Development of Vietnamese Stock Market: Influence of Domestic Macroeconomic Environment and Regional Markets

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Abstract: This study has analysed the role of the domestic economic environment and regional markets (Thailand, Japan, Hong Kong and China) in explaining the dynamics of Vietnamese stock market. In so doing, we employed a TVSVAR framework which accounts for time variations (in coefficients as well as in the variance-covariance matrix of innovations) on the data from July 2000 to December 2016. Our key findings suggested that the easing of monetary and credit conditions, stable and stronger currency and economic growth have played a significant and positive role in the development of the stock market in Vietnam. Inflation shocks did have a negative impact which implied that in policy setting the price stability is very important for the financial stability in Vietnam. The Vietnamese stock market is also heavily influenced by the regional markets, as there is strong evidence of co-movement. However, it was also witnessed that despite having a similar direction of impact and co-movement, different markets have an influence of different degrees and intensity on the Vietnamese stock market. Lastly, we also witnessed that as compared to the Global Financial Crisis, the recent periods showed comparatively lesser responsiveness. This could be associated with the intensive reaction during the period of financial turmoil as well as with an increase in the stability of the Vietnamese stock market as it matures.

Keywords: Financial Development, Economic Liberalization, Emerging Economies, Financial Integration, Transition Economies, TVSVAR Model

JEL Classifications : E44, F36, G01, G15.

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1. Introduction

The significance of the stock market is manifested in its core function of acting as an intermediary, which redistributes the resources from savers, for instance, households or intuitional investors to firms, where the former is intended to invest profitably while the latter requires financial resources for further development (Pilinkus, 2010). The Global Financial Crisis (GFC) 2008 and earlier episodes of crisis dating as far back as tulip mania in the 1630s, reiterated the fact that there are some strong inter-linkages between financial markets and the real economy. Nevertheless, the importance of the financial sector for the real economy has been recognized well over a century ago (See seminal work by Bagehot, 1873). Perhaps, it was this context and repercussions of the GFC which led Borio to argue that 'financial and macroeconomic stabilities are two sides of the same coin' (2011, p.26). The GFC has affected the developed as well as emerging economies and financial markets (See Batten and Szilagyi, 2011). By the same token, while having the ability to contribute to the growth and development of the economy, financial markets are also influenced by the dynamics of the real economy[2]. The association between the real economy and the stock market has been a point of attention for many studies as it is widely argued and empirically notified that with a thriving economy, markets become more sanguine and this is reflected in the prices of financial assets. Concomitantly, the economic outlook can be envisaged by attending to the behaviour of the stock markets. An economic despair is often likely to succeed a sharp collapse of stock prices while a surge in them can be interpreted as a positive sign for economic growth and development (for instance see, Airaudo et al. 2008, Funke et al. 2010, Batten and Szilagyi 2011, Nasir et al. 2015, Apergis et al, 2015, Batten and Vo, 2015, Chatterjee 2016)[3]. Consequently, due to the prima facie macro-financial inter-linkages, one shall be beware of the factors which may influence the stock market, particularly when the global financial system in general, and developing economies in particular, have become more integrated and complicated (Morana and Beltratti 2008, Batten et al. 2015).

In the last couple of decades and particularly Post-GFC and the Great Recession of 2008, which ended the era of the *Great Moderation*, the developing economies have been the locomotives of global growth. With China and India as two of the significant players, the developing economies of the East and South Asia have shown promising growth figures[4]. Nonetheless, there has been a significant increase in the degree of integration between Asian and international financial markets in the recent past (Batten et al. 2015). Among other emerging economies, Vietnam is a promising economy and important member of the frontier emerging market group referred to as CIVETS[5] (Batten and Vo, 2014). It has demonstrated appreciable progress in recent years, growing at an annual rate varying between 5.2% and 7.5 % since 2000 (World Bank, 2017). The Vietnamese economy is also deemed to be one of the best-performing economies of 2017 with an annual growth of 6.8%. The liberalization of the economy and positive policy initiatives led to the provision of a facilitating environment for investment. Despite not being ranked very high in terms of international competitiveness, Vietnam can be still considered as one of the best-emerging economies in terms of its achievements on the socio-economic fronts (Bui and Vo, 2007). The same holds true for the Vietnamese stock market, since its inauguration in July 2000, it has shown rapid development and has become one of the best performing stock markets in the world[6]. The prima facie evidence of remarkable performance by the Vietnamese stock market is reflected in the latest figures which suggest that the VN-index increased by 48% in the year 2017 making Vietnam the best performing Asian market of the year (Vietnam Investment Review (2018). Perhaps, this is the

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[2]In the wake of GFC 2008, a number of contemporary studies have re-emphasised on the significance of macro-financial linkages (e.g. see Blanchard et al., 2010; Gros, 2010; Borio 2011; Mishkin (2011) Nasir et al (2015).

[3] Stock market performance can also have social health implication (See, Ratcliffe and Taylor, 2015).

[4]The East and South Asia economies grew 6.1% in 2016 the projections for 2017 are 6% by FocusEconomics (2017) and 5.8% by United Nation (2016), given that the Q4 of 2016 brought better than expected results one can allocate more weightage to the former.

[5] i.e. Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa.

[6]Vietnam was put 3rd in the world and best in Asia based on performance in 2017 (Vietnam Investment Review, 2018).

reason that Vietnam's stock market has also been successful in attracting foreign investments flows and overseas investors have been net buyers for the 10th consecutive years (Bloomberg, 2016). In specific to Vietnam, the evidence also suggests that foreign investors follow a long-term investment strategy to exploit the potential growth prospects (Batten and Vo, 2015).

The notion of a Vietnamese stock market came into existence as Vietnam embarked on sweeping economic reforms in the 1990s. Since then, Vietnam is en-route to turn its economy to be more market-oriented and efforts have been made towards the development of banking and financial sectors. As Manning (1992), put it, "in a capitalist economy, the stock market acts as an institution which facilitates the internalisation of the welfare of future owners by persuading the current owners of the firm". One may dispute the purpose, yet in any capitalist economy, the stock market is indisputably an important institution. Perhaps, with this rationale, the launch of a first stock exchange in Vietnam was a step towards building a financial economy with market orientation. Since its inauguration, the stock market has not only become a channel for firms with medium and long-term capital requirements, it has also positively contributed to financial and economic liberalization and accelerated the process of economic restructuring. Since its inauguration, the Vietnamese stock market has witnessed remarkable growth and as it stands, there are over 700 companies listed on the stock market. The rapid growth of the market is explicit in the number of annual transactions, which have increased approximately 140 fold since it started its operations in 2000. Nevertheless, there has also been a significant increase in the financial deepening, as the stock market capitalization has reached to 73% of the national income (Vietnam Investment Review, 2018). Being attractive to foreign investors due to miraculous growth since its inception, there have been approximately 1.3 million accounts opened by foreign investors (Sam Ta, 2015). This influx of FDI can undoubtedly lead to higher economic growth, yet it depends on a number of institutional factors. One of the key institutional factors to moderate and influence the positive role of FDI in growth is the development of the stock market (Batten and Vo, 2009).

The liberalisation and integration of an economy and its financial sector such as the one evident in the case of Vietnam comes with a whole set of new challenges (see, for instance, Batten and Kearney 2006, for evidence on European Emerging economies, Iwata and Wu 2009, on Latin American and Bai and Chow 2017, on Chinese stock markets). Considering the fact that the Vietnamese stock market is young and has been under the phase of development, intuitively, it is expected to go through a learning process as it reaches maturity. Concomitantly, its reaction function and adjustment process to a number of domestic and foreign factors may also vary with its maturation. Keeping that in context, the subject study is an endeavour to analyse the role of domestic macroeconomic environment and regional markets in explaining the dynamics of the Vietnamese stock market in a framework in which the parameters of association are time-variant. The first objective of this study is to analyse the impact of Vietnamese macroeconomic environment that is depicted by the key macroeconomic variables that constitute the macroeconomic outlook of an economy; these are inflation, exchange rate, interest rates and GDP growth. The choice of macroeconomic factors and its rationale is drawn from theoretical and empirical literature. On this aspect, a number of studies for instance, Chang (2009), Pilinkus (2010), Al-Mamun (2013), Gupta and Modise (2013), Kishor and Marfatia (2013), Andreou et al (2013), Batten and Vo, (2014), Narayan et al. (2014), Chowdhury et al. (2017), reported the significance and role of interest rates, GDP, exchange rates and inflation in developing and developed stock markets. The second objective and noteworthy aspect of this study is the analysis of integration and influence of regional markets on the Vietnamese stock market. Perhaps, the stock market returns' co-movements are central to the international portfolio risk management and asset allocation (Batten and Vo, 2014). Nevertheless, the interdependence of stock markets is the prima facie evident aftermath of the GFC. On the aspect of co-movement and influence of foreign stock markets on domestic markets, there are a number of studies which have reported varying degrees of co-movement and integration in developed as well as developing markets (for instance, contrast, Gérard et al. 2002, Bekaert et al. 2008, Graham 2012, Dajcmanet 2012, Zhou et al. 2012, Park 2013, Wang 2013, Uddin et al. 2014, Batten et al. 2015, Kim et al. 2015, Jinwoo 2016, Bai and Chow, 2017, Nasir and Du, 2018). Nevertheless, the empirical evidence also suggests that the Asian markets, in particular, have idiosyncratic dynamics when it comes to issues around co-movements and integration (See Lipinsky and Ong 2014, Kim et al. 2013, Batten et al. 2015). Since the Vietnamese economy has been going through liberalization, it is also intuitive

