysis with many powerful tools attempted to discover the main sources of macroeconomic fluctuations. Kydland and Prescott (1982) and Long and Plosser (1983) were pioneers in the *real business cycle* approach to economic fluctuation. In spite of unresolved issues, the research successfully explained some of the key empirical regularities of business cycle. After that research developed and focused on deriving the driving forces of business cycle fluctuations (Blanchard & Quah, 1989; Shapiro & Watson, 1998).

The research, however, primarily focused on industrialized countries, thus there is a serious lack of empirical research in emerging countries. This is due to the lack of data from developing countries to conduct the research in this field. Moreover, these countries tend to experience sudden crises which make it difficult to find out the sources of business cycles. Recently, scholars attempted to adjust and construct new methods for developing countries which open new chances for economic research in this field in these countries (Mendoza, 1991; To Trung Thanh 2007; Hoffmainster & Roldos, 2001). But these methods might not appropriately apply to others because of distinct characteristics of business cycles as well as economic development models of each country. Therefore, we need more business cycles analysis which should be conducted for particular developing countries, especially in Vietnam.

Economic reforms and international integration brought a high growth rate and a stable economic development, with average annual growth of 7.2%, Vietnam was considered as a new emerging country with many potential developments. Vietnam, however, experienced the Asian financial crisis in 1997 and has recently continuingly faced

macroeconomic instability. This instability has become more serious since 2007 when Vietnam participated in World Trade Organization (WTO). This has resulted in such problems as high inflation (over 23% in 2008 and 18.13% in 2011) accompanied by the low level of economic growth (declined from 8.2% in the period 2004-2007 to nearly 6% in 2008-2011 period and only 5.3% in 2012), serious budget deficit with public debt and foreign debt reaching the dangerous level (The public debt which was accounted for around 40% in many years increase sharply to 54.9% in 2011 and 55.4% in 2012 and Vietnam's budget deficit accounted for 1.3% of GDP in 2003-2007 and almost double to 2.7% in 2008-2012 (Ministry of Finance, 2013)), highly fluctuated exchange rate (from approximately 16,000 in 2007 to nearly 21,000 in 2012), vulnerable banking and financial market. Especially, the global financial and economic crisis in 2008 and its consequences prompt some key questions, such as whether the macroeconomic fluctuation could end soon or last for long, whether the internal or external shocks have more impacts on these fluctuations and others. Vietnam's policy aims to control these problems such as control prices and inflation, stabilize the value of money, and ensure the sound development of financial institutions. However, these policies tend to be inconsistent overtime and partly contribute to macroeconomic instabilities in Vietnam. Therefore, the study of business cycles and its sources has become an important goal to not only help Vietnam get over the current macroeconomic instabilities but help policy makers identify the main sources of these instability to design appropriate stabilization policies and reach stable economic growth in the long-run.

However, no empirical studying to date has investigated the business cycle in Vietnam. Following the above arguments, conducting research about the sources of macroeconomic fluctuation in Vietnam has become a critical requirement. Such study serves two important purposes. On the one hand, this research will attempt to explain the main sources of business cycles in Vietnam which help policy makers design stabilization policies to reach a long-term growth. On the other hand, this research also fills the serious gap in the empirical literature. The specific questions to be addressed are: (i) what are the main features of business cycles in Vietnam?; (ii) How does the economy respond to

various structural shocks, how relatively important is the contribution of each shock to macroeconomic fluctuations?; and (iii) What are the policy implications in the context of current macroeconomic instability?

By adopting the Structural Vector Autoregressive (SVAR) originated by Shapiro and Watson (1988) and Blanchard and Quah (1989) with long-run restriction for small open-economy with flexibility of price, suggested by Ahmed and Park (1994) and Gali (1994), the study attempts to investigate the main source of macroeconomic fluctuations in Vietnam. Moreover, this study chooses Indonesia and Philippines due to the fact that these countries are the official member of the Association of Southeast Asian Nation (ASEAN) and have many same characteristics with Vietnam to compare and give some possible explanations for any differences. The main purpose of study is to indicate empirical evidences about impacts of five kinds of shocks, including term of trade shocks, external supply shocks, domestic supply shocks, IS and LM shocks on macroeconomic fluctuations in some developing countries during 1996-2013 period.

The paper is organized as follows, besides introduction (chapter 1), the study begins with a brief literature review in chapter 2 which will describes the empirical methodologies as well as the evidence of business cycle in previous research. Chapter 3 will represent the empirical methodology to investigate the features and main sources of business cycle. Subsequently, the study will indicate and analyze some stylized facts of business cycles (chapter 4) and results for driving factors of macroeconomic fluctuations (chapter 5) in Vietnam over period 1996-2013. Finally, chapter 6 will show some conclusion of main finding and policy implications.

2. Literature Review

2.1. Regularities of Business Cycles

The research on empirical regularities that characterize economic fluctuations was originated in the pioneering work of Kydland and Prescott (1982) and John Long and Charles Plosser (1983). In spite of unresolved issues, the research successfully explained some of the key empirical regularities of business cycle. After that research developed and focused on deriving the determinants of business cycle variances (Blanchard & Quah,

1989; Shapiro & Watson, 1998). Now, we will investigate the features of business cycles in developed and developing countries by reviewing previous research.

2.1.1. Stylized facts of business cycles in developed countries

Most of the industrialized countries exhibit well defined empirical regularities in both domestic and key international indicators of economic activities. Backus and Kehoe (1989) indicated historical evidences on these international aspects of business cycle. They investigated the features of business cycle in the majored industrialized countries. Furthermore, by studying many macroeconomic variables, they found that inflation rates were significantly more persistent in the postwar period that prices are generally pro-cyclical prior to World War II and counter-cyclical after the War in most of countries. They also found an opposite characteristic between prewar and postwar periods of fluctuations of money which are less highly correlated with output and then more persistent after that.

Christodulakis, Dimelis and Kollintzas (1995) also conducted a research about features of business cycles in EC countries and their finding suggested that there were remarkable similarities between business cycle patterns of these countries. They also showed that the type of shocks and the propagation mechanism is similar across the EC countries.

2.1.2. Stylized facts of business cycles in developing countries

Kim, Kose and Plummer (2003) examined the similarities and differences of business cycle regularities between seven Asian countries and the G7 by applying the Hodrick-Prescott (HP) filter. They found that there are some similar characteristics of business cycle such as co-movement and persistence between Asian and the G7 economy. They also suggested that the patterns of business cycle fluctuations expressed some similarities, the behaviors of fiscal and monetary policies varied across Asian countries.

Kose (2006) analyzed the sources of macroeconomic fluctuation in the emerging countries in the Middle East and North Africa (MENA) regions. They showed that the amplitude of business cycle is relatively large in the emerging MENA economy, the main features of business cycles in this region are quite similar to other countries.

2.2. Sources of Business Cycles

Structural vector autoregressive models (SVAR) was the most popular method for business cycle analysis. Furthermore, there was empirical research which utilized other methods, such as Ahmed and Loungani (1998) or Ambler (1989) utilized a vector-error correction model (VECM) to examine business cycle in Asian countries and Canada, respectively. Regardless of kinds of methodology, one of the most important goals of previous studies is to investigate the main sources of macroeconomic fluctuations.

2.2.1. Sources of Business Cycles in developed countries

A research of Blanchard and Quah (1989) is a famous study about business cycles which is developed by other empirical research. The authors assumed that there were two kinds of disturbances having permanent and transitory effects which could be interpreted as supply and demand shocks. By carrying out a research in the US with bivariate VAR (real GNP growth and the unemployment rate) over the period 1965:1 to 1986:4, they found that demand disturbances significantly explained to output fluctuations in short-term and middle-term whereas the effects of supply disturbances increase steadily overtime. Moreover, they indicated that the supply component of GNP positively correlated with real wages at high and medium frequencies.

Blanchard and Quah's study was also one of the pioneers in applying SVAR approach with long-run restriction. Many empirical studies have applied similar approaches but imposed long-run restriction from different theories. Ahmed and Murthy (1994) utilized real business cycle theory with small open-economy framework to investigate main sources of business cycle in Canada from 1973:1 to 1992:4 with seven variables. The authors found that domestic supply shocks played a vital role in explaining short-run fluctuations in output whereas real interest rate and term of trade have no effect. Amber (1989) also utilized the data in Canada to address the question of whether money matter Canadian business cycle fluctuations. By using VECM method, the author indicated that money play an important role for real output.

Gali (1992) built model which relied on Blanchard and Quah (1988) who identify aggregate demand and aggregate supply shocks by using a long-run constraints. However, Gali developed this method and imposed both long-run and short-run restriction to examine

the sources output fluctuation in the US after the war. The author investigated the impacts of exogenous disturbances: supply, money supply, money demand, and IS shocks on 4 variables: output, money, prices and interest. The main results of this study showed that supply shock significantly account for most of the output fluctuation in US.

2.2.2. Sources of Business Cycles in developing countries

Business cycle analysis primarily focused on major developed economies and a limited number of developing countries. It is only since late 1990, this figure gradually increase toward emerging countries. The study of Hoffmaister and Roldos (1997) in groups of developing countries was remarkable. They carried out research which compared business cycle in 15 Asia and in 17 Latin American in period 1970-1993. Authors utilized structural VAR with a set of long-run economic restrictions. This study also extended to examine the role of world interest rate and provide a framework with many kinds of shocks namely term of trade, supply, fiscal and nominal shocks. The main results showed that supply shocks substantially explained to output fluctuations in Latin American (65%) and Asia (90%) in both short run and long run whereas term of trade shock played a key role in examine trade balance fluctuation but not for output or real exchange rate. What's more, the nominal shocks had insignificant impacts on output and real exchange fluctuations. Hoffmasiter and Roldos (2001) continued utilizing the same to examine the main sources of business cycle in South Korea and Brazil. They found that output variations in Korea were mostly driven by domestic supply shocks whereas domestic demand shocks played a large role in Brazil.

Siregar and Ward (2000) investigating 5-variable VAR in Indonesia in period 1984-1999, imposed two long-run restrictions related (a) a long-run money demand equation and (ii) a modified McCallum(1994) policy reaction function on the cointegration matrix. Accordingly, aggregate demand shocks were considered as the main source of output and other macroeconomic fluctuations whereas aggregate supply shocks are less important. Authors indicated the reason for it was smallness of the economy.

Recently, Thanh (2007) also utilize SVAR empirical approach with the imposition of long-run restriction which is guide by the stochastic Mundell-Fleming open economy to

evaluate the impacts of structural shock on macroeconomic fluctuations in ASEAN-5 countries. The 4-variable VAR model examine 4 types of disturbances including of external shocks, domestic supply shocks, domestic demand shocks and nominal shocks. The author found that output fluctuations in ASEAN-5 countries were mostly driven by domestic supply shocks and domestic demand shocks were the main contributor to variations in trade balance. It is partly explain by a long period of high growth in the region. Furthermore, the external and domestic supply shocks caused output to expand and this expansion was sustainable in the long-run. In contrast, the domestic demand shocks negligibly affected output in short-run.

3. Data and Methodology

The study investigates the main sources of 4 macroeconomic variable-variations including real output, interest rate, money supply and inflation under the impacts of 5 structural shocks: external shocks, domestic supply shocks, domestic money supply shocks, domestic money demand shocks and spending (IS) driving forces. By applying the strategy that was first proposed by Shapiro and Watson (1998) and Blanchard and Quah (1989), we will utilize SVAR approach with long-run restrictions theoretically guided by stochastic version of the Mundel-Fleming model for a small and open economy.

3.1. Data and Variables Analysis

The model consists of 5 variables, which are term of trade (TOT), foreign output (Y^f), real output (y), Trade Balance (TB) and Real Exchange Rates (RER) and consumer price index (P). The term of trade is the ratio of the export price index to the import price index .However, in some developing countries, such as Vietnam, Indonesia and Philippines these indexes are not readily available. Hence, we will compute our own export and import price by taking a weight average of export-weighted and import-weighted price level of major trading partner. This method was suggested by Ahmed and Loungani (2000) for some Latin American countries. Particularly, in the case of three countries, we will calculate by utilizing the indexes of 4 main trade partners, including United States, Japan, Korea (Republic) and Singapore. There are several reasons which help us to explain for this choice. First, United States, Japan, Korea and Singapore are 4 of 5 the main trade partner

with Vietnam, Indonesia and the Philippines. Second, the information of export and import price is already available. The other variable is the level of foreign output which is an export-weighted of real GDP of five main trading partners (www.cia.gov, 2012). Trade balance (TB) proxied by the ratio of net export to nominal output. The real exchange rate (RER) was considered as the ratio of PPI in US to CPI in VN multiplying nominal exchange rate which represents the relative price of non-traded goods and traded goods. Finally, the domestic price level (P) was the CPI.

Other domestic variables were collected from many sources. All variables except for trade balance are in logarithm form and are covered from 1996 to 2013 from International Financial Statistics (IFS). Several data in Vietnam were taken from General Statistics Office of Vietnam. Furthermore, we also take the first differences of all variables and utilize it in the empirical model. This is to make sure that all variables are stationary which are necessary to satisfy the requirements of VAR model. After taking first differences, we need utilized some method to examine this characteristic of time series, such as Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and other methods.

3.2. Analytical Framework

3.2.1. The fact of business cycle

First, we discuss the definition of business cycle. Until now, there have been two main definition of business cycle. Mitchell (1927) and Burn and Mitchell (1946) firstly mentioned this definition and we can consider it as "classical" one. They argued that business cycle is characterized by the durations of expansions and contractions and the timing of turning points. Many scholars realized some limitations of the "classical" definition and try to alternatives which can fully explain the characteristics of business cycle. Lucas (1977) and his book "Understanding of business cycle" precisely indicated the definition of business cycle. He indicated that business cycle is the deviation of aggregate economic time series from their smoothed trends, which constitute the long-term growth or "secular" components. The "secular" components have a low frequency variation while business cycles or the cyclical components have a higher frequency fluctuation. This

definition has become popular and followed by most current studies and this research also adopts this definition.

This study will utilize several methods, such as Hodrick and Prescott (HP) filter (1997) and Band-Pass (BP) filter proposed by Baxter and King (1999) to decompose a given time series into trend component and cyclical component. The secular (trend) component captures the long-term trends in the data (non-stationary low frequency dynamics) while the cyclical one measures the deviation from long-term trend. Building upon the analysis of Backus and Kehoe (1992), the stylized facts of business cycles employed in this study will be characterized by three dimensions: (a) volatility as measure by the percentage standard deviation; (b) persistence as measure by the first-order autocorrelation coefficient and (c) the degree of contemporaneous and non-contemporaneous correlations of a series with output, as measured by the correlation coefficient up to first lag and lead. The amplitude of fluctuations is measured by volatility; and persistence shows the amount of inertia in business cycles and we rely on the correlation between series to describe the comovement.