that it's stock market has become more integrated into the international markets over time. Such behaviour was observed in the Chinese and Latin American stock markets which became more responsive to external shocks financial liberalisation (See Iwata and Wu 2009, Goh et al. 2013, Bai and Chow, 2017). Similarly, Batten et al. (2015) also suggested time-variation in the degree of integration of Asian markets[7]. However, the existing literature and particularly with regards to Vietnam[8], does not provide any evidence on either the dynamics of association of stock market with domestic economy and regional markets as the country goes through economic transition and development. Concomitantly, this study is an endeavour to address these caveats and gaps in the existing body of knowledge.

Focusing on the role of the domestic macroeconomic environment and regional stock markets in explaining the dynamics of the Vietnamese stock markets, this study contributes to existing evidence on the subject by employing a Time-Varying Structural Vector Autoregression (TVSVAR) model on the data from July 2000 to December 2016. The novelty of this framework is that it will help us to comprehend the dynamics of the association among under analysis entities over a period, as the parameters of the association among them will be time-variant. The selected macroeconomic variables to depict the macroeconomic environment of Vietnam are the real GDP (economic growth), inflation (price stability), real exchange rate (value of currency) and interest rate (money and credit conditions). For regional stock markets, based on the geographical proximity and capitalisation, we considered Japanese, Hong Kong, Thai and Chinese markets. Our key findings suggest that the easing monetary and credit conditions, strong and stable currency and economic growth play a significant and positive role in the development of the stock market in Vietnam. The price hike or inflation does not positively contribute to the stock market which implies that in policy setting the price stability is rather more important for financial stability than inflation fueled positive return. It was also found that the Vietnamese stock market is heavily influenced by the regional stock markets. There was strong evidence of co-movement, although there were differences in the degree to which different markets affect the Vietnamese stock market. Furthermore, compared to the pre-crisis and just after the Global Financial Crisis, the recent periods showed comparatively milder responsiveness of Vietnamese market. This could be associated with the intensive reaction around the epoch of GFC and associated financial turmoil as well as with the increase in the stability of the Vietnamese stock market as it matures.

The paper proceeds as follows, in Section-2, contextualizes the subject in the context of the existing empirical literature. Section-3 provides a concise discussion on methodology and set out the TVSVAR model. Section-4 presents the empirical findings and in Section-5, we draw conclusions and discuss the policy implications.

2.1 Macroeconomic Environment and Stock Market

Financial and economic stability being two sides of the same coin logically implies that, as the flourishing financial sector is vital for economic progress, a stable economy underpins a strong financial system. The evidence on the subject suggests that stock market and macroeconomic dynamics result in substantial business and financial cycle fluctuations in an emerging market. There could be a difference in the magnitude, however, empirical evidence suggests that the same holds true for the developed countries. For instance, Chen et al. (1986) found that inflation dynamics were highly significant in explaining US stock market dynamics. Similarly, in evidence from UK, Clare and Thomas (1994) found a significant impact of credit conditions on the stock market, whereas, in a study on Norwegian stock market, Gjerde and Sættem (1999) reported the significant impact of interest rates and economic activity. A rather recent study by Gospodinov and Jamali (2015) on interest rate and US stock returns, Chatziantoniou et al. (2013) on the impact of credit conditions (money supply and interest rates) on stock markets in the Germany, UK and USA and Ruiz (2015) on impact of interest rates and inflation on Spanish stock market reported significant association. In fact, a study by Apergis et al. (2015) reported significant nexus between the liquidity of the stock market and real economy while Shahzad et al. (2018) reported a strong association between credit conditions (default swap) and associated

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[7] Including Korea, Malaysia, Hong Kong Philippines, Indonesia Singapore, Taiwan and Thailand.
[8] With exception of Batten and Vo (2014)

sectoral stock. An important, yet underappreciated aspect of the association between macroeconomic factors and the stock market is time variation. In this regard, a study by Kishore and Marfatia (2013) reported significant evidence of time variation in the response of 36 leading stock markets (excluding Vietnam) to shocks from US monetary policy. Their empirical findings reflect the importance of time variation which is a significant aspect of the subject study.

As a corollary to above, an important point to acknowledge here is that there could be nuanced differences between the reaction function of developed and developing markets, in this aspect, a study by Suliaman et al. (2009) on exchange rate and later Al-Jafari et al. (2011) on the impact of economic growth, inflation and interest rates reported significant differences in the behavior of developed and developing stock markets. Similarly, in their study on 11 developing (Islamic) and developed countries, Dewandaru et al. (2014) found a significant impact of macroeconomic variables on these countries, however, they also found relatively low and unstable integration of developing (Islamic) countries. The developing economies have contributed significantly to global growth, particularly in the post-GFC period. On this issue, Al-Mamun (2013) identified 11 countries constituting almost two-thirds of the global population, which could contribute to relieving the stagnation in global growth[9]. It was also shown that macroeconomic factors significantly influence and underpin the performance and sustainable growth of the stock market. Arguments on the similar lines were made by Naka et al. (1998) as they showed a significant association between Indian stock returns and stable economic growth as well as inflation, money supply and interest rates. Similarly, Savasa and Samiloglub (2010) analysing the Turkish stock market showed a significant impact of the money supply, exchange rate and interest rates on the dynamics of the Istanbul stock market. Moreover, they argued that the exchange rate appreciation could have an adverse impact on the stock market due to an intuitive economic explanation that the depreciation helps exports and import substitution. Perhaps, that depends on the structure of the economy as well as on the investor's exposure to exchange rate risk. In this regards, Ülküa and Demirci (2012) reported significant positive comovement between stock and exchange rate markets in emerging European economies. A later study by Andreou et al. (2013) investigating the nexus between exchange rate and stock markets in emerging Asian and Latin American economies[10](excluding Vietnam) reported a significant association between exchange rate and the stock market, though the results varied among countries. In specific to the subject economy, given the fact that there has been a considerable amount of the foreign investment in Vietnamese stock market in the last few years as well as the increased openness of the economy, the exchange rate is an important factor to consider.

East Asian stock markets have considerable status among emerging economies, specifically, in terms of their size and international significance. In a study of the Korean stock market, Kwon and Shin (1999) reported that analyzing the association with macroeconomics factors lead to having a better understanding of the stock market. Perhaps, this is the reason we have included the macroeconomic variables to have a better understanding of the Vietnamese stock market's dynamics. Their results showed an association between stock indices and exchange rate and money supply. Similarly, analysing the Malaysian stock market, Ibrahim and Aziz (2003) found evidence of significant impacts of inflation, exchange rates and money supply on stock returns. On Thail stock markets, Vithessonthi and Techarongjwong (2012) reported a negative impact of interest rates while Forson and Janrattanagul (2013) showed the positive impact of money supply and inflation. While analysing the Chinese stock market by Tang et al. (2013) reported that lowering interest rates has positive effects, which were even more pronounced in the bearish market. In a multi-country study examining the influence of macroeconomic factors (GNP, money supply, interest rate, inflation and exchange rate) on the equity

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[9] Considered six matrixes which included domestic saving and investment, demographic trends, quality of health, standard of education, quality of the institutions and policies and degree of (trade) openness, an index was developed which identified 11 countries called as Global Growth Generators (3G). It included China, Bangladesh, Indonesia, Egypt, India, Iraq, Mongolia, Nigeria, Philippines, Sri Lanka and Vietnam (See, Al-Mamun (2013) for details).

[10] (India, Korea, Malaysia, Pakistan, Philippines and Thailand) and Latin America (Argentina, Brazil, Chile, Colombia, Mexico and Venezuela)

market in five of the ASEAN economies[11], Wongbangpo and Sharma (2002) reported that there does prevail short as well as long-run association among under analysis macroeconomic factors and stock markets. In a rather recent study focusing on eight Asian emerging countries[12], Chowdhury et al. (2017) reported that stock market liquidity is also strongly influenced by the short-term interest rate, bank rate government borrowing and money supply. At this juncture, one may question whether the diversification of portfolio among East Asian markets can be helpful in the face of macroeconomic shocks. In this regard, a Study by Narayan et al. (2014) on 18 developing countries (excluding Vietnam) reported that there is significant country-level heterogeneity in the impact of macroeconomic factors on the stock market. On this aspect, Bilson (2001) while analyzing the co-movement of 20 developing markets from Asia (excluding Vietnam as its foundations were just laid), Africa and Latin America in the face of macroeconomic variables, reported a commonality in the regional stock market response, however, there was no evidence of common sensitivity across regions. It led them to suggest that there could be benefits of diversification for investors beyond regions. Similar, a study by Batten and Vo (2014) reported a positive association between liquidity and Vietnamese stock returns which led them to argue that the lack of liquidity will be a less important risk factor when a market is not fully integrated with the global economy. However, with the increase in the integration of the East Asian markets as reported by Batten et al. (2015), this study is considering whether there has been any time-varying association between the stock market and its determinants. Perhaps, keeping that notion in the context, we are also analysing the impact of regional markets on the Vietnamese stock market.

2.2 Role of Regional Markets

Integration of financial markets has important implications for international finance. In this regards, Iwata and Wu (2009), argued that the benefit of stock market liberalisation is to be able to better hedge against exogenous and idiosyncratic financial market risks; however, in order to reap the full benefits, the stock market liberalization should be accompanied by a wider degree of economic integration. Specifically, lower integration of frontier markets such as Vietnam makes them attractive for international portfolio diversification (Batten and Vo, 2014). However, Globalization and technological advances have led to more integrated economies as well as the more integrated global financial sector. Investigating financial integration and selected markets[13], Wong et al. (2004) found that the co-movement between developed and emerging markets has changed over time. It was also found that since the stock market crashes in 1987 and 1997, there is an increase in interdependence between most of the major stock markets. An important aspect of the integration is that it brings a limitation to the international portfolio diversification and risk management. However, there was heterogeneity in the degree to which each stock market was affected by other markets, for instance, at the regional level, Taiwan, Singapore and Japan were found to be co-integrated, while Hong Kong stock market showed rather a stronger a relationship with the UK and US stock markets, that implied rather a more global than regional characteristic. Furthermore, there was no significant causal relationship found between Thai, Korean and Malaysian markets with UK, US and Japanese markets. In a later study on developed economies, Morana and Beltratti (2008) reported that there has been an increase in the integration of stock markets in the US, the UK, Germany and Japan from 1973–2004. They argued that it has led to an increase in the co-movement among these markets. Their findings were supported by Kizys and Pierdzioch (2009) which reported that the international comovement of stock returns in the developed economies (U.S, Canada, UK, Germany, France) have changed over time. Similarly, in an analysis on the Swiss economy, Hess (2004) employed a time-varying vector error correction model and reported that the foreign stock markets exert a strong influence on an integrated domestic stock market of a small open economy like Switzerland. Evidence of comovement is also found in the emerging stock markets. For instance, Verma and Ozuna (2005) on Latin American countries (Mexico, Argentina, Brazil, and Chile) reported comovements, although there were also some asymmetries in a relationship. Similarly, Bouri et al. (2017) analysis on the BRICS reported the significant influence of regional as well as global markets.

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[11] (Singapore, Thailand, Philippines, Indonesia and Malaysia).
[12] Indonesia, South Korea, Bangladesh, Taiwan India, Malaysia, Pakistan and Thailand.
[13] Among the Korean, Japanese, Singapore, Thai, Hong Kong, Malaysian, UK and US stock markets.

In evidence on East Asian markets and integration in the context of Asian Financial Crises, Huyghebaert and Wang (2010) suggested that the East Asian stock markets are not substantially influenced by the regional markets, yet they are only influenced by the shocks propagated globally. Furthermore, that the crisis had significant implications for the co-movement of all the East Asian stock markets except the Chinese stock market. Perhaps, it was the Hong Kong stock market, which played a significant role in propagating the global crisis, particularly in the East Asian markets. Concomitantly, they complimented the Wong et al. (2004) findings and concluded that stock markets do not have a long-term equilibrium relationship. Interestingly, they argued that there has been no dramatic fall in the isolation of the Chinese stock market, despite its miraculous economic growth and development of the capital market, although the global linkages of the East Asian economies have flourished in recent years. Obviously, increased openness of the region in general and Vietnamese economy, in particular, is intriguing and provides a rationale to the subject study. On this aspect, Gupta and Guidi (2012) reported that the conditional correlation between Asian stock markets and Indian stock markets substantially increased during the crisis period, however, it returned to their initial levels once the period of tranquillity arrived. An interesting dimension of correlation and co-movement is the portfolio diversification. The co-movements imply that for international investors, the potential profits through portfolio diversification have some limitations because of the presence of a positive association. Hence, investors endeavour to divide and diversify their investments among different markets that could be for instance in our case is Vietnam and under analysis regional markets.

The interlinkages and interdependencies among the global financial markets were made more explicitly by the Global Financial Crisis 2008-09. On this aspect, Nasir and Du (2018) argued that since GFC, there has been a significant shift in the association among the global financial markets. Furthermore, there is clear evidence of a change in the association between the UK and the global financial sector. Similalry, Khanna (2016) investigating the association among Indian, Japanese and UK stock markets, reported a significant shift in the association Post GFC. It led them to conclude that financial crisis has led to a change in the association among the stock markets of these countries. Their results were complemented by another study by Kanakarajammal and Paulraj (2016) which was focusing on the association among stock markets of China, India, South Korea, Japan, Taiwan, US and UK during the GFC. Their empirical analysis did not show a significant long-run association of the Indian stock market with other stock markets, although, there was evidence of a short-run bidirectional causal relationship with US, UK, Hong Kong and Taiwan. Interestingly, the Chinese stock market did not show either a significant long-term or even short-term relationship with the Indian stock market. Similar to an earlier cited account by Huyghebaert and Wang (2010), the Chinese stock market stood apart. Later analysis by Jayasuriya (2011) on Chinese stock market integration with three of regional markets, Thailand, Indonesia and Philippine showed that at aggregate levels markets were not found to be interrelated. However, contrarily while Yu et al. (2017) analysing the impact of the Chinese stock market risk contributions to four developed market (UK, USA, Germany and Japan), they found significant risk contribution from China to all four developed countries. This heterogeneity in the response implies that when it comes to stock markets co-movements, each market has its idiosyncratic dynamics which provides a rationale for the subject study.

It is intuitive to expect that the Regional economies and financial markets might be more integrated due to their political, economic and geographical positioning. Perhaps that is the reason this study is focused on the regional integration rather Global which makes it more specific. On this aspect, Horvath and Poldaulf (2011) while analysing a number of stock markets[14] and their integration, stated that the association between the Asian and US stock markets is relatively weak as compared to the association between US and Canadian, Brazilian and German stock markets. The UK stock market also showed stronger synchronization with the US market due to the greater influence of the latter on Western markets rather than Asian stock markets. Similarly, Bekaert et al. (2009) analysis of 23 developed countries showed that the return correlations were only present among European stock supporting the notion that the regional markets have stronger financial integration. Among the prominent other studies

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[14] It included the stock markets of Australia, Hong Kong, Japan, Russia, South Africa, Brazil, Canada, China, Germany, UK and US.