If output has a positive (negative) correlation with another macroeconomic variable, the variable is pro-cyclical (counter-cyclical). Acyclical is described by the closely zero correlation which indicates that there is no correlation between variables. In order to analyze whether the correlation is significant or not, we utilize the confidence bands given by $\pm 1.96/\sqrt{T}$ where T denotes the number of observation. The cut-off point for the full sample from 1996 to 2012 is ± 0.24. Moreover, we utilize the cross-correlation coefficients to show the phase shift of variables (Y_t) to the cycle in output. We say that Y_t lead to the cycle by j period if this cross-correlation is maximum for positive j, is synchronous with the cycle if it is maximum for j=0 and lags the cycle if it is maximum for negative j. This methodology was mentioned in the study of Agenor, McDermott and Prasad (2000).

Hodrick - Prescott filter

This method, which firstly mentioned by Hodrick and Prescott (1997), decomposes a given time series into a trend component and a cyclical component by solving an optimization problem. This method is briefly described as follow: consider a given time

series y_t express in natural logarithms. We can split the series y_t into a cyclical component, x_t, and a trend component, g_t, where

$$y_t = x_t + g_t$$

The trend component can be found by solving the following optimization problem

$$\min \sum_{t=1}^{T} x_t^2 + \lambda \sum_{t=2}^{T-1} [(g_{t+1} - g_t) - (g_t - g_{t-1})]^2$$

The first term in this optimization problem is the sum of squared deviation from the trend component and measures the fit of the trend to time series. The second term is the sum of squares of the trend component's second differences and measures the smoothness of the trend. λ is a smoothing parameter, which penalizes the acceleration in the trend component. We set the value of λ at 1600 and 100, which are the conventional value used for quarterly and annual data, respectively.

3.2.2. Theoretical Economic Model: Mundell-Flemming Model

Structural VAR has been a popular tool which utilized to analyze the dynamic characteristics of economic system. The main difference between researches is the theoretical model framework. Blanchard and Quah (1989) assumed that there were two kinds of disturbances which are supply and demand disturbances. They argued that the former have a permanent effects on output and the latter did not and they utilized this assumption to investigate the properties of business cycle in US. Other scholars, such as Gali(1992), Siergar and Ward (2005) or recently Thanh (2007) applied IS-LM model for small open economy to explain the sources of business cycle. By using different theoretical framework, these scholars had different outlooks and interpretations for the same issues.

This study considers Vietnam as a developing country with characteristics of small open-economy. Hence, this section presents a simple version of the Muldell-Fleming small open-economy.

An open-economy IS equation

$$y_t = \varphi_1(e_t - p_t) - \varphi_2\big(r_t - E_t(\Delta p_{t+1})\big) + \varepsilon_t^{is} \qquad (1)$$

Where e_t is exchange rate and $(e_t - p_t)$ is real exchange rate; r_t is interest rate and $\big(r_t - E_t(\Delta p_{t+1})\big)$ is real interest rate. The equation (1) shows that the demand for domestic

output positively correlated with the real exchange rate whereas there is a negative association between domestic output and real interest rate. ε^{is} is a IS structural shock, such as fiscal policy, term of trade shocks.

Domestic money-market equilibrium (LM curve)

$$m_t^d = p_t + \varphi_3 y_t - \varphi_4 r_t + \varphi_5 e_t + \varepsilon_t^{md} \tag{2}$$

$$m_t^s = \varepsilon_t^{ms} \tag{3}$$

$$m_t^d = m_t^s \tag{4}$$

The equation (2), (3), (4) represent equilibrium in domestic money market and ε_t^{md} and ε_t^{ms} are money demand shocks and money supply shocks, respectively. Equation (4) is LM curve. The equation indicates that money demand is affected by many factors, such as price level, opportunity cost of holding money (interest rate) and exchange rate. These associations were indicated in the study of Mundell (1993). There are many previous studies conducting research about relationship between exchange rate and money demand in open economies. The substitution of domestic assets for foreign asset occurs when there is depreciation of domestic currency. The value of domestic asset will decrease while the price of foreign assets in domestic currency will increase. Thus, it causes domestic money demand to increase.

Price adjustment equation

$$p_t = \varphi_6[y_t - (y^N + \varepsilon_t^{ds})] \tag{5}$$

Where y^N is the full-employment level of output (natural output); ε_t^{ds} is domestic supply shocks. The equation (5) represents that whenever demand for domestic output deviates from natural output, price will adjust.

Output in response of term of trade shocks

Theoretically, we know that term of trade have positive impacts on trade balance. An increase in term of trade causes a country to earn more for its exports and pay less for its imports. In my model, I will consider that term of trade is captured by the price of intermediate inputs. Like the study of Hoffmaister at et (1997), the small open economy produce an exportable and a nontradable good in which the exportable good utilizes

domestic inputs, including capital (K) and labor (L) and an imported intermediate input (M). In order to examine the impacts of term of trade shocks on output, I will utilize the equation which was mentioned by Hoffmaister at et (1997), as follows

$$Y_t = \Phi + \left(\frac{1}{\mu}\right)a_{x_t} - \left(\frac{1-\mu}{\mu}\right)p_{m_t} + (1 - s_n / \lambda_n)\log K_t + (\alpha - s_n / \lambda_n)\log l_x \qquad (6)$$

Equation (6) represents the longt-run output in which a_{x_t} and are exogenous shocks. Bruno and Sachs (1985) or Hoffmasiter at et (1997) argued that an increase in the price of intermediate inputs have the same impacts of negative technological progress. Hoffmaister et al (1997) indicated that "An improvement in the term of trade and/or a structural reform that removes distortions leads to a positive response in total GDP." (p.10). Kose (2002) also investigated this relationship and show the similar results. Hence, I predict that there is a positive impact of term of trade shocks on output for small open economy model of Vietnam.

The long-run equilibrium

The studies of Clarida and Gali (1994) and Prasad (1998) or recently applied research of To Trung Thanh (2007) about the long-run equilibrium consist a lot of important implications which help this study identify the impacts of shock over macroeconomic variables. The set of equation representing the long-run equilibrium is below

$$y_t^e = y_t^s \qquad (7)$$

$$q_t^e = \frac{y_t^s - d_t}{\eta} + \frac{1}{\eta(\eta + \delta)}\sigma\gamma\delta_t \qquad (8)$$

$$tb_t^e = y_t^s\left(\frac{\xi}{\eta} - \beta\right) + \frac{\xi}{\eta}\left[-d_t + \frac{1}{(\eta + \sigma)}\sigma\gamma\delta_t\right] \qquad (9)$$

$$p_t^e = m_t - y_t^s + \left[\frac{1}{(1 + \lambda)(\eta + \sigma)}\right]\lambda\gamma\delta_t \qquad (10)$$

Where $y_t^e, q_t^e, tb_t^e, and\ p_t^e$ denotes real output, real exchange rate, domestic trade balance and relative price level. These studies and above equations indicate many important implications in the long-run: (i) the IS, LM shocks do not have any impacts on real output;

(ii) LM shocks (nominal shocks) do not affect the trade balance and real exchange rate; and

(iii) price level is affected by all kinds of shocks.

Empirical Methodology

In this study, we apply and develop some restrictions for small open-economy with flexibility of price which was utilized in the study of Ahmed and Park (1994) besides employing the aforementioned theoretical framework. Additionally, we also impose other restrictions in order to analyze the impacts of other external shocks as well as internal shocks on macroeconomic stability which are more suitable for Vietnam economy.

External factors

In this study, we will investigate the main source of macroeconomic fluctuations in Vietnam under 5 shocks: ε^{tot} is the external shocks for term of trade, ε^{f} is the external shocks for foreign output, ε^{ds} is the domestic supply shocks, ε^{IS} and ε^{LM} are the IS and LM shocks, respectively. Importantly, we assume that Vietnam is small open economy with long-run flexibility of price, thus the foreign output and term of trade are exogenously given. The equation of term of trade and foreign output can be expressed

$$\Delta TOT_t = C_{11}(L)\varepsilon_t^{tot} \tag{11}$$

$$\Delta y_t^f = C_{21}(L)\varepsilon_t^{tot} + C_{22}(L)\varepsilon_t^f \tag{12}$$

Where $C_{11}(L), C_{21}(L), C_{22}(L)$ are a finite-order polynomial in the lag operator and $\varepsilon_t^{tot}, \varepsilon_t^f$ are a white noise. Because Vietnam is small economy, the world output and term of trade are not affected by the domestic shocks, but by external shocks. The external shocks can be interpreted as a global technological improvement, a change in the world interest rate or the world price of oil.

Domestic output

The behavior of domestic output is described as follows

$$\Delta y_t^d = C_{31}\varepsilon_t^{tot} + C_{32}\varepsilon_t^f + C_{33}\varepsilon_t^{ds} + C_{34}\varepsilon_t^{IS} + C_{35}\varepsilon_t^{LM} \tag{13}$$

Where $C_{31}(L), C_{32}(L), C_{33}(L), C_{34}(L), C_{35}(L)$ are a finite-order polynomial in the lag operator and the processes $\varepsilon_t^{tot}, \varepsilon_t^f, \varepsilon^{ds}, \varepsilon^{IS}$ and ε^{LM} are a white noise. Looking at the

equation (13), we can see that the term of trade and external supply shocks directly affect the domestic output. The term of trade shocks are captured by the price of intermediate inputs. An increase in this price has the same impacts as negative technological process. Kose (2002) examined the correlation between term of trade and total output by using the small open economy model and the result indicated that there is a positive correlation between them. So, we need to carefully determine the sign of C_{31} .The positive domestic supply shocks probably raise the domestic output in direct and indirect ways due to the substitution effects on the labor input. We might predict that the effect of domestic supply shocks on domestic output is more likely to be positive and persist over time.

Theoretically, IS shocks represent exogenous shift in fiscal policy and LM shocks indicates changes in domestic money supply and domestic money demand (which originate from foreign countries). I will impose restrictions which reflect the long-run neutrality of money. It implies that IS and LM shocks are expected to have short-run positive effects on domestic output but not in long-run. This assumption is consistent with Mundell-Fleming open-economy model with long-run flexibility of price and theory of real business cycles which I mentioned above.

Balance of Trade

The following equation reflects behavior of trade balance

$$TB_t = C_{41}\,\varepsilon_t^{tot} + C_{42}\,\varepsilon_t^{f} + C_{43}\,\varepsilon_t^{ds} + C_{44}\,\varepsilon_t^{IS} \qquad (14)$$

According to Stockman (1985) and Ahmed and Park (1994), there is not clear presumption about the direction of nominal shocks (LM shocks) on trade pattern, thus we impose the restriction C_{45} =0 for my empirical study. The term of trade shock directly affect the trade balance through export and import but the sign might be ambiguous. The external shocks for foreign output and the domestic supply shocks is likely to be temporary but are expected have positive impacts on trade balance in short-run.

The long-run response of the real exchange rate (RER) in response to the different shocks is represented by following equation

$$RER_t = C_{41}\,(L)\varepsilon_t^{tot} + C_{42}\,(L)\varepsilon_t^{f} + C_{43}\,(L)\varepsilon_t^{ds} + C_{44}\,(L)\varepsilon_t^{IS} \qquad (15)$$

Hoffmaister and Roldos (1996) argued that positive supply shocks result in the appreciation of real exchange shock because of a higher demand for non-tradables which leads to a reallocation of labor in non-traded sectors. This supply shocks might be a technological progress in the tradable sector or trade liberalization. The IS shocks is expected to leads to the appreciation of real exchange rate through the mechanism of Mudell-Flemming model for a small opened economy. Furthermore, we also impose a restriction that nominal shocks have no impact on the changes of real trade balance.

Price Level

The inflation is a function of all the five shocks discussed above

$$\Delta P_t = C_{51}\,\varepsilon_t^{tot} + C_{52}\,\varepsilon_t^{f} + C_{53}\,\varepsilon_t^{ds} + C_{54}\,\varepsilon_t^{IS} + C_{55}\,\varepsilon_t^{LM} \tag{16}$$

We expect that the aggregate supply shocks and term of trade shocks cause price level to fall whereas the price level increase in response to aggregate demand shocks. Thus, the sign of C_{51}, C_{52}, C_{53} is negative and those of C_{54}, C_{55} is positive.

3.2.3. SVAR model

In this section, we will discuss about the empirical methodology. The reduced form of VAR model is expressed as following

$$Y_t = A_0 + \sum_{i=1}^{k} A(i)Y_{t-1} + e_t = A_0 + A_L Y_{t-1} + e_t \tag{17}$$

We assume that Y_t=[tot, y^f, y^d,tb, p] is a covariance stationary process. In the study, A_0 is a (5x1) vector of constant. e_t is (5x1) vector of serially uncorrelated structural disturbances and there exists a (5x5) non-singular matrix $c(0)$ such that $e_t = c(0)\varepsilon_t$ implying that the reduced form residuals are a linear transformation of the structural shocks, where (ε^{tot}, ε^f, ε^{ds}, ε^{IS}, ε^{LM}). ε^{tot} is the external shocks for term of trade, the vector of ε^f is the external shocks for foreign output shocks; ε^{es} is the internal domestic supply shocks; ε^{IS} and ε^{LM} are the vector of the internal IS shocks and domestic LM shocks or nominal shocks, respectively.. A_L is a (5x5) matrix of lag polymonials.

The reduced-form VAR can be written as the moving average expression (VMA (∞)), mentioned in the study of Sims's (1980) which trace out the time path of various shocks:

$$Y_t = (I - A_L L)^{-1} A_0 + (I - A_L L)^{-1} e_t = \mu + B_L e_t$$

$$= \mu + \sum_{i=0}^{t} b(i) \, e_{t-i} \tag{18}$$

where $\mu = (I\text{-}A_L L)^{-1} A_0$, $B_L = (I\text{-}A_L L)^{-1}$ is the (5x5) matrix of lag polynomials where

$B_{L.mn} = \sum_{i=0}^{\infty} b_{mn}(i) L^i$. $b(i)$ is a (5x5) matrix of coefficients for i = 0, 1, 2, …, k and $b(0) = I$.

There exists a (5x5) non-singular matrix $c(0)$ such that $e_t = c(0)\varepsilon_t$ where (ε^{tot}, ε^f, ε^{ds}, ε^{IS}, ε^{LM}).Then (5) can be rearranged as follows:

$$Y_t = \mu + \sum_{i=0}^{\infty} b(i) c(0) \varepsilon_{t-i} = \mu + \sum_{i=0}^{\infty} c(i) \varepsilon_{t-i} \tag{19}$$

The residual in the reduced-form VAR are represented by the structural shocks in model, including external shocks (term of trade shocks, foreign output shocks), domestic supply shocks and domestic demand shocks.