focusing on regional markets, Aloui and Hkiri (2014) and Alotaibi and Mishra (2015) on the Gulf Co-operation Council Countries (GCC) reported significant co-movement and integration which was also found to be increased after GFC. Nevertheless, they acknowledged that the co-movements among GCC markets have implications for the value at risk of multinational portfolios. In evidence from CEE3 (Central and Eastern European) countries[15], Bienkowski et al. (2014) showed that the most important factor in these countries' stock is the volatility spillovers. They also observed that the way stocks of countries behave to GFC was different from the European stocks. However, after the participation of the CEE-3 in the European Union, there was a substantial increase in the co-movement of stock markets of the CEE-3 and other European stocks. On the same region, later study by Boubaker and Raza (2016) reported significant co-movement between CEE and US stock markets which implied that over the period of time, the CEE-3 stock markets have been more integrated as their economies. As the Vietnamese economy has been going through liberalization it would be intuitive to observe how its co-movement with regional counterparts has been changed. Perhaps, there are some important factors to consider here as the behaviour of developing markets may also differ as they progress on the development and integration into the global financial system. A study by Cheung and Lai (1999) found significant evidence of co-movement among German, French and Italian stock markets, however, Lorde et al. (2009) could not find significant evidence of either short or long-run co-movement among Caribbean markets. It led them to argue that these markets were weakly efficient and segmented, hence, there are potential benefits of portfolio diversification. Perhaps, there are demarcations among developing and developed markets. According to Khandaker and Islam (2015), emerging stock markets in particular exhibit higher volatility as well as co-movement, which increases during the crisis. On a broader context, Graham et al. (2013) and later Balli et al. (2015) found a varying degree of spillover from developed markets (Europe, Japan and the US) to emerging markets in Asia and MENA regions which imply that each market has its idiosyncratic features and dynamics of co-movement. In evidence from Latin America, Marcet (2017) focusing on six developing Latin American economies (Argentina, Brazil, Chile, Columbia Mexico, Peru reported significant evidence of co-movement. In specific to Asian markets (excluding Vietnam) and Asian Pacific market, Lipinsky and Ong (2014) and Kim et al. (2013) found evidence of greater idiosyncratic influences in the pricing of these stock markets. Their findings contradict the study by Gérard et al. (2002) on three developed (US, Japan and Hong Kong) and three emerging markets (Thailand, Malaysia and Korea) which suggested that the East Asian emerging markets may not yet be fully integrated. However, one point to acknowledge here is that in the last couple of decades the Asian and East Asian markets have become more integrated. On this aspect, a study by Batten et al. (2015), focusing on integration in Asian markets (excluding Vietnam) found that there has been an increase in integration except for the Japanese markets. Their results also suggest time-varying nature of financial market integration and considerable benefits that may bring to domestic as well as international investors.

The evidence on the influence of macroeconomic factors and regional markets on the domestic stock market is intriguing to make an inquiry into the dynamics of the Vietnamese stock market. This inquiry is based on the logic that the Vietnamese stock market has been rapidly developing just over one and a half-decade and it is important to consider the learning mechanism and reaction function of this market. Some studies focusing on the aspect of stock market integration reported the evidence of time variation, for instance, Kizys and Pierdzioch (2009) on developed economies (U.S, Canada, UK, Germany, France) and Verma and Ozuna (2005) on Latin American countries (Argentina, Brazil, Mexico and Chile). However, the time variation in the association among the underlying economic and financial entities has been acknowledged as far back as Keynes (1938) while discussing the role of uncertainty and reflecting on the weaknesses of 'long chains of reasoning' in favour of a 'piecemeal' approach. While acknowledging the weaknesses of chain reasoning due to the inability of axioms to hold their ground in the face of time variation, we are employing a time-varying framework to investigate the underlying phenomena in the subject study. This framework accounts for the time-variation which can be intuitively associated with the learning mechanism of the stock market participants. The evidence on the dynamics of stock markets acknowledged hitherto occasionally reported a structural break around the GFC, yet often neglected the time variation aspect. Even the limited evidence, we have just

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[15] i.e. Poland, the Czech Republic and Hungary.

discussed earlier, considered the discreet structural break around the Global Financial Crisis. Concomitantly, there is a caveat in that framework as that does not consider the consistent and smooth variation in the association among the underlying entities over time. Therefore, there are no learning or feedback mechanisms possible in their empirical frameworks. This study is an endeavour to address this caveat as well and in the next section, we will elaborate on it.

3.1 Methodology

The Time-Varying Structural Vector Autoregressive framework employed in this study tracks its roots into the seminal work by Primiceri (2005) and Del Negro and Primiceri (2015). The notion of the time variation in the multivariate linear framework is established in the literature and a number of studies, for instance, Cogley and Sargent (2001), Canova (1993) and Stock and Watson (1996) have employed VAR models in which they had drifting coefficients. However, these studies very often imposed restrictions on the time evolution of the elements of the variance-covariance matrix. The typical restriction did let covariances evolve independently of the variances or a factor structure for the covariance matrix. Some later studies employed time-varying variances in VARs with drifting coefficients, for instance, Cogley and Sargent (2003) and Cogley (2003). However, in their models, the simultaneous relations among the under-analysis variables were time-invariant[16]. In order to overcome these issues, we are using a framework, in which both the coefficients as well as the entire variance-covariance matrix of the shocks are time-variant. Perhaps, in order to distinguish between changes in the transmission mechanism of shocks and the changes in the typical size of the exogenous innovations this it is crucial to do so. An important point to acknowledge here is that a number of studies focusing on the time variation and particularly to capture a limited number of switching regimes considered the discrete breaks in the dataset (see e.g. Ruiz (2015) and Khanna (2016). This might have some benefits to account for the rapid shift in association among under analysis variable, however, such a strategy is not useful, particularly to account for the changes in the behaviour of market participants (agents). Specifically, in a scenario where most of the changes are smooth by the aggregation among the agents (For a detailed discussion, see Primiceri, 2005). In specific to this study, the existence of any type of learning dynamics by the stock market and the influence of macroeconomic factors and regional markets seems to favour a framework which caters for smooth and continuously drifting coefficients and heteroscedasticity innovations than a framework or model which entails discrete-breaks. Perhaps, that is logically the better option when the objective is to observe the time-varying reaction function as a representation of the learning mechanism of the maturing stock market, since its inception.

3.2 TVSVAR Model

Considering the fact that the TVSVAR model employed in subject study occasions the features of time-variation in coefficients as well as in the variance-covariance matrix of the additive innovations, concomitantly, it is beneficial as the nonlinearities and time-variation in the lag structure of the model is captured in the form of drifting coefficients. Furthermore, nonlinearities in the simultaneous relations among the under analysis variables as well as possible heteroscedasticity of the shocks is captured by the multivariate stochastic volatility. Concomitantly, it is the data employed which determines the time variation of the linear structure. Specifically, whether they are determined by or derived from changes in the propagation mechanism (response) or changes in the size of the shocks (impulse). A TVSVAR framework such as this admits various types of shocks discussion of which is beyond the scope of this study (please refer to Cogley and Sargent 2003, and Primiceri, 2005 for details). Let us consider the following model: -

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[16] Moreover, they used a reduced form model which was only feasible forecasting or descriptive statistics. Later study Boivin (2001) accounted for the time-varying simultaneous relationships, yet did not consider the aspect of heteroscedasticity in the innovations. The Boivin's (2001) framework was extended by Ciccarelli and Rebucci (2003) as they also allowed for t-distributed errors which accounted for non-persistent changes in the scale of the variances over time. Similarly, Uhlig (1997) incorporated the unrestricted multivariate stochastic volatility in the VAR framework, however, their specification suffered from the assumption that the coefficients were constant.

$$y_t = C_t + B_{1,t}\, y_{t-1} + \ldots\ldots\ldots + B_{k,t-k} + u_t \qquad t = 1, \ldots\ldots\ldots, T. \qquad (1)$$

Where y_t is an n x 1 vector of observed endogenous variables; in specific to subject study, these will be Vietnamese stock market, macroeconomic factors (inflation, economic growth, real exchange rate and interest rates) and regional stock markets (include Japanese, Hong Kong, Thai and Chinese); C_t is an n x 1 vector coefficients which are of time-variant and multiplied with the constant terms; $B_{i,t,i=1,\ldots,k}$ are the n x n matrices coefficients and are also of time-variant, lastly u_t are heteroscedastic unobservable shocks with variance-covariance matix Ω_t which can be defined as;-

$$A_t \Omega_t A_t' = \sum_t \sum_t', \qquad (2)$$

Where the A_t is a lower triangular matrix,

$$A_t = \begin{bmatrix} 1 & 0 & \ldots & \ldots & 0 \\ a_{10} & 1 & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & \ddots & 0 \\ a_{n1,t} & \ldots & \ldots & a_{nn-1,t} & 1 \end{bmatrix}$$

And $\sum_t$ is the diagonal matrix

$$\Sigma t = \begin{bmatrix} \sigma_{1,t} & 0 & \ldots & \ldots & 0 \\ 0 & \sigma_{2,t} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & \ddots & 0 \\ 0 & \ldots & \ldots & 0 & \sigma_{n,t} \end{bmatrix}$$

Thus, it follows that;-

$$y_t = C_t + B_{1,t}\, y_{t-1} + \ldots\ldots\ldots + B_{k,t-k} + A_t^{-1} \Sigma_t \varepsilon_t \qquad (3)$$

$$V(\varepsilon_t) = I_n$$

At this point, if we stack all the RHS coefficients in the equation (3) in a vector B_t, it could be rephrased as

$$y_t = X_t' B_t + A_t^{-1} \Sigma_t \varepsilon_t\,, \qquad (4)$$

$$X_t' = I_n \otimes [1, y_{t-1}', \ldots, y_{t-k}']$$

Where the character $\otimes$ symbolizes the Kronecker product. The decomposition of the variance-covariance matrix as occasioned in equation-4 is a fairly common practice, perhaps more common in the literature focusing efficient estimation of covariance matrices (for details see, Smith and Kohn 2002 or Primiceri, 2005) [17].

At this point, if we let the σ_t be the vector of the diagonal elements of the matrix $\sum_t$ and a_t be the vector of non-zero and non-one elements of the matrix A_t. Then we can specify the dynamics of our model's time-varying parameter as follows; -

$$B_t = B_{t-1} + v_t, \qquad (5)$$
$$a_t = a_{t-1} + \zeta_t, \qquad (6)$$
$$\log\sigma_t = \log\sigma_{t-1} + \eta_t, \qquad (7)$$

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[17] The mapping (one to one) from eq. 1 to 4 provides justification to this approach.

Where the components of the vector B_t are modelled as the free elements of the matrix A_t as well as random walk. Due to the general perception that the random walk can hit any upper or lower bound with the probability 1 one may perceive it be undesirable here. However, this set of assumption would be fairly innocuous as long as eq. 5 to eq. 7 are placed for a finite period of time. Nevertheless, the assumption of random walk comes with the benefit of reduced number of parameters as well as provides focus on permanent shifts (Primiceri, 2005). All the innovations in the model are assumed to be jointly normally distributed along with the following assumptions on the variance-covariance matrix:

$$V = Var = \left(\begin{bmatrix} \varepsilon_t \\ \upsilon_t \\ \zeta_t \\ \eta_t \end{bmatrix} \right) = \begin{bmatrix} I_n & 0 & 0 & 0 \\ 0 & Q & 0 & 0 \\ 0 & 0 & S & 0 \\ 0 & 0 & 0 & W \end{bmatrix} \qquad (8)$$

Where Q, S and W are positive definite matrices and I_n is a n n-dimensional identity matrix. In each equation, the coefficients of the simultaneous associations among under analysing variables of interest are supposed to evolve independently, despite the fact that this is not the fundamental assumption; it is beneficial due to reason that it simplifies the inference and leads to increase in the efficiency of the estimation.

3.3 Bayesian Estimation

We employed the Bayesian approach for estimation of our model and evaluation of the posterior distribution of the parameters of interest i.e. B^T A^T Σ^T and the hyperparameters of the variance-covariance matix V. In a scenario where the distinction between parameters and shocks is less clear while we are dealing with unobservable components, the Bayesian approach is seemed to be most feasible. Furthermore, there are three main reasons for the preference of Bayesian estimation over classical approach. First, the classical maximum likelihood estimator of this variance may have a point mass at zero, particularly in a scenario where the variance of the time-varying coefficients is small, (pile-up problem). Second, the classical maximum likelihood is related to the high dimensionality and nonlinearity of the problem which could be an issue due to the reason that a complicated model often accompanies a likelihood with multiple peaks, some of which not much of interest or in the region of the parameter space which is not plausible[18]. Lastly, the pragmatism of this approach, the Bayesian approach very efficiently treats the nonlinearities in the model as well as the high dimension of the parameter space (Primiceri, 2005; Nasir et al 2018, Nasir and Simpson, 2018).

In so doing, it splits the original estimation problem into smaller and simpler ones. Concomitantly, Bayesian estimation seems to be the most appropriate approach to consider. Nevertheless, for the posterior numerical evaluation of the parameters of interest, this study is employing Gibbs Sampling. This involves drawing from lower dimensional conditional posteriors as opposed to the high dimensional joint posterior of the whole parameter set. The Gibbs Sampling is a variant of the Markov Chain Monte Carlo (MCMC) which is a smoothing method and therefore leads to smoothed estimates (Primiceri, 2005; Nasir et al 2018). Putting it simply, we obtained parameters estimates which are based on the entire dataset available to us.

3.4 Selection of Priors

We followed the principle of appropriateness and applicability in the selection of priors. To begin with, the hyper-parameters are legitimately and intuitively considered to be independent of the initial states

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[18] Nonetheless, the likelihood may reach to very high values where the peaks are very narrow. Undoubtedly, not a representative of the model's fit on a wider and more interesting parameter region. Interestingly, in the Bayesian framework, such a mis-behaviour is ruled out due to the effective use of uninformative priors on reasonable regions of the parameter space.

of the coefficients as well as from each other, for the covariances and for the log volatilities. Furthermore, Q, W and the blocks of S (i.e. priors for the hyper-parameters) are considered to be distributed as independent inverse-Wishart. Whereas, the log standard errors $p(B_0)$, $p(a_0)$, and $p(log_{\sigma 0})$ and the priors for the initial states of the time-varying coefficients, simultaneous relations are considered to follow normal distribution. In tandem with (5), (6) and (7), these assumptions and considerations imply normal priors on the entire sequences of the B's, α's and log σ's (conditional on Q, W and S). It is worth acknowledging here is that the choice of normal priors is appropriate and fairly standard. This is choice is supported by the reason of tractability due to not being very conjugate (see, e.g. Sims and Zha 1998, Smith and Kohn 2002, Primiceri, 2005, Nasir et al 2018). A sample is generated from the joint posterior of B^T A^T Σ^T and V by employing the earlier mentioned MCMC algorithm. Specifically, to exploit the blocking structure of the unknowns the Gibbs sampling is used. This entails a four-step approach i) drawing in turn time-varying coefficients B^T, ii) simultaneous relations A^T, iii) volatilities Σ^T and iv) hyper-parameters V, conditional on the rest of the parameters and underlying observed dataset [19]. The details of our dataset are as follows: -

3.5.1 Dataset

The dataset includes the series on macroeconomic variables which are inflation (CPI), economic growth (GDP growth), exchange rate (real effective exchange rate or REER) and interest rates (3-months deposit rates), regional stock markets which include Japanese (Nikkei-225), Hong Kong (Hang Seng), Thailand (SET) and Chinese (SE-180) and lastly the data series on the Vietnamese stock exchange (VN Index). For the analysis of the macroeconomic environment, the monthly data has been obtained from the DataStream from June 2005 to September 2016. We must report here that the acquiring of the data on Vietnamese economy for as long as the possible span of time was quite a challenging task. Although stock market data was available from 2000, yet there was no suitable proxy to use for the credit condition and monetary environment from that date. Therefore, we chose the June 2005 date when we had the data available on the deposit rates. However, for the second part of the analysis (effect of regional markets), we chose weekly data from July 2000 to December 2016. The details on each variable are as follows: -

3.5.2 Macroeconomic Environment: To depict the domestic macroeconomic environment of Vietnam, we used four macroeconomic variables
(i) **Inflation:** The Consumer Price Index (CPI) is used as a proxy for the inflation rate, which is the change in the weighted average price of a basket of good over time. The consumer price index is the most frequently used proxy for inflation. We expect a negative impact of inflation.
(ii) **Exchange Rate:** The Real Effective Exchange Rate (REER) was used as a proxy for the exchange rate, instead of using the exchange rate of the Vietnamese Dong against a single currency. The REER was a better proxy as it entails the exchange rate of Dong against a basket of currencies. We used the J.P. Morgan, Real Broad Effective Exchange Rate Index. We used the closing values for each month. As we are using real exchange rate, hence it is also adjusted for inflation which is another reason for making it a more appropriate proxy in terms of information. We expect a positive effect of the real exchange rate shocks.
(iii) **Interest Rates:** The interest rate is an important factor to consider as it has characteristics to reflect the time value of money if we consider it as a compensation from the borrower to the creditor for postponing consumption for the benefit of former. The interest rate is a good proxy to reflect on monetary and credit conditions prevailing in an economy. We choose the monthly data on 3-month deposit rate data to represent interest rates and expect a negative impact of interest rates shocks.
(iv) **Economic Growth:** The quarterly data on GDP growth rate were interpolated to construct the monthly rate of GDP growth**,** in a principle; the movement of stock price should match the real growth of GDP. We expect a positive impact of growth shocks.