Y can be expressed into internal and external variables and also in structural demand and supply shocks, as follows

$$Y_t = \begin{bmatrix} Y_{1t} \\ ... \\ Y_{2t} \end{bmatrix} = \begin{bmatrix} \Delta TOT_t \\ \Delta Y_t^f \\ \Delta Y_t^d \\ \Delta TB_t \\ \Delta P_t \end{bmatrix}, \varepsilon_t = \begin{bmatrix} \varepsilon_{1t} \\ ... \\ \varepsilon_{5t} \end{bmatrix} = \begin{bmatrix} \varepsilon^{tot} \\ \varepsilon^f \\ \varepsilon^{es} \\ \varepsilon^{IS} \\ \varepsilon^{LM} \end{bmatrix}$$

$$c(i) = b(i)c(0)$$

Equation (18) is the SVAR model in moving average expression, in which Y_t is expressed by a function of history of innovations. The structural innovations are in the central role in the SVAR approach as they are the driving forces behind the stochastic

dynamics of the system's variables. The elements of matrix *c(i)* are impulse response functions.

3.2.4. Identification of SVAR and specification of model

From my business cycle analysis, we utilize some main restrictions. First, the external factor, such as term of trade are foreign output are exogenously given to the domestic country in the long run (the assumption for small open economy). Second, the restriction is imposed to make sure that the long-run neutrality of money is held. Finally, LM shocks (nominal shocks) have no impacts on trade balance.

Additionally, we will utilize the long-run restrictions approach. Thanh (2007) discussed some main reasons for using this approach. He indicated that model relied on implications of economic theories should impose long-run restrictions. Moreover, he argued that "this approach does not restrict the short-run relationship among the variables in the system and the dynamics of the system are less constrained and determined by the data" (p.19). So, in the study, we also employ the long-run restriction approach.

Third, one of the most important purposes of this study is to examine not only the domestic shocks but also the external disturbances. Hence, based on the ideas of Mudell-Fleming model, we clearly separate types of shocks to identity the main sources of business cycles. Moreover, we also construct a block-exogeneity assumption which reflects the features of a small and open economy. This approach is quite similar to long-run restrictions of Blanchard and Quah (1989) and Thanh (2007). The long-run impact matrix can be expressed in the formula: $Y_t = \mu + C\varepsilon_t$ and the long-run multipliers are $C_{ik} = \sum_{j=0}^{\infty} c_{ik}(j)$. And we have

$$
\begin{bmatrix} \Delta TOT_t \\ \Delta Y_t^f \\ \Delta Y_t^d \\ \Delta TB_t \\ \Delta P_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \\ \mu_5 \end{bmatrix} + \begin{bmatrix} C_{11} & 0 & 0 & 0 & 0 \\ C_{21} & C_{22} & 0 & 0 & 0 \\ C_{31} & C_{32} & C_{33} & 0 & 0 \\ C_{41} & C_{42} & C_{43} & C_{44} & 0 \\ C_{51} & C_{52} & C_{53} & C_{54} & C_{55} \end{bmatrix} x \begin{bmatrix} \varepsilon^{tot} \\ \varepsilon^f \\ \varepsilon^{es} \\ \varepsilon^{IS} \\ \varepsilon^{LM} \end{bmatrix}
$$

Looking at the model (18), we can express as follows

$$Y_t = \mu + B_L c(0)\varepsilon_t \qquad (20)$$

From this equation, we can identify the matrix c(0) based on above long-run restrictions. The matrix c(0) consists 10 equations

$$b_{11}c_{12} + b_{12}c_{22} + b_{13}c_{32} + b_{14}c_{42} + b_{15}c_{52} = 0$$

$$b_{11}c_{13} + b_{12}c_{23} + b_{13}c_{33} + b_{14}c_{43} + b_{15}c_{53} = 0$$

$$b_{11}c_{14} + b_{12}c_{24} + b_{13}c_{34} + b_{14}c_{44} + b_{15}c_{54} = 0$$

$$b_{11}c_{15} + b_{12}c_{25} + b_{13}c_{35} + b_{14}c_{45} + b_{15}c_{55} = 0$$

$$b_{11}c_{12} + b_{12}c_{22} + b_{13}c_{32} + b_{14}c_{42} + b_{15}c_{52} = 0$$

$$b_{21}c_{13} + b_{22}c_{23} + b_{23}c_{33} + b_{24}c_{43} + b_{25}c_{53} = 0$$

$$b_{21}c_{14} + b_{22}c_{24} + b_{23}c_{34} + b_{24}c_{44} + b_{25}c_{54} = 0$$

$$b_{21}c_{15} + b_{22}c_{25} + b_{23}c_{35} + b_{24}c_{45} + b_{25}c_{55} = 0$$

$$b_{31}c_{14} + b_{32}c_{24} + b_{33}c_{34} + b_{34}c_{44} + b_{35}c_{54} = 0$$

$$b_{31}c_{15} + b_{32}c_{25} + b_{33}c_{35} + b_{34}c_{45} + b_{35}c_{55} = 0$$

$$b_{41}c_{15} + b_{42}c_{25} + b_{43}c_{35} + b_{44}c_{45} + b_{45}c_{55} = 0$$

3.2.5. Impulse Response Function (IRF)

A vector autoregression can be written as a vector moving average (VMA). In fact, equation (12) is the VMA representation of original equation (11), in which the variables are expressed in term of current and past of the shocks. The VMA representation is an essential feature, suggested by Sims (1980) allow us to trace out the impacts of the various shocks on the variables in VAR model. We can get IRF for orthogonalized shocks when the disturbances are uncorrelated through the expression $c(i) = b(i)c(0)$. The elements of matrix $c(i)$ are impulse response functions.

3.2.6. Variance Decomposition

The study aims to analyze which structural shocks have significant impacts on fluctuations of business cycle. In order to obtain it, we need to rely on variance decomposition which will be captured after running SVAR model. We can compute the error by utilizing the equation: $Y_t = \mu + \sum_{i=0}^{\infty} b(i)c(0)\varepsilon_{t-i} = \mu + \sum_{i=0}^{\infty} c(i)\varepsilon_{t-i}$. So, $\mu = Y_t - \sum_{i=0}^{\infty} c(i)\varepsilon_{t-i}$. We also predict the error in the s period ahead of the i variables which is given by

$$Y_{i,t+s} - E_t(Y_{i,t+s} = \sum_{j=0}^{s-1} c_{i1}(j)\varepsilon_{1t+s-j} + \sum_{j=0}^{s-1} c_{i1i2}(j)\varepsilon_{2t+s-j} + \dots$$

According to the orthogonality assumption, we have $E(\varepsilon_t, \varepsilon'_t) = I$, thus forecast error variance of the i variable can be expressed:

$$\delta_i^2(s) = \sum_{j=0}^{s-1} c_{i1}(j)^2 + \sum_{j=0}^{s-1} c_{i2}(j)^2 + \sum_{j=0}^{s-1} c_{i3}(j)^2 + \sum_{j=0}^{s-1} c_{i4}(j)^2 \sum_{j=0}^{s-1} c_{i5}(j)^2$$

So, the s-period forecast error variance of i variable accounted by the shock is

$$\varphi_{ik}(s) = \frac{\sum_{j=0}^{s-1} cik(j)^2}{\delta_i^2(s)}$$

4. Findings of Business Cycles Features

In this section, we show findings as well as explanations regarding the business cycle features of Vietnam. we firstly investigate the properties of macroeconomic series such as output, trade balance, real exchange rate (RER) and inflation through the examination of the amplitude and co-movement and then we present the actual facts corresponding to these properties. In order to analyze changes in business cycle features, the data collected from 1996 to 2012 will be separated into two periods: before and after the financial economic crisis in 2008. There are several reasons to explain why I do that. First, after experiencing a long period of growth and sustainable development, Vietnam has witnessed the serious macroeconomic instabilities which tend to drive Vietnamese economy down overtime. The growth rate of Vietnam declined from 8.2% in the period 2004-2007 to nearly 6% in 2008-2011 period and only 5.3% in 2012. An inflation rocketed up dramatically, especially after the financial economic in 2008 (over 23%) and in 2011 (18.13%). The budget deficit and budget debt reached the dangerous rate. The public debt which accounted for roughly 40% in many years increase sharply to 54.9% in 2011 and 55.4% in 2012 and Vietnam's budget deficit made up for 1.3% of GDP in 2003-2007 and almost double to 2.7% in 2008-2012 (Ministry of Finance, 2013). Second, Vietnam was significantly affected by external factors when Vietnam participated in WTO in 2007. For the purposes of analyzing the impacts, we need to separate the time series into before and after participation in WTO. This chapter will cover all the business cycle features of Vietnam.

4.1. Properties of Output Fluctuations

The table 4.1 indicates the volatility and persistence of output fluctuations. In Vietnam, the volatility and persistence of output increases substantially in the second period. We can see that the volatility of output fluctuations is greater than those in all period. The persistence, however, mostly focuses on the period 1997-2007. Conversely, almost output variations in the Philippines and Indonesia concentrate on the first period when the Asian Financial Crisis (AFC) 1997 occurred. The reason to explain for this is that these two countries opened up financially by the early 1990s, thus they experienced

negative growth during the AFC in 1997 due to macro shocks, such as speculative attacks and liquidity problems, the balance-sheet vulnerability caused by the weakness of their banks, reaching the bad debt because of borrowing in the short term but lent to long-term project and so on. When the Philippines and Indonesia faced with the global financial crisis in 2008, they have weathered global economic and financial downturns better than its regional peers due to lower dependence to exports, minimal exposure to troubled international securities and others. How can we explain these increases in amplitude of economic fluctuation in Vietnam?

Table 4.1

Properties of Output Fluctuations (HP)

	Volatility			Persistence		
	1996-2007	**2008-2012**	**1996-2012**	**1996-2007**	**2008-2012**	**1996-2012**
Vietnam	0.126	0.157	0.135	-0.666	-0.472	-0.619
Indonesia	0.037	0.015	0.032	0.520	-0.072	0.481
Philippines	0.081	0.047	0.072	0.350	-0.690	0.211

Note. The data are collected from IFS (2014) which are real GDP and detrended using the HP-filter with the smoothing parameter set at 1600. Volatility is measured by the standard deviation and persistence is measured by the first order autocorrelation coefficient of the filtered series.

First, after the introduction of the "Doi Moi" reform policies, the average growth rate was not high (4.4%) but in the subsequent years (1991-1995), this figure improved significantly to 8.2%. The government launched policies which opened the economy to create opportunities for economic development. More specifically, Vietnam witnessed a surge in capital from Foreign Direct Investment (FDI), trade reforms, reduce taxes to create competitiveness. But during 1996-2000 period, Vietnam experienced decreases due to impacts of the Asian financial crisis in 1997. The export growth and foreign direct investment which were key factors of economic development decreased and the growth rate in this period halted to only 4.8%. However, Vietnam quickly recovered after the financial crisis in 2007. In period 2000-2007, Vietnam witnessed a long-period of steady growth (7.63%). In this stage, the government proposed a lot of fiscal and monetary policies to promote the economy (the government expenditure increased from 22.6% to 28.1%, the money supply by slightly larger than 2 times).

In the second period, Vietnam became an official member of WTO which gave Vietnam opportunities as well as the risks in the future relating to the low level of national competitiveness and enterprise competitiveness. The second period was considered as an end to the period of high growth with clear signs of volatility. Vietnam underwent periods of macroeconomic instabilities: the first one occurred in late 2009, the second one occurred in mid-2008 and the third one occurred in late 2010 and 2011. Although the scale of these instabilities was different, they finally brought serious consequences for Vietnamese economy. Furthermore, Vietnam also suffered a shock of gold price which caused people to withdraw money from the banking system, putting pressures on exchange rate. In 2008, Vietnam adjusted 5 times the amplitude of exchange rate which never happened before. The exchange rate of dong per US Dollar enlarged significantly from approximately 16,000 in 2007 to nearly 21,000 in 2012. Moreover, the government indicated that Vietnam was overstating the economic growth objectives and led to a range of adverse impacts on economy. As a result, the government determined that in the current period of time, the economic growth target was not a top priority and policies set out in pursuit of other goals. Because of these reasons, in the period 2008-2012, we witnessed an increase in volatility and persistence of growth rate after a long period of stable development.
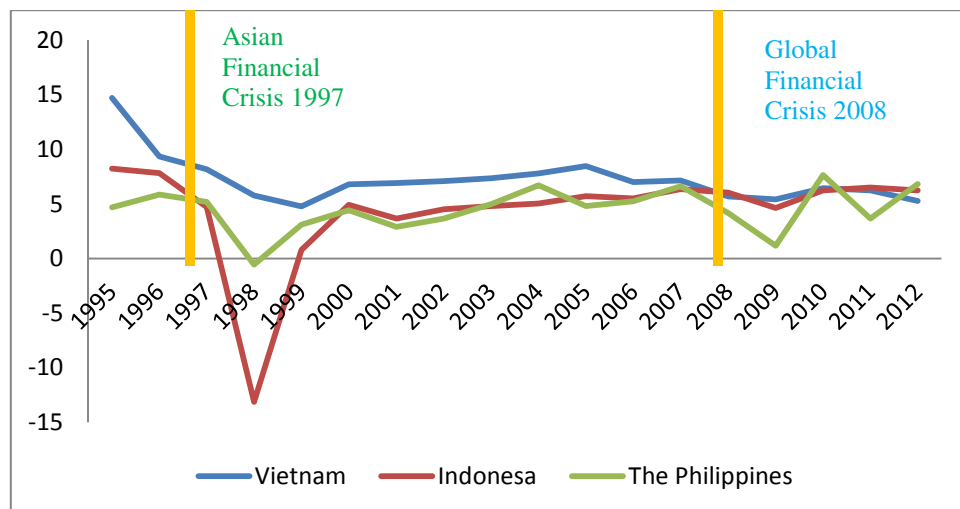

Figure 4.1: GDP growth over crisis in 1997 and 2008

Note. Data taken from International Financial Statistics (IFS)

The figure 4.1 indicates that Vietnam's GDP growth has been relatively stable during the AFC, compared to Indonesia and the Philippines. In 2007, Vietnam became the official member of WTO, Vietnam experienced the difficult year of the global economic downturn from 2005 to 2010.

Second, based on the analytical framework of growth, it is quite clear that the development of Vietnam's economy mainly relied on continuous increase in inputs, especially in industry area. However, the effectiveness of using resources is still low and slowly improved which lead to the inefficiency of economy. The figure 4.2 shows the structure of output at current market price. We can see that the share of agricultural activity decrease and the shares of industry and service sector increase overtime.
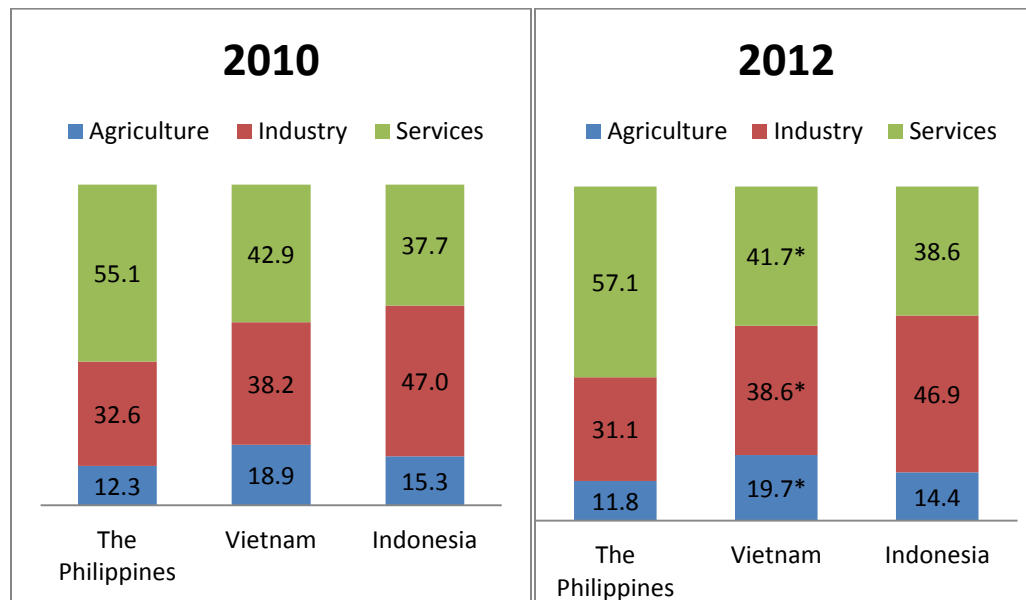
Figure 4.2: Structure of output at current market price, (%)

Note. Data taken from Asian Development Bank (2013)

Vietnam's growth has been broad-based which growth led by balance between industry and service. Industry and service account for over 40% of GDP, with remaining approximately 20% from agriculture. Agriculture expanded at the modest rate which two counterparts has grown at annual rate of 8% during the 5-year period. In the Philippines, the growth of output is mainly driven by services, whereas manufacturing and industry are dominant sector in Indonesia. However, the growth in Indonesia and Philippines are mainly

contributed by Total Factor Productivity (an increase from 12% and 10% in period 1990-2000 to 38% and nearly 50% in period 2000-2008 (Vietnam Competitiveness Report, 2010). This partly limited the impacts of the global financial crisis on fluctuations of economy of these countries.

The growth relied on inputs and an increase in the share of economic activities partly causes industry to become highly variable. The industry sector output will be affected by the volatile productivity and price shocks and then the higher share of industry lead to the greater amplitude of output fluctuations. We also know that agriculture sector output is highly variable and depend on the price shocks. However, the financial crisis 2008 leads to enormous changes in price of inputs and outputs, the impacts from industry sector outweighs the potential decrease in the volatilities caused by agriculture sector when the share of agriculture decrease overtime.

Third, the set of financial instruments, which are utilized to limit the impacts of shocks and provide a variety of risk-sharing opportunities still lack and do not develop. This implies a lack of preparations when Vietnam integrated into the global economy.

4.2. Properties of Inflation

The table 4.2 examines the volatility, persistence and comovement properties of price level-fluctuations. We can see that the volatility of price level is relatively smaller than those of output whereas the persistence of price is greater than output. The standard deviation of CPI slightly increases from period 1996-2007 to period 2008-2012 while there is a reduction in the first order autocorrelation coefficient. It presents that during 1996-2012 period, the fluctuations of CPI depend on previous period. This persistence, however decrease after economic crisis and the fluctuation of price level can be explained by other external factors. The price in the Philippines and Indonesia behave similarly the same as output which the volatility increases slightly in the second period.

In my own perspective, the movement of price level is consistent to the actual facts. In the first period, the volatility of price level was more stable. Experiencing deflation in 2000 and 2001, there was a reversed trend from 2002. This figure rose from -1.6% in 2000 to 8.3% in 2007. The main reasons to explain for this increase were that there were

expansion of monetary policies and fiscal policies in the period 2001-2007 to promote the economic growth. The continuous increase in money supply, especially in 2006 caused inflation to increase. Moreover, a rise in demand for food around the world made export enlarge but because of the natural disasters, supply shocks could not be met and led to the increase in price level. The rise in price of input, oil could be included. More importantly, Vietnam participated in WTO in 2007, which integrated in global economy, thus there is a huge amount of inflowing capital that forced state bank to supply money to stabilize exchange rate system and then the price level increased.

Table 4.2

Properties of Price Level Fluctuations (CPI)

	1996-2007			2008-2012			1996-2012		
	VN	Indo	Phi	VN	Indo	Phi	VN	Indo	Phi
Volatility (HP)	0.023	0.078	0.017	0.035	0.014	0.010	0.028	0.065	0.015
Persistence (HP)	0.830	0.848	0.854	0.747	0.721	0.577	0.801	0.846	0.832
Comovement	-0.228	-0.537	0.494	-0.038	0.145	-0.068	-0.152	-0.509	0.414

Note. The data are collected from IFS (2014) which are detrended using the HP-filter with the smoothing parameter set at 1600. Volatility is measured by the standard deviation and persistence is measured by the first order autocorrelation coefficient of the filtered series. Comovement with output is measured by the correlation between the filtered series and filtered output. The statistic of persistence and comovement for the period 1996-2012 is significant at the 5% level if it lies outside of (-0.24, 0.24).

The second period was considered as the most volatile period of inflation. The cycle of inflation repeated every 3 years (in 2007-2009 period, the CPI were 12.6%, 19.9% and 6.5%; in 2010-2012 period, the CPI were 11.8%, 18.13% and 6.81%, respectively). The financial crisis in 2008 led to economic recession as countries reduced investment, consumptions. In 2009, the price level remained stable but there were large differences in the price index at the beginning and the end of the next years. There were some underlying causes, such as an increase in salary, fuel prices, input costs, excessive credit growth from 2007 to 2009 (money supply increased to 135%) and others.

Let us consider the correlation between the CPI and output. There is a counter-cycle in Vietnam and Indonesia and these coefficients are significant at 5% level (only in first period for Vietnam), whereas the Philippines appear the pro-cycle relationship and the

coefficients of correlation are also significant at the 5% level. The result in Vietnam is consistent with the result in previous research in developing countries, for instant Agenor (2000), Kim at el (2003).

Table 4.3

Cross Correlation between Output and CPI

	4-quarter lag	**8-quarter lag**	**Zero-lag**	**4-quarter lead**	**8-quarter lead**
1996-2007	-0.167	-0.124	-0.227	-0.228	-0.166
2007-2012	-0.074	-0.078	-0.038	-0.046	0.124
1996-2012	-0.061	-0.083	-0.152	-0.162	-0.082

Note. Data taken from IFS and author's calculations

In order to evaluate the phase shift of the CPI relative to the cycle in output, I utilize the cross-correlation coefficients with different lags and leads. We easily find that the cross-correlation between the CPI and output at the 4-quarter lead is the largest. It indicates that the volatilities of the inflation in the current period will suddenly lead to the fluctuations of output in the short-run. The dynamics of business cycle can be directly and contemporaneously explained by the price level. The analysis is so important for policy maker, economic researchers to effectively intervene and limit business cycle issues.

Trade-off between growth and inflation

During period 2008-2012, we witnessed the rise of money supply under the circumstance of unclear targets. The concentration of available resources on economic growth or the stabilization of inflation has been controversial, especially in period 2008-2012. The trade-off between the economic growth and inflation can be explained by a relationship between aggregate demand (AD) and aggregate supply (AS). If the government intervene the market by fiscal and monetary policies which cause AD curve to shift, the price and level of output will be affected. What's more, changes of inflation depend on the slope of AS curve. As we mentioned earlier, Vietnam utilize the investment-based growth model to achieve growth targets. However, in order to gain one extra unit of output, Vietnam must consume more available resources because of ineffective and improper utilization. Hence, output increase at the extent of a skyrocket of inflation.
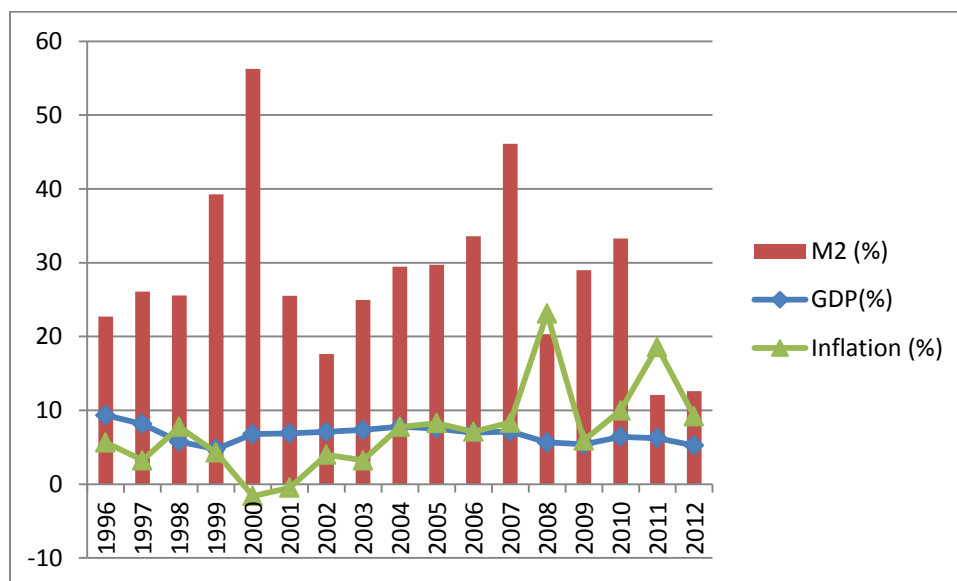
Figure 4.3: Money supply, growth and inflation, 1996-2012 (percent)

Note. Data taken from Asian Development Bank (2013)

Vietnam experienced a last-long period of stable growth (7.3%) with relatively low level of inflation (4.4%) in period 1996-2006. Although money supply increased significantly in this period (approximately 31%), the inflation was still low because of a high money demand. The next period experienced the fluctuations of inflation as well as growth rate.
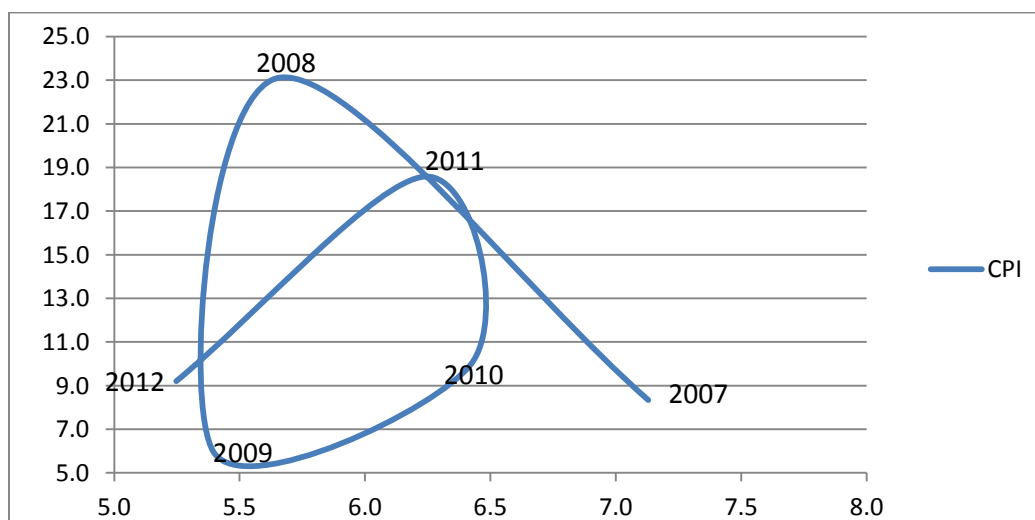

Figure 4.4: The CPI and real GDP in 2006-2012 (percent)

Note. Data taken from Asian Development Bank (2013)

The macroeconomic instabilities starting from 2006 could be explained by both external and internal factors. The external factor was a huge of foreign capital (nearly 25%) inflowing in Vietnam in 2007 and first quarter in 2008 which led to the climbing inflation. The government attempted to limit impacts of financial crisis by cutting off credit and money supply which caused the growth rate to decrease in the late 2008. In 2010, the impacts of financial crisis became weakened but the government slowly proposed policies to simulate consumption and investment. As a result, in 2011 the inflation climbed to 2-digit. Clearly, uncontrolled external factors as well as internal factors, especially the failures in conducting macroeconomic policies mainly contributed to macroeconomic instabilities in the recent period.

4.3. Properties of Trade Balance

Table 4.4 displays the standard deviation and the first order of autocorrelation of trade balance. This table indicates that all trade components are more volatile and persistent in period 2008-2012 than period 1996-2007 and all period. Regarding the first order of autocorrelation of net export, this figure in period 1996-2012 is seemly larger than period 1998-2012. What are the true facts behind these figures?

Table 4.4

Properties of Trade Component

	1996-2007			2008-2012			1996-2012		
	VN	Indo	Phi	VN	Indo	Phi	VN	Indo	Phi
Volatility (HP)	0.043	0.033	2.485	0.111	0.013	0.825	0.069	0.029	2.127
Persistence (HP)	0.321	0.486	0.085	0.270	0.530	0.201	0.345	0.489	0.090
Comovement	-0.232	-0.418	0.345	0.085	-0.296	0.167	-0.046	-0.410	0.328

Note. The data are collected from IFS (2014) which are and detrended using the HP-filter with the smoothing parameter set at 1600. Net exports are detrended series of exports minus detrended series of import. Relative volatility is measured by the ratio of the standard deviation of the filtered series to that of filtered output. Comovement with output is measured by the correlation between the filtered series and filtered output. The statistic of persistence and comovement for the period 1996-2012 is significant at the 5% level if it lies outside of (-0.24, 0.24)

There are several plausible reasons for the increase in the cyclical fluctuations in exports and imports. Vietnam becomes more vulnerable to external shocks when Vietnam became the official member of WTO. Trade liberalization and domestic market openness cause export and import to increase but Vietnam also became more sensitive to the change of global economy. The data for exports and imports dramatically rocket up, especially in

2007 and 2008 and then weakened sharply in 2009 amid global turmoil before continuing rising in 2011.
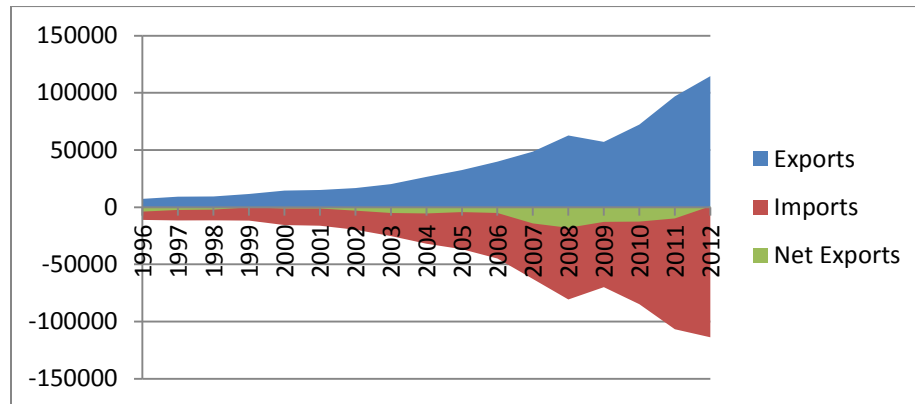
Figure 4.5: Exports, Imports and Trade Balance in 1996-2012, (million US dollars)

Note. Data taken from Asian Development Bank (2013)

With the bright future after participating in WTO, Vietnam mostly concentrated on the goals of economic growth, industrialization and modernization of the country which increasingly raised the demand for modern machines and equipment. Moreover, Vietnam pursues investment-biased growth model which the growth bases on consuming inputs, such as capital, natural resources. In the period of crisis, Vietnam suffered the price shocks of oil, gold and other inputs which raised the value of imports. However, after that Vietnam economy was frozen and both production and consumption decreased. We also witnessed the fluctuations of trade balance in this period when the chase between exports and imports occur. These reasons partly make exports, imports more fluctuating in period 2008-2012.