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[19] Please see Primiceri (2005) for further details and discussion on identification and structural interpretation.

3.5.3 Vietnamese stock: The data on the Vietnam Stock Exchange (HSX) VN-index was collected which is the main stock exchange and index in Vietnam. The proxy of capitalization is used as an indicator of stock market development, as it indicates how much capital a stock market holds, this has been also been explained in the choice of variables. There could be different measures to analyse stock market development and behaviour. On this aspect, Bayraktar (2014) has summarized the literature which chose market capitalization as a measure to gauge the degree to which stock market has developed. The weekly closing values were transformed by natural logarithm. For the second part of our analysis in which we investigated the association between the Vietnamese stock market and regional markets, in order to employ the higher frequency data, we used the weekly observations.

3.5.4 Regional Stock Markets: Based on the geographical proximity and capitalisation We choose four regional stock markets, which are following;

(i) Japan Stock Index (Nikkei-225): Among Asian stock markets the Tokyo stock exchange is one of the most developed and largest. Its capitalization and volume of trading make it the fourth largest in the world with over 2000 listed companies. Therefore, when it came to the regional market selection, the Tokyo stock market is the first candidate. The Japanese Nikkei 225 Stock Average (JP) was used as a proxy to represent the market.

(ii) Chinese Stock Index (SE-180): The second market we choose is the Shanghai Stock Exchange which is ranked fifth globally and 2nd in Asia after Tokyo. It has a capitalisation of over US$3.5 trillion (as for February 2016). Contrary to its counterparts, the Shanghai Stock Exchange is rather an object of frequent interventions by the Chinese government. The Shanghai SE-180 Index was used as a proxy to represent the Chinese stock market.

(iii) Hong Kong Stock (Hang Seng) Index: The third market we choose is the Stock Exchange of Hong Kong Limited. It is also the third largest stock market in Asia by capitalization and ranked sixth in the world. Contrary to the Shanghai stock market, it not influenced by the Chinese government very often. The Hong Kong stock market's Hang Seng index is used as a proxy.

(iv) Thailand Stock (SET) Index: Thailand's stock market which is officially called "The Stock Exchange of Thailand" (SET) is the fourth regional market we choose to incorporate into our analysis. It is one of the key emerging markets in the East Asian region. The selection of the SET was also based on the rationale that it is the geographically closest stock market and could have important spillover effects on the Vietnam stock exchange.

4.1 Analysis and Findings

Prior to application of TVSVAR framework, we conducted the unit-test. One may suggest that it is not necessary to impose or verify the assumption of stationary under the Bayesian framework (e.g. Sims (1989) and Fanchon and Wendel (1992). However, our purpose is to gain some insight into the order of integration of series and any explosive behaviour which may prevail in the dataset. In so doing, an Augmented Dickey-Fuller (ADF) with the consideration of structural break in data series is employed.[20] The under-analysis series of data on financial markets are prone to exhibit a structural change from their usual trend which could be due to a number of reasons, for instance, due to business and financial cycles. To test for the stationarity the ADF test is applied in the presence of a break with Additive and Innovative Outliers[21]. The results are displayed in Table-1.

Table-1: ADF Unit Root Test with Structural Breaks

	Variable	ADF Test Statistic	Critical Value at 1% level	Critical Value at 5% level	***Probability	Breaks
Level	GDP	-6.833	-4.949	-4.443	< 0.01*	2012M12

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[20] Considering its importance Ahmed et al. (2011) also employed LM test of Lee et al. (2011), Bai-Perron or Harvey-Leybourne-Taylor tests with structural break.

[21] See Fox (1972) and/or Tsay (1988) for details and categorisation of "Additive (affects a single point) and "Innovative" (innovation to the process affects the observation as well as the successive data series) Outliers.

	Exchange Rate	-2.460	-4.949	-4.443	0.854	2010M06
	Inflation	-5.420	-4.949	-4.443	< 0.01*	2008M05
	Interest Rates	-4.264	-4.949	-4.443	0.081	2012M02
	Viet Index	-3.638	-4.949	-4.443	0.312	2009M10
1st Difference	GDP	-6.821	-4.949	-4.443	< 0.01*	2012M12
	Exchange Rate	-11.341	-4.949	-4.443	< 0.01*	2008M12
	Inflation	-13.081	-4.949	-4.443	<0.01*	2008M05
	Interest Rates	-11.753	-4.949	-4.443	<0.01*	2008M07
	Viet Index	-9.441	-4.949	-4.443	<0.01*	2007M09

*1% level of statistical significance **Vogelsang's (1993) asymptotic one-sided p-values.

The results of suggests that except inflation and GDP all the series possess a unit root at the level. This was clearly indicated by the ADF test statistic which is lower than the benchmark critical value at 1% level of statistical significance[22]. However, after taking the first difference all the data series were found to be stationary i.e. I (1). This is often observed in economics and financial dataset. As the next step, we performed a lag length selection test to determine the optimal number of lags in our TVSVAR model. For this purpose, although we used alternative information criteria i.e. Akaike, Schwarz and Hannan-Quinn information criterions, most of them unanimously suggested two as the optimal numbers of lags[23].

4.2 Domestic Macroeconomic environment & Vietnamese Stock Market

In terms of ordering, we ordered the interest rates last, due to the exogenous nature of interest rate setting. Moreover, the identification assumption also implies that monetary policy shocks affect with lags. In a lower triangular form with the stock market first, we arbitrarily modelled the simultaneous interaction between real GDP, inflation, exchange rate and the stock market. This was for sake of normalisation and not an identification condition. There might be some potential of any difference associated with the arbitrary normalisation, however, the ordering of stock market block did not affect the results in the subject setting. 10000 iterations of Gibbs Sampling were chosen with a burn rate of 20% i.e. (2000 iterations). Furthermore, for training sample, we chose the initial 56 observations (almost four and half years).

To being with, we consider the time-varying stranded deviation of the residuals in response to the shocks. The plots of posterior mean and percentiles (16th and 84th) of the time-varying standard deviation of the interest rate shocks are presented in Figure-1. The percentiles correspond to the bound of a one standard deviation confidence interval. The results in Figure-1 (A to E) presented below provides us with insight into the behaviour of under analysis series. Specifically, the period between 2012 and 2013-showed higher variance. Thereafter we can clearly observe a rather more smoothing pattern and the consistency in oscillation.
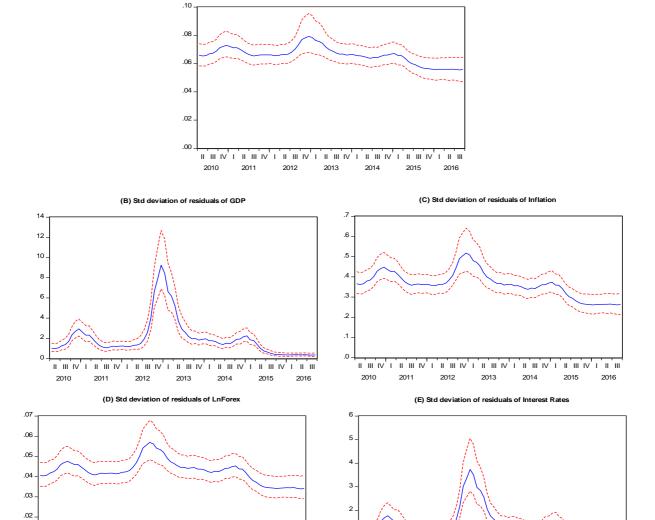
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[22] The Schwarz information criterion (SIC) is used to determine the number of lags in ADF test which is appropriate, particularly when we have structural breaks in series (Asghar and Abid (2007).
[23] The results are not reported here to conserve the space, however are available on request.