Importantly, the challenges now facing Vietnam is that the largest and fastest growing export segments have been relatively low-valued added manufactured products and labor-intensive products such as textile, footwear and so on. The below figure indicates that Vietnam is more likely to concentrate on the lower end value of the value-added than China and other ASEAN countries. There are opposite trends in Vietnam. While the agriculture products for instance rice, coffee… have expanded dramatically, high-valued-added exports improved slightly and Vietnam continually imported a huge amount of oil from foreign countries. Vietnam has also started to gain increasing share in machinery and

equipment but these shares is still modest, only 13% compared to 43% of China and nearly 34% of ASEAN economy.

Note. Machinery includes electric equipment, electronic products and general machinery and equipment. Emerging countries include Indonesia, Malaysia, the Philippines and Thailand

Figure 4.6: Vietnam's exports are concentrated in low-value-added products compared with ASEAN countries (%; billion)

Note. Global Insight 2011; McKinsey Global Institute analysis

Importantly, the challenges now facing Vietnam is that the largest and fastest growing export segments have been relatively low-valued added manufactured products and labor-intensive products such as textile, footwear and so on. The below figure indicates that Vietnam is more likely to concentrate on the lower end value of the value-added than China and other ASEAN countries. There are opposite trends in Vietnam. While the agriculture products for instance rice, coffee… have expanded dramatically, high-valued-added exports improved slightly and Vietnam continually imported a huge amount of oil from foreign countries. Vietnam has also started to gain increasing share in machinery and equipment but these shares is still modest, only 13% compared to 43% of China and nearly 34% of ASEAN economy.

Additionally, we also study comovement properties of trade components. The previous research, for instance Agenor (200), Fiorito and Kollintzas (1994), Prasad and Gable (1998) indicated counter-cyclical features between trade balance and output. In this

study, I also find out the same result with previous research in Vietnam, Indonesia but not in Philippines. Specifically, the correlation between trade balance and output is statistically and negatively significant in the first period whereas after the crisis in 2008, there is not a clear relation between them in Vietnam. The Philippines and Indonesia experience a small decrease in the coefficients.

4.4. Properties of Real Exchange Rates

The table 4.5 represents the volatility, persistence and co-movement of real exchange rate movements. We can see that the volatility and persistence property mostly focused on the second period. The standard deviation of RER increases substantially from 0.024 in the first period to 0.053 in the crisis period which is also higher than whole period. Similarly, there is a slight increase in the first order of autocorrelation which show a rise in persistence property in the crisis period. How can we explain for these characteristics of business cycles in Vietnam?

Table 4.5: Properties of Real Exchange Rate (RER)

	1996-2007			2008-2012			1996-2012		
	VN	Indo	Phi	VN	Indo	Phi	VN	Indo	Phi
Volatility (HP)	0.024	0.192	0.061	0.053	0.054	0.031	0.036	0.161	0.054
Persistence (HP)	0.718	0.664	0.710	0.814	0.804	0.288	0.796	0.668	0.705
Comovement	0.243	-0.356	0.254	0.074	0.002	0.164	0.074	-0.337	0.246

Note. The data are collected from IFS (2014) which are detrended using the HP-filter with the smoothing parameter set at 1600. Volatility is measured by the standard deviation and persistence is measured by the first order autocorrelation coefficient of the filtered series. Comovement with output is measured by the correlation between the filtered series and filtered output. The statistic of persistence and comovement for the period 1996-2012 is significant at the 5% level if it lies outside of (-0.24, 0.24).

The period 2008-2012 marked variations in policy responses in Vietnam. In 2007, a huge amount of foreign currency flew in domestic market which leads to an increase USD supply in Vietnam. It causes VND to appreciate in this year. Due to impacts of high inflation and the global financial crisis, the foreign currency started outflowing. The general trend in 2009 is the depreciation of nominal exchange rate. In the late 2009, the official exchange rate increased by 5.6% compared to the late 2008. The pressure on supply and demand in the market accompanying with the psychological pressures resulted in an

increasing differences between the exchange rate in free market and official exchange rate. Although the central bank was forced to expand the official exchange rate from +/- 3% to +/- 5%- the largest margin within 10 years, the commercial banks still traded at ceiling rate. The prolonged and increasing trade deficit led to a rise in money demands. Additionally, the large difference between the domestic price and the world price of gold led to increased demand for USD to import gold. The price of USD and gold soared together. The panic and distrust in VND led an increase in USD demand and a fall in USD supply which drove the exchange rate in free market up. The worries of devaluation of VND in the future exaggerate the depreciation of VND.
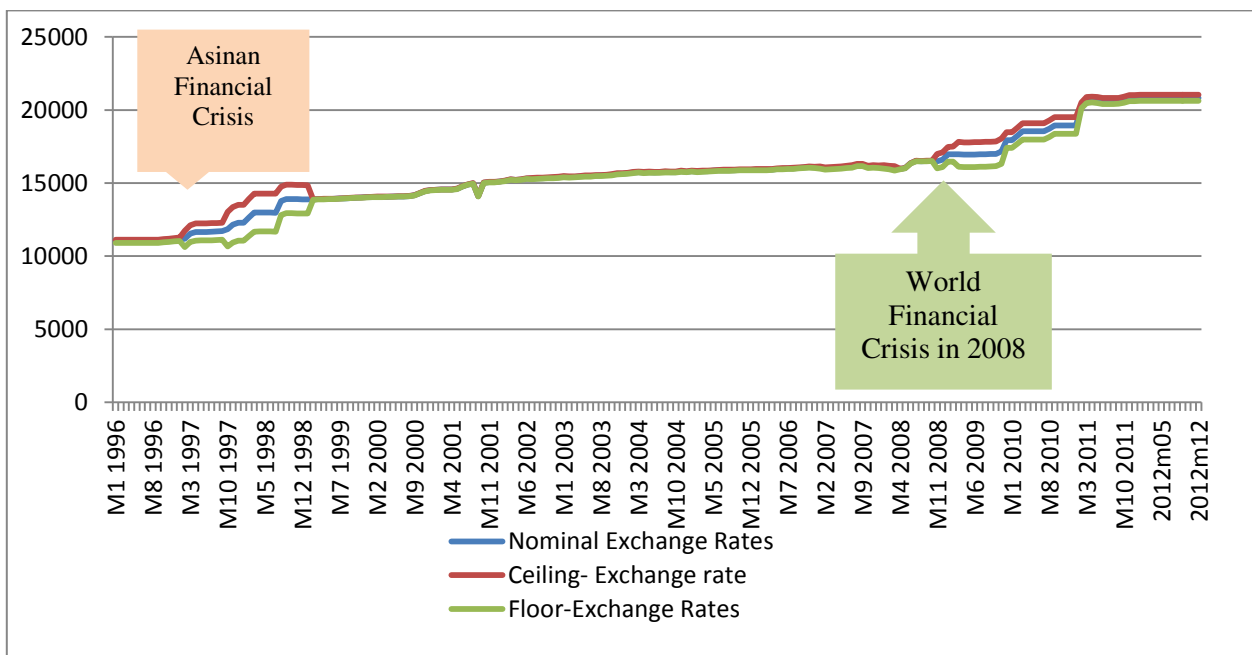
Figure 4.7: The nominal exchange rate VND/USD and its margin, (1996-2012)

Note. The State Bank of Vietnam and Author's calculations

On 26/11/2009, the central bank was forced to devalue the VND by 5.4%-the highest devaluation since 1998- to prevent currency speculation and reduce market pressure and narrowed the margin to +/- 3%. Along with the exchange rate policies, the central bank raised the interest rate from 7% to 8% at the same time. These policies were consistent but too late. The VND was continually depreciated to 19,400 VND/USD. The central bank showed the reluctance and inconsistency which made the depreciation of VND worse-off.

In 2010, Vietnam continually experienced the same trend in foreign exchange market as in 2009. The difference between the official and free-market exchange increased to the unprecedented high level at the end of 2010. Due to the increasing pressure despite the efforts of the central bank in late 2009, the central bank raised the official exchange rate from 17,941 VND/USD to 18,544 VND/USD (devaluation of VND by 3,3%). On 17/8/2010, the central bank raised the exchange rate by 2.1% to 18,932 VND/USD but because the increase in world price of gold- leading to gold speculation and the return of inflation in 9/2010 (from 11.75% in 2011 compared to 7% in 2009) resulted the instability of exchange rate. In 2/2011, Vietnam also witnessed the highest devaluation of VND (9.3%) and raised the official exchange rate to 20.693 VND/USD and reduced the margin to +/- 1%.
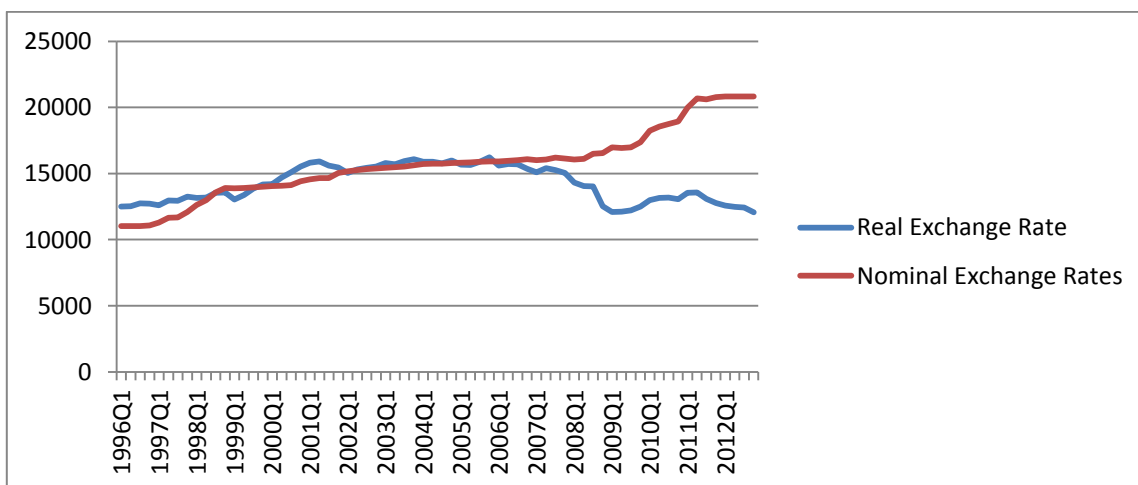
Figure 4.8: The nominal and real exchange rate in 1996-2012 period

Note. Data taken from IMF and Author's calculations

We can see that in the period 2008-2012, there are many fluctuations in exchange rate due to many factors. This partly explains the higher persistence and volatility of exchange rate in this period than in first period and whole period.

The figure 4.8 represents the general trends of nominal exchange rates and real exchange rates. The nominal exchanges have an increasing trend and it increases significantly in 2008 to the present time. By calculating, VND depreciated by approximately 0.4% per quarter in period 2000-2007 but increased by 1.8% per quarter in

the following period starting from the first quarter of 2008. However, the real exchange rates have a different trend. The real exchange rates increase slightly in the period and there is a substantial reduction in the second period. The gaps between 2 kinds of exchange rate gradually expand, especially in period 2008-2010. It can be explained by the fluctuations of CPI (nearly 120% if based year is 2000) in Vietnam which is greatly larger than CPI (or PPI used to compute real exchange rate in this study). Thus, the real exchange rate increased in this period. Even the central bank depreciated the VND by 9.3% in February 2011, the situation cannot be improved due to an increase to 13.29% of inflation in 12/2010.

Now we consider the correlation between the RER and output. Vietnam and the Philippines behave as pro-cycle whereas there exists counter-cyclical relationship in Indonesia but these coefficients are only significant at the level of 5% in the first and whole period. In order to evaluate the phase shift of RER relative to the cycle of output, I utilize the cross-correlation coefficients with different lags and leads. We easily find that the cross-correlation between the RER and output at the zero-lag is the largest. It indicates that the volatilities of the RER in the current period will suddenly lead to the fluctuations of output in the same period. The dynamics of business cycle can be directly and contemporaneously explained by the real exchange rate.

Table 4.6

Cross correlation between output and Real Exchange Rate (RER)

	4-quarter lag	**8-quarter lag**	**Zero-lag**	**4-quarter lead**	**8-quarter lead**
1996-2007	0.204	0.159	0.244	0.208	0.192
2007-2012	0.022	0.044	-0.093	-0.011	-0.121
1996-2012	0.047	0.052	0.074	0.124	0.058

Note. Data taken from IFS and author's calculations

5. The empirical results of macroeconomic fluctuations

In this study, we investigate the main sources of business cycle in Vietnam following two Structural VAR models. Model 1 is run with 5 endogenous variables, including (TOT, Y^f, Y, TB, P) and Model 2 explains the impacts on structural shocks on (TOT, Y^f, Y, RER, P). The selection of these variables was based on the theoretical framework as I discussed earlier for a small open economy. The main purpose is to compare the effects of structural shocks on domestic variables for two model and analyze whether the changes of structural shocks' impacts when we run two model are significant or not and attempt to give some explanations for these changes. Additionally, by substituting the trade balance for real exchange rate, we can examine effects of shocks on a real exchange rate and provide knowledge to policy maker in order to design appropriate policies to limit these effects.

This section depicts the empirical evidence about the impacts of external (term of trade, foreign output) and domestic (supply, IS and LM) shocks on macroeconomic variables (output, real exchange rate and trade balance, prices) for Vietnam, Indonesia and the Philippines. Besides analysis of these effects summarized by the variance composition, we also illustrate the dynamic of adjustment through the impulse response functions.

5.1. Output Fluctuations

Domestic shocks

In Vietnam, although output growth fluctuations are mainly explained by domestic shocks while external shocks account for a small fraction (around 25% in model 1), the percentage of output fluctuations explained by domestic shocks is quite different in two models. In model 1, the supply shocks are the main sources which explain roughly 40% and the IS shocks and LM shocks are 17% and 19% in short-run. However, the former decrease dramatically by nearly 20% after 2 years, whereas the latter increase slightly in the long-run. In model 2, the supply shocks continue to play a vital role on explaining the fluctuations of output (approximately 80%) but this figure fall drastically to nearly 50%. In Indonesia and Philippines, the output fluctuations can also be explained by the domestic supply shocks, with nearly 70% and 55% in model 1 and around 65% and 70% in model 2, respectively.

However, these figures tend to witness a slightly decreasing trend over time. The results indicating the important role of supply shocks is similar to many other studies in this aspect, for instance Shapiro and Watson (1988), Gali (1992), Hoffmasiter and Roldos (1997 & 2001), To Trung Thanh (2007) and others. According to the impulse response figure, supply shocks drive up output at a far higher magnitude than any other kind of shocks in both short-term and long-term in three countries. Clearly, the government of these countries should employ the supply side to push up the economy further.

Additionally, the IS and nominal shocks explain insignificantly the changes of outputs but we should pay attention to these shocks because it tends to increase in the long-run. In detail, the variance decomposition table for 2 models indicate that impacts of IS and LM shocks enlarge substantially over 2 years in Vietnam. The increasing trend of these shocks in the next periods reflects that Vietnam economy should carefully focus on fiscal and monetary policies to reach the stable state in the future. This is shown more clearly when we look at the impulse response figure in Vietnam. These two kinds of shocks lead to fluctuations of output. Hence, these policies should be implemented strictly and flexibly to control these fluctuations. The results also illustrate that Philippines should concentrate on fiscal policy to limit the variations of output because IS shocks seemly lead to a decrease in output in the long-run while they account for relatively high proportion (around 30%) of output's fluctuations in the short-run and this figure remain stable in the long-run. In Indonesia, these shocks play a small role and the output seems to not respond to them.

External shocks

In Vietnam, term of trade shocks represent a trivially increasing trend over time in model 1 while output's changes are mainly explained by external supply shocks in model 2. Particularly, term of trade shocks account for roughly 15% in short-run and gradually increase in the long-run. In contrast, although explained a small part in the short term, the figure for foreign output shocks experience an upward trend. Focusing on the impulse response functions, the results indicates that the domestic output generally increases with respect to term of trade shocks, whereas the response to foreign output seems to decrease in the long run. There are several possible reasons to explain for this fact. Vietnam apply

export-led growth model that Vietnam's overall exports of goods grew nearly 20% in 2012 (ADB, 2013). But the largest and fastest growing segments have mainly focused on relatively labor-intensive, low-value-added manufactured products, such as textile, footwear and others which account for one-third of Vietnamese exports. Indeed, Vietnam exports the low end of the value-added than other countries in the same regions. Therefore, Vietnam still experiences a growth of exports even in the context of financial crisis. Notwithstanding, the external shocks just play a small role on explaining the fluctuations of output as the decomposition tables represent.

Instead of being explained by two external shocks, the external supply shocks mostly explain for the fluctuations of output but this impact decrease trivially in the long-term in Indonesia, whereas the term of trade shocks play an important role but only in the long-run. Particularly, the external supply shocks make up for nearly 20% in model 1 and 12% in model 2 and these numbers decrease to roughly 15% and 10% in the long-run in Indonesia. What's more, these shocks lead to narrowing trend of output. The reason is that export and imports have declining shares of GDP because the commodity boom, the real contraction in manufacturing export. Indonesia successfully started to diversity its export toward manufacturing export which the majority exports stem from manufacturing performance improvements not from production volume. Moreover, according to IMF estimation, China that the main partner of Indonesia could lower Indonesia's growth through commodity prices as well as increase in production and export volume, especially on-oil and gas commodities namely coal, palm oil and rubber. In Philippines, the output tends to decline in the long-run with respect to the term of trade shocks but term of trade shock only make up for small proportion of variation. The Philippines economy has weathered global economy due to lower dependence on exports, relatively resilient from domestic consumption and a rapidly expanding business process outsourcing industry.

In brief, domestic shocks mainly explain for output's fluctuations in which domestic supply shocks are the most important disturbances in explaining in both short-run and long-run. These supply shocks lead to output expansion in three countries. IS and LM shocks have trivially increasing impacts on output in Vietnam and IS shocks play a vital role in

explain the variation of output in Philippines. The impacts of external shocks vary across three countries. The outputs only response to term of trade shocks in long-run in Philippines, while the variations of output in Indonesia could be explained by external supply shocks.

5.2. Trade Balance and Real Exchange Rate

5.2.1. Trade Balance

The variance decomposition tables represent the result similar to what we expect in the theoretical framework session. The fluctuations of trade balance are mostly due to external shocks, especially term of trade shocks. In both short-run and long-run, the differences in impacts of 2 kinds of shocks remain stable.

Domestic shocks

Amongst the domestic shocks, IS shocks play an important role on explaining the fluctuations of trade balance in three countries. IS shocks account for more than 25%, 40% and 60% in Vietnam, Indonesia and Philippines, respectively in the short-run and this figure remains relatively unchanged in the long-run. This result is consistent to the research of Hoffmaister and Roldos (1997) which fiscal policies explain over 70% of the movement in short-run for Asian countries roughly 55% for Latin America or the research of To Trung Thanh (2007) for ASEAN countries. In general, the magnitude of IS shocks in Vietnam is lower than these countries and these shocks are largest in Philippines. Impulse response function also indicates that the IS shocks lead to an expansion of trade balance in the long-term. The role of fiscal policy is so important to control the issues of trade balance. Depending on the targets for trade balance, policy makers can mainly concentrate on fiscal policy and design appropriate policies to achieve these goals.

Moreover, although supply shocks account a modest part in the first period, this impact gradually improves over time in Vietnam. If we observe changes in the long-run, we can see that the role of supply shocks cannot be taken for granted. In Indonesia, we can see that the supply shocks are an important determinants besides the IS shocks. Theoretically, the change in trade balance is capture by its elasticity with respect to the real exchange rate and to output level. As the Muldell-Fleming model argued, the positive supply shocks lead

to an expansion of output which enhances the demand for imports. What's more, these shocks also have positive impacts on export through a depreciation of real exchange rate. Previously, we indicated the impacts of supply shocks which cause output to expanse, thus then results in an expansion of trade balance. So, the effects of supply shocks are undeniable through theoretical framework as well as the empirical evidence in Vietnam and Indonesia. In Philippines, the impacts of supply shocks are only relatively significant in the short-run.

In conclusion, the IS shocks play a vital role in both short-run and long-run and the magnitude of shocks in Philippines are the largest. The trade balance experiences an expansion response to the IS shocks. Furthermore, we also pay attention to the role of supply shocks, especially in long-run for Vietnam.

External shocks

The external shocks account for roughly 65%, 15% and 16% in Vietnam, Indonesia and Philippines of the variance of the trade balance, with the term of trade shocks explaining the bulk of the movements and external supply shocks explaining for around 20% in Vietnam and not significant in Indonesia and Philippines in the short-run. Amongst three countries, the magnitude of term of trade shocks in Vietnam is the largest and decrease negligibly in the long-run. Indonesia and Philippines make up for the relatively similar percent but these figures in Philippines tent to diminish over time. Theoretically, we know that term of trade have positive impacts on trade balance. An increase in term of trade causes a country to earn more for its exports and pay less for its imports. Particularly, according to impulse response figure, in Vietnam, term of trade shocks lead to an expansion of trade balance within 1 year, but this expansion suddenly stops and starts decreasing after that. The possible explanation is that Vietnam has a high demand for intermediate input due to lack of supporting industries and the export structure. Vietnam's exports mostly processed products and raw material. In 2012, the proportional of total exports for raw materials are so big (crude oil, ores and minerals reach $9.65 billion, account for 8.4%) and unprocessed or semi-processed agriculture and forestry, fishery products have a high

proportion (about $27 billion, accounting for 23.6%). Thus, in the long-run, the impacts of this shock will gradually decrease. In contrast, this kind of shocks causes trade balance in Philippines and Indonesia to increase in both short-run and long-run. These evidences are consistent to actual fact because both two countries started to diversity its export toward manufacturing export which the majority exports stem from manufacturing performance improvements. Furthermore, the Philippines now rank as one of the most promising newly-industrialized industry which its export moves away from low-added values, agriculture products to electronics and other goods.

External supply shocks explain a small share (nearly 20% in Vietnam) of the movement of trade balance in both short-run and long-run. The important role of external shocks is consistent to the result in research of Hoffmaister et al (1997) for Asian and Latin America. External supply shocks lead to expansion in Vietnam as indicated by the impulse response figures.

In brief, the fluctuations of trade balance are mostly due to external shocks, especially term of trade shocks. The magnitude of term of trade shocks in Vietnam is largest, compared to Philippines and Indonesia. For domestic shocks, IS shocks mainly explain the variances of trade balance but we also pay attention to domestic supply shocks which are examined by the theory as well as evidences in Vietnam and Indonesia.

5.2. 2. Real Exchange Rate

Domestic shocks

As widely acknowledge, the negative IS shocks can result in a transitory output deterioration and a real exchange rate depreciation and LM shocks also lead to some change in real exchange rate in the short-run. The variance decomposition table illustrates the main sources of real exchange rate's fluctuations relatively vary across three countries. The real exchange rate variances in Vietnam are mostly determined by the domestic shocks. The domestic shocks account for approximately 85% of its fluctuations in which IS shocks explain a large share of movements, whereas the external shocks explain roughly 15%. Specifically, IS shocks are the most important determinant of real exchange rate in both short-term and long-term. The sources of real exchange rate's movements are consistent to

the results in Asian and Latin America suggested by Hoffmaister at el (1997). In Indonesia, changes of real exchange can be explained by both three shocks in which the nominal shocks account for the largest part and the proportion of supply and IS shocks are relatively equal. The supply shocks and IS shocks are the most important driving force of real exchange rate's movement in both short-run and long-run in Philippines.

Looking at the impulse response functions, IS shocks lead to a remarkable increase of real exchange rate. Although nominal shocks explain a large share of real exchange rate's fluctuations in Indonesia, the accumulated response implies that LM shocks causing real exchange rate to appreciate only have impacts in short-run. The supply and IS shocks in the Philippines indicate opposite trends. While supply shocks lead to appreciation of exchange rate in both long-run and short-run, the depreciation caused by IS shocks but only in short-run.

External shocks

External supply shocks mainly explain the movement of real exchange rate in Vietnam. The proportion of these shocks remains unchanged over time. External supply shocks result in a depreciation of real exchange rate at a higher magnitude over time. In contrast to Vietnam, the movement of real exchange rate in Philippines and Indonesia are mainly driven by term of trade shocks (approximately 10%). The dynamic response to term of trade shocks in Indonesia, however, leads to appreciation of exchange rate, whereas those in Philippines are depreciated over time.

In brief, the fluctuations of real exchange rate are mainly driven by the domestic shocks but internal causes of each country are different. In Vietnam, IS shocks or fiscal policy are the main determinant, thus Vietnamese policy makers should design the appropriate fiscal policies in order to reach the stability of exchange rate.

5.3. Price Fluctuations

The movements of inflation in Vietnam, Indonesia and the Philippines are mainly determined by domestic shocks. However, amongst the domestic shocks, the main sources of price fluctuation are quite different.

Domestic shocks

The variance decomposition table for model 1 represents that in the short-run, domestic shocks account for over 85% of price's movement in which LM shocks explain a bulk of fluctuations in three countries. However, the share of nominal shocks decline dramatically by nearly a half after 2 years. Conversely, although explaining a small share in the first period, those of supply and IS shocks rocket up noticeably in the long-run, especially IS shocks in Vietnam with an increase from roughly 3% to 16% and supply shocks in Indonesia (from 16% to 37%) and the Philippines (from 13% to 26%). In the long-run, the price fluctuations can be explained by two kinds of domestic shocks in Vietnam.

For the model 2, IS shocks are the main determinant of the variances of price in both short-run and long-run in Vietnam. There are opposite trends for other shocks. Supply shocks account for nearly 12% in the first period and this share remain stable over 2-year period, whereas there is a dramatic increase of LM shock's proportion overtime. In general, the domestic policies play a crucial role in controlling the movement of price but this finding implies that Vietnam should concentrate on demand in the long-run to obtain the stable inflation. The results also emphasize that the government of Indonesia and Philippines should design stabilization policies to limit impacts of supply and nominal shocks.

More interestingly, the dynamic impulse response to nominal shocks for two models represents the same fact in three countries. The favorable nominal shocks lead to the increase of price and this trend seemly expand in the long-term. In contrast, the IS shocks cause price to decrease at a high magnitude overtime in Vietnam. The response of price to supply shocks increases in price in short-run, but decreases in the long-run.. It is so important for policy maker in order to design policies to stabilize the price level in the long-run. Supply shocks in Indonesia and Philippines behave in different ways. The supply shocks result in an increase in price in Indonesia, as oppose to a decrease of price in the Philippines.

External shocks

Both models represent that external shocks play a very small role in the short-run. However, these proportions, especially term of trade shocks improve significantly in the long-run. The dynamic response to two kinds of external shocks illustrates the same trends. In a predicted manner, the reduction of price appears with respect to positive term of trade shocks and external supply shocks. The trend is quite stable for term of trade shocks in model 2. In Philippines and Indonesia, the impacts of external shocks made up for very small proportion in explaining the fluctuations of price.

In brief, the impacts of external shocks on price fluctuations are not significant. Basing on the results from two models, the most two important sources of price's movements in Vietnam are fiscal and nominal shocks, whereas supply and nominal shocks mainly explain for these changes of price in Indonesia and the Philippines. In order to dampen the prolonged inflation rates, Vietnam should concentrate on the domestic shocks, especially demand side-nominal and fiscal shocks.

6. Conclusions

This paper investigated the dynamics of business cycle feature in Vietnam, such as volatility, persistence and the degree of contemporaneous and non-contemporaneous correlation of series with output based on the analysis of Backus and Kehoe (1992) and Agenor at el (2000). We separated whole time into 2 periods: before (1996-2007) and after (2008-2013) period and evaluate changes of business cycle features. Additionally, this study empirically examined the sources of domestic macroeconomic variables' movements including output, trade balance and real exchange rate, and price under the effects of external (term of trade and foreign output) and domestic (supply, IS and nominal) shocks in Vietnam, Philippines and Indonesia. This paper adopted the SVAR models with long-run restrictions, suggested by Evan (1987), Shapiro and Watson (1988), Blanchard and Quah (1989) and many other studies in the same aspect. By using and developing the spirit of Gali (1992) about the stochastic Mundell- Fleming model and ideas about a small open economy of Ahmed and Park (1994) and Hoffmaister and Roldos (1997), we imposed some long-run restrictions which are consistent to characteristics of business cycle in developing countries such as Vietnam, Indonesia and the Philippines. We also attempted to make some

comparisons about the size and trend of shocks on domestic variables between Vietnam and developing countries in other papers. The data were covered from 1996 to 2013. In order to get the result, we investigated the main sources of business cycle in Vietnam following two Structural VAR models. This study indicated some interesting and useful facts of the business cycle in Vietnam.