Figure 1: Posterior mean, 16th and 84th percentiles of the standard deviation of (A) residual of the LnVN-index (B) residual of the GDP growth Rate (C) residuals of the inflation equation and (D) residuals of the equation for LnForex (E) residual of the equation for interest rate shocks

The dynamics of the Vietnam stock market in response to the interest rate shocks are summarised in Figure-2. Specifically, it depicts the impulse responses of the VN Index to the interest rates shock in three different dates of the under-analysis period. The pairwise difference between impulse responses in different dates with the 16th and 84th percentiles are also presented. We chose the latest dates for comparison i.e. July, August and September 2016. Figure-2 showed the response of VN-index to interest rates shocks. The three latest periods showed that the response was sharp, negative and persisted for almost 36 periods (months).
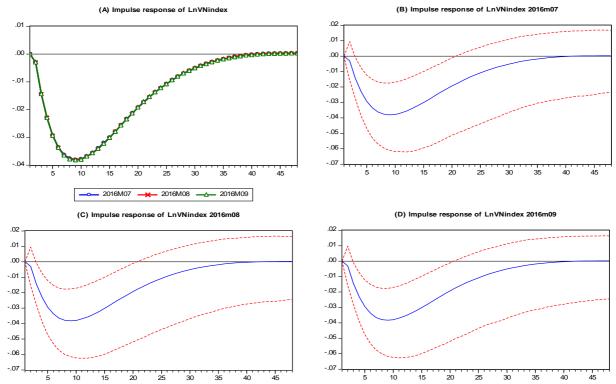
Figure 2 a) Interest Rates Shocks July, August & September 2016 b) difference between the responses in July and Aug 2016 with 16th and 84th percentiles, (c) difference between the responses in July and Sep2016 (d) difference between the responses in Aug and Sep 2016.

Figure-2 also depicts the pairwise differences between the impulses on different dates with 16th and 84th percentiles. As is obvious in representation, the responses do not show the evidence of significant variations implying the robustness of relationship, implying a strong and significant negative impact of tightening credit conditions on the Vietnamese stock market.
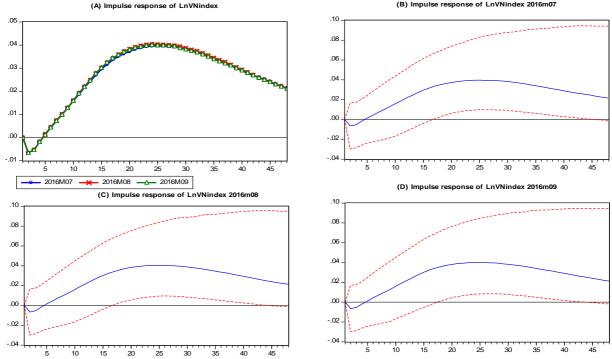

Figure 3 a) Real Exchange Rate Shocks July, August & September 2016 b) difference between the responses in July and Aug 2016 with 16th and 84th percentiles, (c) difference between the responses in July and Sep2016 (d) difference between the responses in Aug and Sep 2016.

Figure-3 showed the response of VN-index to exchange rate shocks was analogous to the J-curve; despite the short-term negative impact, exchange rate appreciation led to a long-term surge in the Vietnamese stock market. The pairwise differences between impulse responses did not show significant variation either, indicating the robustness of the relationship between the VN-index and exchange rate in the face of time. On the whole, the appreciation of the real exchange rate has positive consequences for the Vietnamese stock market, particularly in the long run.
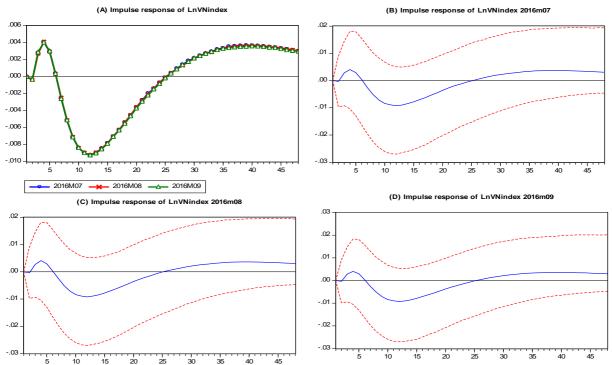

Figure 4 a) Inflation Shocks July, August & September 2016 b) difference between the responses in July and Aug 2016 with 16th and 84th percentiles, (c) difference between the responses in July and Sep2016 (d) difference between the responses in Aug and Sep 2016.

Figure-4 shows the response of VN-index to inflation shocks. Despite the initial surge, there was rather medium terms fall in the stock index which after persisting for the several periods recovered in the longer term. On the whole, it showed that on balance the impact of the surge in inflation was rather adverse on the stock market in Vietnam.
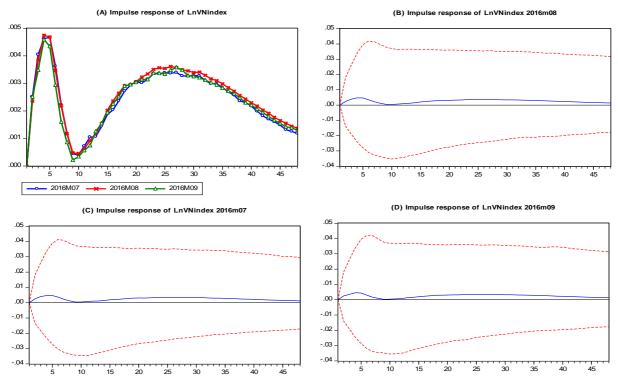
Figure 5 a) GDP Growth Shocks July, August & September 2016 b) difference between the responses in July and Aug 2016 with 16th and 84th percentiles, (c) difference between the responses in July and Sep2016 (d) difference between the responses in Aug and Sep 2016.

The GDP growth shocked as depicted in the Figure-5 lead to a surge in the VN-index which after an initial drop persisted even in the longer term reflecting the strong nexus between economic growth and financial market. The pairwise difference did not show any significant difference which also implied that the relationship was robust against time variation. It implied that economic growth (GDP) and stability are vital for stock market performance in Vietnam. This importance has been time-invariant and cannot be time-barred.

4.3 Regional Stock Markets and Vietnamese Stock Market

We performed the unit root test, which did not show any explosive behaviour in series as all the series are found to be integrated of $I(1)$[24]. Thereafter we proceed with the application of TVSVAR framework. We started with the Japanese stock market and its implications for the Vietnam stock market. Figure-6 (A to E) presented below gives some interesting insight into the behaviour of under analysis series around the period of 2008 where it showed higher variance. Thereafter we can witness a consistent oscillation and rather smoothing pattern until 2015 where we can witness again increasing variance due to the Chinese stock market upheavals. China had a stock market crisis in 2015 and 30% the value of A-shares on SSE was lost within a month. The implications are visible in the increasing standard deviation of the residuals around this period.

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[24] To conserve the space we are not reporting the results here, however they are available on request.

Figure 6: Posterior mean, 16th and 84th percentiles of the standard deviation of (A) residual of the LnVN-index (B) residual of the SE180 index (C) residuals of the LnSET (D) residuals of the equation for LnNikkei (E) residual of the equation for LnHangseng

4.3.1 Japanese Stock Market Nikkei- 225

We started the analysis with the Japanese stock exchange and its implications for the Vietnam stock market and the results are presented in Figure-7.
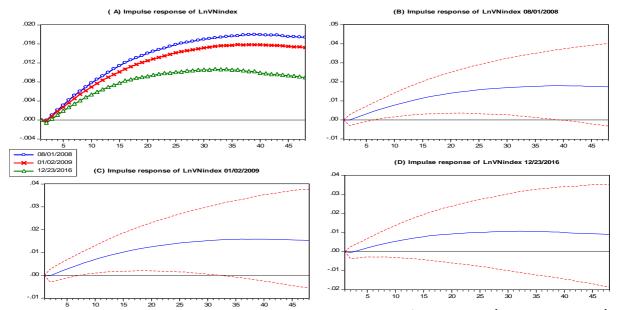
Figure 7 A) Impulse responses of LnVN-index to Nikkei Shocks in 1ˢᵗ Aug 2008, 2ⁿᵈ Jan 2009 and 23ʳᵈ December 2016 (b) difference between the responses in 1ˢᵗ Aug 2008 and 2ⁿᵈ Jan 2009 with 16ᵗʰ and 84ᵗʰ percentiles, (c) difference between the responses in 1ˢᵗ August 2008 and 2ⁿᵈ Jan 2009 (d) difference between the responses in 2ⁿᵈ Jan 2009 Dec 2016.