Some findings are summarized as follows to answer the first question: What are the main features of business cycles in Vietnam? *First,* the volatility and persistence of output in Vietnam increased substantially in the global financial crisis period (2008-2013). Conversely, almost output variations in the Philippines and Indonesia concentrated on the first period when the Asian Financial Crisis (AFC) 1997 occurred. There are several reasons to explain for this fact, for instance the volatility of the whole economy in crisis; the participation in WTO raising the potential risks and causing Vietnam to become more sensitive to global fluctuations; the inefficiency of using resources; the lack or limit of financial instruments to face with the impacts of shocks and others. *Second,* the volatility of price slightly increased in the second period, whereas the persistency decreased in Vietnam. The correlation between the CPI and output was a counter-cycle in Vietnam and Indonesia and these coefficients were significant at 5% level only in the first period. The Philippines indicated the pro-cyclical relationship between output and price and the coefficients were statistically significant at 5%. Moreover, the volatilities of the inflation in the current period will suddenly lead to the fluctuations of output in the short-run in Vietnam. The dynamics of business cycle could be directly and contemporaneously explained by the price level. There existed a trade-off between growth and inflation in Vietnam economy.

For the second research question of the study, the main findings are described as below. *Firstly*, output growth fluctuations were mainly explained by domestic shocks while external shocks accounted for a small fraction, the percentage of output fluctuations explained by domestic shocks is quite different in two models. In general, output's movements were mainly explained by supply shocks in both short-run and long-run. We also witnessed a fall in the impacts of supply shocks on output in the long-run. We should pay attention to fiscal and nominal shock because it tends to increase in the long-run. IS

and LM shocks had trivially increasing impacts on output in Vietnam and IS shocks played a vital role in explain the variation of output in Philippines. Furthermore, the domestic output generally increased with respect to term of trade shocks, whereas the response to foreign output seemly decreased in the long run, but the external shocks just played a small role on explaining the fluctuations of output. *Secondly*, the fluctuations of trade balance were mostly due to external shocks, especially term of trade shocks in short-run and long-run. Term of trade shocks leaded to an expansion of trade balance within 1 year, but this expansion suddenly stopped and started decreasing after that. The IS shocks played an important role on explaining the fluctuations of trade balance. What's more, although the supply shocks accounted a modest part in the first period, this impact gradually improved over time. It implies that we cannot take supply shocks for granted. *Thirdly*, the IS shocks were the most important determinant of real exchange rate in both short-term and long-term. In addition to domestic shocks, the term of trade shocks had a relatively large impact on real exchange rate. *Fourthly*, the movements of inflation in Vietnam were mainly determined by domestic shocks. The domestic policies played a crucial role in controlling the movement of price but this finding implies that Vietnam should concentrate on fiscal and monetary policies in the long-run to obtain the stable inflation.

Policy Implications

Importantly, after answer the first two questions, we need to solve the final questions: what are the policy implications for policy makers in order to design the appropriate policies to help Vietnam overcome the current macroeconomic instability? Some policies are listed as follows

Firstly, in order to maintain the stability and raise the level of output, policy makers should propose some policies reflecting the change in supply. These policies may reflect the changes of labor market, the improvement of technology, changes in legal and regulatory systems such as a public sector restructures, privatization, infrastructure improvement, tax reforms, removal of trades and capital controls and so on. Particularly, Vietnam has currently pursed the investment-led growth model which economy is growing quantitatively, basing mainly on continuous increase in inputs. However, the effectiveness

of using resources is still low and slowly improved which lead to the inefficiency of economy. Hence, Vietnam should restructure the economy, change from out of date model to the modern one for economic development. That means Vietnam concentrates on improving technology, infrastructures, learning experience of industrialized countries and then applying to Vietnam, and so on. They step by step transform a model- growth based on inputs, resource into a model- growth relied on modern technology, capital. Furthermore, becoming an official member of WTO brought Vietnam opportunities, expectations as well risks in the future relating to the low level of national competitiveness and enterprise competitiveness. The policies toward improving the quality, effectiveness and productivity of economy are the prerequisites to make sure the national competitiveness and help Vietnam seize the chances and minimize the risk when integrated into the global economy. Vietnam should build a set of financial instruments which are necessary to deal with unexpected issues from outside of economy. Generally, restructure of the economy, transformation of economic development model are the perquisites to help Vietnam overcome the current instabilities. However, we should be careful if we want Vietnam to control the instabilities of real exchange rate by using the tool of supply shocks because it is not an effective way to deal with this issue. In order to obtain the goal of stable real exchange rate, Vietnam should focus on fiscal policies.

Secondly, the fiscal policies are recorded by important role on controlling the fluctuations of output, trade balance, real exchange rates, prices, specifically in long-term. The role of IS shocks such as government spending, shocks to public preferences, shifts in domestic fiscal policies and others is undeniable. In the long-run, Vietnam should concentrate on improving the effectiveness of fiscal policies, avoiding the wasteful loss, corruption in the implementation process. Tight fiscal policies are also an effective way to limit the fluctuations of domestic macroeconomic variables in Vietnam.

Thirdly, LM (nominal) shocks such as money supply change by monetary authorities, appreciation or depreciation of domestic currency or financial innovation are determinants of the variances of output, real exchange rate and price and are not effective in improving the trade balance. In order to achieve the goal of controlling trade deficit,

Vietnam should focus on other policies rather than nominal shocks. The theory representing the relationship between net export and nominal shocks might not be effectively applied in the case of Vietnam. Instead, fiscal policies will be a better choice to control the movement of trade balance and other problems.

Fourthly, inflation has currently become a sensitive problem not only in Vietnam but also other countries. The results suggest that Vietnam should mainly focus on fiscal and monetary policies in order to reach the stable inflation.

Although this study attempts to control as much problems as possible, there exist some limitations. One of the most important shocks, technology shocks, did not mention in this study, thus it might not fully explain the main source of business cycle in Vietnam. Gali (1999), Gali and Rabanal (2004), Francis and Ramey (2005) and others examined and indicated the important role of the technology shock-driven real business cycle hypothesis. Without controlling this kind of shocks might lead to misleading results. Hence, we should construct other models based theoretical framework to control all kinds of shocks and compare the current results. Moreover, there are problems which mainly related to the drawback of SVAR methodology. As I mentioned in literature review, SVAR methodology is the most popular approach to measure the business cycles. However, this approach has been controversial due to the fact that many researchers argued the identification of shocks. The response of macroeconomic variables might not be consistent to the expectation of theory, thus we need carefully interpret and give more evidences to explain these differences.

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APPENDIX A: Statistical Properties of Data

A1. Unit root test for Variables in SVAR model

Table A1: ADF and KPSS Test

Variables	ADF Unit Root Test				KPSS Test	
	Level		Difference		Level	Difference
	k	t-statistic	k	t-statistic	t-statistic	t-statistic
Vietnam						
TOT	0	-2.507			0.109**	
Yf	0	-1.149	0	-8.717**	0.231	0.224**
Y	4	-1.723	3	-2.712*	0.142*	0.358*
TB	0	-4.287**			0.133**	
RER	1	-0.989	0	-6.284**	0.322	0.445*
P	5	-0.789	0	-4.492**	0.277	0.584*
Indonesia						
TOT	0	-0.923	0	-9.009**	0.935	0.106**
Yf	0	-1.428	0	-7.155**	0.613	0.078**
Y	0	-2.699	7	-2.837*	0.226	0.642*
TB	0	-2.157	0	-8.121**	0.803	0.388**
RER	0	-2.661	0	-6.348**	0.725	0.12**
P	0	-3.227*	0	-3.795**	1.042	0.362**
Philippines						
TOT	0	-2.887	0	-11.607**	0.580	0.372**
Yf	1	-1.956	0	-14.106**	0.267**	0.168**
Y	0	-2.867	0	-9.388**	0.157	0.196**
TB	0	-5.931**			0.149**	
RER	1	-2.172	0	-5.886**	0.283	0.414*
P	1	-2.714	0	-5.778**	0.072**	

Note. k is the lag length in ADF test which utilize Schwartz Bayesian Criterion (SBC). TOT is term of trade, Yf and Y are foreign and domestic output, respectively; TB is the ratio of net export to domestic output; RER is real exchange rate. All variables except for trade balance are in logarithm form. The model used in the test includes intercept. (*), (**) represent the statistically significant at 5% and 1% level.

A2. Johansen Co-intergration Test for Level of Variables

It is quite clear that the Johansen cointegration test is sensitive to the number of lag used in VAR model. In order to select the most appropriate number of lag, I will utilize the lag length criterion statistics for VAR at levels of variables. The results using the Schwarz information Criterion (SC) indicate that we accept the hypothesis of 1 lags for VAR in all countries. In general, the other criterion also show the similar results, thus VARs at the level of variables with 1 lag are estimated and utilized for the cointegration test.

Table A2: Lag Length Criterion LR Test Statistics for VAR at Levels of Variables

Lag	Model 1			Model 2		
	Vietnam	Indonesia	Philippines	Vietnam	Indonesia	Philippines
1	-11.89323*	-21.10905*	-18.10541*	-13.77682*	-18.80913*	-18.16564*
2	-11.37441	-20.22744	-17.13495	-13.44883	-18.01366	-17.37715
3	-10.75341	-19.53512	-16.33754	-12.72123	-17.08484	-16.69681
4	-10.34920	-18.57231	-15.14196	-12.43788	-16.21931	-15.98349

Table A3: Johansen Co-integration Test at Level of Variables

Ho	H1	Model 1			Model 2			95%
		Vietnam	Indonesia	Philippines	Vietnam	Indonesia	Philippines	
r=0	r=1	33.06535**	26.78568**	24.68178**	24.68178**	32.65041	15.09497**	33.87687
r=1	r=2	22.60311	21.18843	16.65508	16.65508	25.38937	12.14007	27.58434
r=2	r=3	9.828024	14.09032	8.851365	8.851365	14.71251	8.817328	21.13162
r=3	r=4	7.286490	4.805076	6.894404	6.894404	5.433418	4.818681	14.26460

Note. The table represents the cointegration test bu using Maximum Eigenvalue Statistics. (**) indicates that we fail to reject the zero-ranking null hypothesis, thus there in no cointegrating relationship between variables. r is the number of cointegrating relationships.

Table A4: Lang Length Criterion LR Test Statistics for VAR-Vietnam

Lag	LR	FPE	AIC	SC	HQ
Vietnam- Model 1					
0	NA	6.41e-12	-11.58449	-11.41582	-11.51804
1	130.6045	1.48e-12	-13.05504	-12.04306*	-12.65637*
2	41.03137	1.51e-12	-13.04796	-11.19267	-12.31707
3	58.04905	1.02e-12	-13.47607	-10.77746	-12.41295
4	42.51397*	8.91e-13*	-13.68352*	-10.14160	-12.28817
5	13.62906	1.54e-12	-13.26092	-8.875693	-11.53336
Vietnam- Model 2					
0	NA	6.52e-13	-13.86866	-13.70000	-13.80222
1	118.6513	1.85e-13	-15.13312	-14.12115*	-14.73446*
2	44.21959	1.78e-13	-15.18621	-13.33092	-14.45531
3	47.27104*	1.50e-13*	-15.38977*	-12.69117	-14.32665
4	24.72389	1.99e-13	-15.18349	-11.64158	-13.78815
5	11.42629	3.63e-13	-14.70294	-10.31770	-12.97537

Table A5: Lang Length Criterion LR Test Statistics for VAR-Indonesia

Lag	LR	FPE	AIC	SC	HQ
Indonesia- Model 1					
0	NA	3.00e-16	-21.55205	-21.37902*	-21.48424
1	68.86267*	1.96e-16*	-21.98442*	-20.94629	-21.57757*
2	30.06910	2.47e-16	-21.76613	-19.86289	-21.02023
3	28.78320	3.09e-16	-21.58609	-18.81773	-20.50114
4	24.21756	4.16e-16	-21.37185	-17.73838	-19.94786
5	30.94676	4.51e-16	-21.43637	-16.93779	-19.67334
Indonesia- Model 2					
0	NA	4.83e-15	-18.77549	-18.60246*	-18.70768
1	85.42463	2.32e-15*	-19.50899*	-18.47085	-19.10213*
2	38.24934*	2.50e-15	-19.45430	-17.55106	-18.70840
3	16.17446	4.13e-15	-18.99406	-16.22571	-17.90912
4	34.69666	4.28e-15	-19.04181	-15.40834	-17.61782
5	31.33433	4.58e-15	-19.11740	-14.61882	-17.35437

Table A6: Lang Length Criterion LR Test Statistics for VAR-Philippines

Lag	LR	FPE	AIC	SC	HQ
		Philippines- Model 1			
0	NA	7.00e-15	-18.40408	-18.23682*	-18.33809*
1	55.31907	5.93e-15	-18.57246	-17.56890	-18.17649
2	45.61257	5.57e-15*	-18.64791*	-16.80804	-17.92196
3	22.71498	7.84e-15	-18.34225	-15.66608	-17.28633
4	38.51127*	7.55e-15	-18.44827	-14.93580	-17.06238
5	30.08258	8.46e-15	-18.45039	-14.10162	-16.73452
		Philippines- Model 2			
0	NA	4.27e-15	-18.89799	-18.73073*	-18.83200*
1	63.14494	3.17e-15*	-19.19901*	-18.19545	-18.80304
2	33.88017	3.70e-15	-19.05719	-17.21733	-18.33125
3	17.48571	5.79e-15	-18.64481	-15.96864	-17.58889
4	41.66888*	5.19e-15	-18.82260	-15.31013	-17.43671
5	33.54362	5.33e-15	-18.91347	-14.56469	-17.19759

Table A7: The LM Statistics for Reduced Form Residual Serial Correlation

Lags(k)	Vietnam				Indonesia				Philippines			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	LM-stat	P-value	LM-stat	P-value	LM-stat	P-value	LM-stat	P-value	LM-stat	P-value	LM-stat	P-value
1	13.976	0.9621	29.6458	0.2378	25.178	0.4524	17.704	0.8547	38.4569	0.4017	36.1473	0.0694
2	21.789	0.6478	21.6566	0.6555	24.484	0.4916	26.6536	0.3734	19.9164	0.7512	25.040	0.4601
3	20.606	0.7144	21.6542	0.6556	27.232	0.3444	15.0916	0.9392	22.4214	0.6113	27.9085	0.3121
4	24.544	0.4881	14.5117	0.9521	23.148	0.5689	25.8310	0.4167	26.6509	0.3735	30.0119	0.2238
5	15.41	0.9311	17.1166	0.8775	21.868	0.6433	20.3686	0.7272	26.5846	0.3769	32.4171	0.1463
6	24.919	0.4669	34.6168	0.0954	15.367	0.9324	17.1454	0.8765	15.0441	0.9403	25.5460	0.4321
7	33.604	0.1166	20.0079	0.7464	29.853	0.2298	20.0899	0.7421	31.4359	0.1750	8.05764	0.9995
8	27.050	0.3534	34.2890	0.1019	53.389	0.0008	43.1272	0.0136	32.5225	0.1434	25.9827	0.4085
9	30.920	0.1917	31.3206	0.1786	29.175	0.2566	27.2873	0.3417	14.9787	0.9419	29.7046	0.2355
10	14.762	0.9468	25.4560	0.4371	12.068	0.9860	15.7710	0.9215	19.8466	0.7548	22.1045	0.6297

APPENDIX B: Estimation Results of SVAR

Table B1. Variance Decomposition of DY to Different Structural Shocks-Model 1

Period	S.E.	TOT shocks	External supply shock	Supply shock	IS shock	LM shock
Model 1						
Vietnam						
1	0.104749	15.43357	5.883302	41.65114	17.32896	19.70303
5	0.132371	18.64764	4.588903	34.29532	18.53601	23.93213
10	0.161461	19.01917	6.732703	26.39958	23.19217	24.65638
20	0.186624	20.20232	5.902749	23.75745	23.12894	27.00854
Indonesia						
1	0.021661	2.600309	19.11047	68.61809	6.222064	3.449066
5	0.025190	5.018192	15.53978	66.26832	7.719778	5.453925
10	0.025191	5.018258	15.53973	66.26779	7.719734	5.454486
20	0.025191	5.018258	15.53973	66.26780	7.719733	5.454486
Philippines						
1	0.048873	3.264954	7.324838	54.03172	35.37717	0.001316
5	0.055566	10.07347	6.402956	48.43853	34.38355	0.701494
10	0.055912	10.02160	6.810396	48.01595	34.33595	0.816101
20	0.055917	10.02045	6.812478	48.01184	34.33745	0.817778

Table B2. Variance Decomposition of DY to Different Structural Shocks-Model 2

Period	S.E.	TOT shocks	External supply shock	Supply shock	IS shock	LM shock
Model 2						
Vietnam						
1	0.125007	1.128674	0.966233	78.54021	6.339671	13.02521
5	0.179715	1.549277	10.06858	57.80404	11.54356	19.03455
10	0.211625	2.217165	12.24324	52.09896	12.14603	21.29460
20	0.240890	1.999871	12.56062	50.68082	11.38090	23.37778
Indonesia						
1	0.019405	0.498395	12.43726	65.93715	18.33312	2.794074
5	0.025001	2.992983	9.560449	57.43691	14.88876	15.12091
10	0.025197	3.015535	9.545461	57.28905	14.72872	15.42123
20	0.025201	3.016056	9.545080	57.28737	14.72587	15.42563
Philippines						
1	0.045038	0.111249	0.002206	70.80594	26.96525	2.115360
5	0.053741	16.80068	0.583399	50.07766	30.11340	2.424856
10	0.053744	16.79924	0.592402	50.07259	30.11078	2.424986
20	0.053744	16.79924	0.592411	50.07258	30.11078	2.424986

Table B3. Variance Decomposition of TB to Different Structural Shocks-Model 1

Period	S.E.	TOT shocks	External supply shock	Supply shock	IS shock	LM shock
Model 1						
Vietnam						
1	0.070991	46.59476	21.60463	2.530645	25.66785	3.602119
5	0.094356	35.15379	23.49710	12.08301	22.55887	6.707230
10	0.103226	37.07373	23.53327	11.96863	21.05580	6.368562
20	0.107391	37.77742	22.37972	13.18307	19.95869	6.701101
Indonesia						
1	0.027415	13.67684	0.752873	31.31353	44.28228	9.974473
5	0.028668	14.28494	1.406631	29.71269	40.64398	13.95176
10	0.028673	14.28532	1.407901	29.72631	40.63146	13.94901
20	0.028673	14.28532	1.407901	29.72631	40.63146	13.94901
Philippines						
1	0.043780	15.90181	1.235312	18.38130	49.77882	14.70277
5	0.058384	10.53192	0.894100	12.99771	60.85288	14.72339
10	0.059447	10.32563	0.965367	13.34768	60.45623	14.90510
20	0.059466	10.32089	0.968045	13.35047	60.45552	14.90507

Table B4. Variance Decomposition of RER to Different Structural Shocks-Model 2

Period	S.E.	TOT shocks	External supply shock	Supply shock	IS shock	LM shock
Model 1						
Vietnam						
1	0.024090	3.358150	11.53165	4.404060	74.56602	6.140126
5	0.025337	3.384267	11.73351	4.067711	74.05653	6.757981
10	0.025347	3.424356	11.72762	4.065953	74.00159	6.780483
20	0.025350	3.444421	11.72518	4.065108	73.98619	6.779090
Indonesia						
1	0.109427	9.998815	3.488800	22.46976	24.05687	39.98576
5	0.126525	7.853461	3.737768	25.85561	22.66973	39.88343
10	0.127280	7.814666	3.749512	26.19052	22.63556	39.60975
20	0.127293	7.813875	3.749615	26.19535	22.63555	39.60561
Philippines						
1	0.039945	11.36859	4.732956	36.97155	46.72122	0.205684
5	0.045135	9.619058	6.467142	29.03627	54.45476	0.422771
10	0.045135	9.619052	6.467487	29.03610	54.45450	0.422858
20	0.045135	9.619052	6.467488	29.03610	54.45450	0.422858

Table B5. Variance Decomposition of D_P to Different Structural Shocks-Model 1
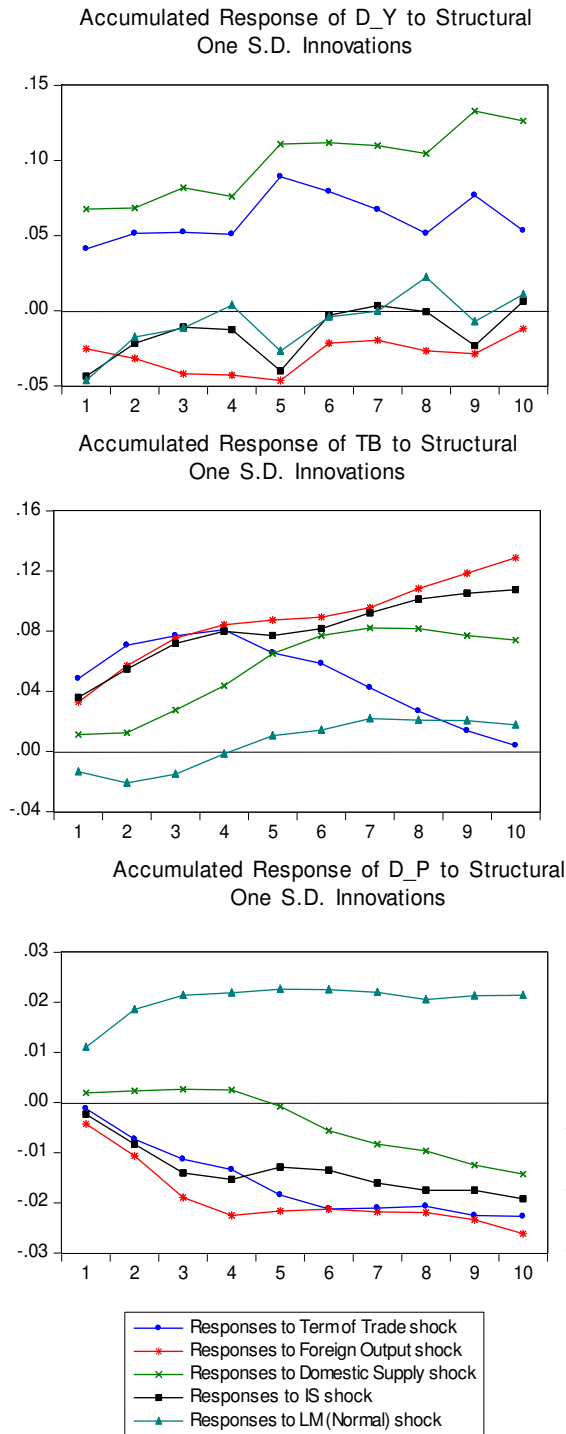
Period	S.E.	TOT shocks	External supply shock	Supply shock	IS shock	LM shock
			Model 1			
			Vietnam			
1	0.012276	0.989840	12.03350	2.436868	3.670719	80.86907
5	0.022578	16.57978	27.74028	2.912921	16.01555	36.75147
10	0.024288	16.22104	25.70629	9.946381	15.87603	32.25026
20	0.025438	18.05540	24.86880	10.21539	16.40113	30.45929
			Indonesia			
1	0.028424	7.123547	13.94734	16.66708	0.153550	62.10849
5	0.038800	7.127889	12.72402	36.99595	0.474995	42.67715
10	0.038828	7.143556	12.71125	37.04575	0.479893	42.61956
20	0.038828	7.143556	12.71125	37.04575	0.479893	42.61956
			Philippines			
1	0.008076	10.79405	1.214785	13.03660	5.983466	68.97109
5	0.009875	13.62509	2.503921	26.11249	9.249280	48.50923
10	0.009928	13.54067	2.530870	25.96242	9.803112	48.16292
20	0.009929	13.53847	2.531820	25.96069	9.812208	48.15681

Table B6. Variance Decomposition of D_P to Different Structural Shocks-Model 2

Period	S.E.	TOT shocks	External supply shock	Supply shock	IS shock	LM shock
			Model 2			
			Vietnam			
1	0.015072	3.343935	18.54039	12.99761	61.96704	3.151022
5	0.022609	2.238254	21.47009	10.70953	45.39163	20.19049
10	0.023178	2.285396	21.87421	11.67186	44.75266	19.41587
20	0.023423	2.368945	21.60510	12.35010	44.44678	19.22907
			Indonesia			
1	0.026018	4.446995	5.362710	2.282927	12.67179	75.23558
5	0.038432	4.198649	7.635068	26.53634	8.252513	53.37743
10	0.038811	4.176565	7.648194	26.63012	8.245378	53.29974
20	0.038819	4.176280	7.648588	26.63386	8.244460	53.29681
			Philippines			
1	0.008743	0.705432	0.767483	8.171775	2.302300	88.05301
5	0.009498	1.550477	0.878675	12.72542	2.836938	82.00849
10	0.009499	1.550456	0.879027	12.72562	2.838680	82.00622

Figure 1: Impulse Response of Domestic Variables: Vietnam

Model 1

Accumulated Response of D_Y to Structural One S.D. Innovations

Accumulated Response of TB to Structural One S.D. Innovations

Accumulated Response of D_P to Structural One S.D. Innovations

Model2

Accumulated Response of D_Y to Structural One S.D. Innovations

Accumulated Response of D_RER to Structural One S.D. Innovations

Accumulated Response of D_P to Structural One S.D. Innovations

- Responses to Term of Trade shock
- Responses to Foreign Output shock
- Responses to Domestic Supply shock
- Responses to IS shock
- Responses to LM (Normal) shock

Figure 2: Impulse Response of Domestic Variables: Indonesia

Model 1

Accumulated Response of D_Y to Structural One S.D. Innovations

Accumulated Response of D_TB to Structural One S.D. Innovations

Accumulated Response of D_P to Structural One S.D. Innovations

Model 2

Accumulated Response of D_Y to Structural One S.D. Innovations

Accumulated Response of D_RER to Structural One S.D. Innovations

Accumulated Response of D_P to Structural One S.D. Innovations

Responses to Term of Trade shock
Responses to Foreign Output shock
Responses to Domestic Supply shock
Responses to IS shock
Responses to LM (Normal) shock
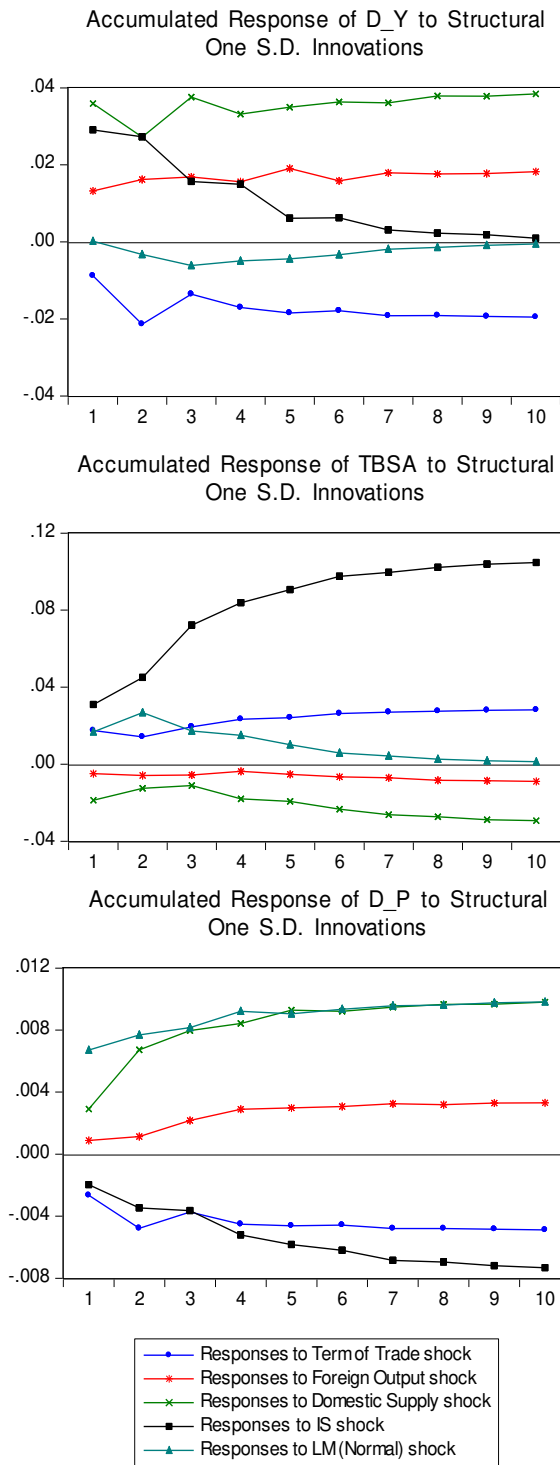
Figure 3: Impulse Response of Domestic Variables: Philippines

Model 1

Model 2

Accumulated Response of D_Y to Structural
One S.D. Innovations

Accumulated Response of D_Y to Structural
One S.D. Innovations

Accumulated Response of TBSA to Structural
One S.D. Innovations

Accumulated Response of D_RER to Structural
One S.D. Innovations

Accumulated Response of D_P to Structural
One S.D. Innovations

Accumulated Response of D_P to Structural
One S.D. Innovations

Responses to Term of Trade shock
Responses to Foreign Output shock
Responses to Domestic Supply shock
Responses to IS shock
Responses to LM (Normal) shock