The results showed that the positive shocks to the Nikkei index led to a positive response from the VN-index, which persisted for quite a few periods (weeks). There was no heterogeneity in the response in different periods. Although in the latest period, we witnessed a response which was slightly milder than preceding periods and was initially slightly negative before turning into positive. It is interesting in a way that it can reflect the portfolio adjustment in the short-term, however, on the whole, there was evidence of strong positive co-movements. Next, we come to the Thai stock exchange and the results are presented in Figure 8 (A-D): -
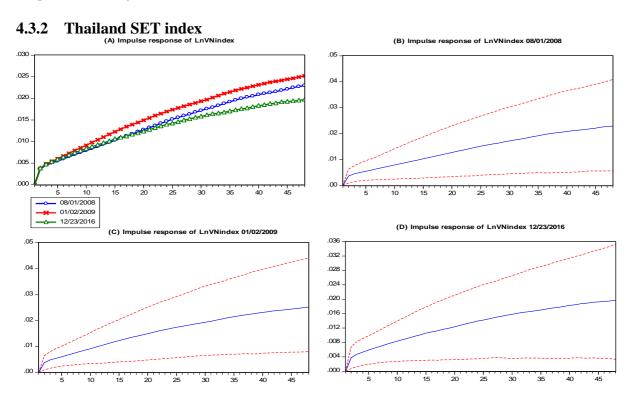
4.3.2 Thailand SET index

Figure 8 A) Impulse responses of LnVN-index to Thailand's SET index Shocks in 1st Aug 2008, 2nd Jan 2009 and 23rd December 2016 (b) difference between the responses in 1st Aug 2008 and 2nd Jan 2009 with 16th and 84th percentiles, (c) difference between the responses in 1st August 2008 and 2nd Jan 2009 (d) difference between the responses in 2nd Jan 2009 Dec 2016.

The positive shock to the Stock Exchange of Thailand (SET) index results in a sharp and positive response from the VN-index which persisted for several periods (weeks). There was no significant difference in the response of VN-index to SET shocks in different periods although in the latest period it seems to start to return to equilibrium a bit sooner. Thereafter, we analysed the impact of Hang Seng Index and the results are presented in Figure 9 (A - D);-
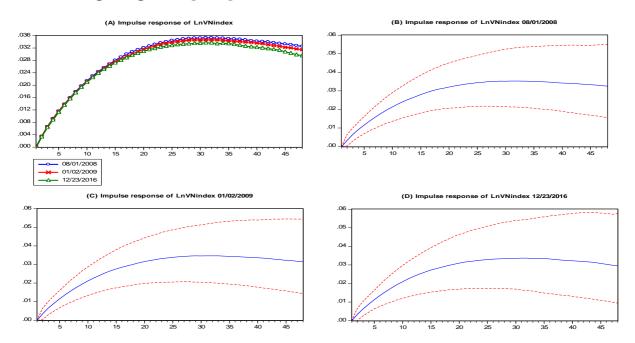
4.3.3 Hong Kong's Hang Seng Index

Figure 9 A) Impulse responses of LnVN-index to Hong Kong's Hang Seng Index Shocks in 1st Aug 2008, 2nd Jan 2009 and 23rd December 2016 (b) difference between the responses in 1st Aug 2008 and 2nd Jan 2009 with 16th and 84th percentiles, (c) difference between the responses in 1st August 2008 and 2nd Jan 2009 (d) difference between the responses in 2nd Jan 2009 Dec 2016.

The shock to the Hang Seng index led to a positive response from the VN-index which persisted for several periods (weeks). Nonetheless, the intensity of response seems to be rather greater than the shocks from SET and Nikkei-225 which implied that the Hang Seng is rather more influential although they all seemed to be affected in the same manner. Lastly, we analysed the impact of the Chinese stock market (SE-180) and the results are presented in Figure 10 (A – D); -

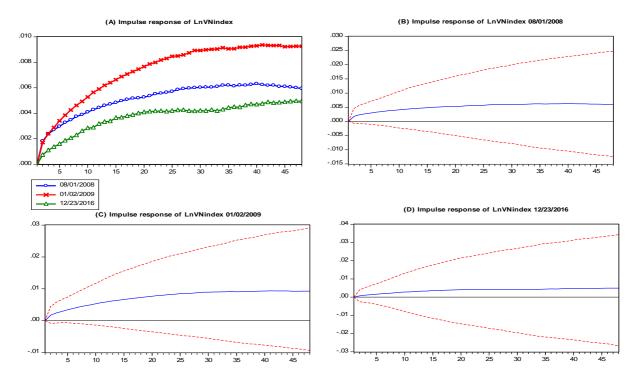### 4.3.4 Chinese Stock Market's SE-180 Index

Figure 10 A) Impulse responses of LnVN-index to China's SC 180 Index Shocks in 1st Aug 2008, 2nd Jan 2009 and 23rd December 2016 (b) difference between the responses in 1st Aug 2008 and 2nd Jan 2009 with 16th and 84th percentiles, (c) difference between the responses in 1st August 2008 and 2nd Jan 2009 (d) difference between the responses in 2nd Jan 2009 Dec 2016

The shock to the Chinese stock market SE-180 index showed a positive response from the VN-index, however, this response seems to be comparatively less than the earlier analysis of Thai, Japanese and Hong Kong markets. There was also a lesser response in the current period as compared to the period around the GFC. These findings have also an interesting dimension as often it is asserted that over time the interdependence and interconnectedness among Asia stock markets would get deeper, especially, during the GFC. We must see that in the context where the market is maturing, as well as despite being more integrated, it is also becoming more stable in the face of shocks from other markets. The Vietnamese market has shown considerable growth and development in terms of capitalization and the rate of returns. The analysis suggests that along with these factors, we observed that the market has become less responsive to shocks from the domestic macroeconomic environment and regional markets. Concomitantly, it is logical to infer that this change in response as the market develops is an indicator that the market is maturing. It leads us to the following conclusion.

5 Conclusion and Policy Implications

Vietnamese stock market which is one of the newest yet fastest growing market in the world has shown some remarkable progress in the last few years. In this study, we analysed the influence of domestic economic environment and regional markets on the Vietnamese stock markets. In so doing, we employed a framework of analysis which accounted for the time variation in the association among the under analysis variables of interest. Based on our empirical findings, we can conclude that the macroeconomic environment of Vietnam and its regional stock markets have profound implications for the Vietnamese stock market and its development. Specifically, the easing monetary and credit conditions, stable and stronger currency and economic growth play a significant and positive role in the development of the stock market in Vietnam. Hence, in terms of policy setting an accommodative monetary policy which ensures that the ease of credit access would lead to positive effects on the stock market. The findings and drawn inference are logical as the lower cost of credit and availability shall lead to the profitability of the firms, which will be concomitantly reflected in their share prices. The strong currency is also found to be positively associated with the stock market. This is also initiative

as it gives confidence to the investors due to the reason that there are gains in appreciation as the value of the investment increases in relative terms. Perhaps, this is a factor important for foreign investors who are often concerned with exchange rate risk, particularly in the emerging economies like Vietnam. The positive association between real economic growth and the stock market just verified the notion that economic and financial sector's stability and performance are two sides of a coin. As the Vietnamese economy has been growing at a very high rate as well as its stock market, the association between the two has become explicit in our results. Looking forward as the economy grows further and Vietnam goes through stages of development it will also have implications for its financial sector and in particular it's stock market. Hence, this is an important aspect of future investment. Our analysis of the association between inflation and the Vietnamese stock market suggests that inflation has detrimental effects. It is intuitive as inflation leads to deterioration of real values of the investment. The time-varying association between the two suggested that inflation does not influence stock market in a positive way; rather there were long-term negative effects. Concomitantly, it implies that in policy setting the price stability is very important for financial stability. This finding is particularly important, for the effective role of monetary policy in price and financial stability.

On the aspect of regional markets and their influence, our findings lead us to conclude that the Vietnamese stock market is hugely influenced by regional stock markets, as there is strong evidence of co-movement in all of the periods. Although it also showed that in the latest periods, the stock market has become less responsive to regional markets shocks which can be seen as an indicator that as the stock market develops and seasoned it becomes less reactive to external factors. Though the regional markets still have considerable influence, it is relatively milder. This inference is logical as it is intuitive that as the market matures and develops the market participants have more confidence in it, relative to when it was initially established. However, it was also witnessed that despite having a similar direction of impact and co-movement, different markets have a difference in the degree and intensity of how they influence the Vietnamese stock market. In this regard, the Chinese stock market was found to be the least influential among the regional counterparts. Lastly, we also witnessed that as compared to the periods around the Global Financial Crisis, the recent periods showed a comparatively milder response which could be associated with the intensive reaction during the period of financial turmoil as well as with an increase in the stability of the Vietnamese stock market as it matures. This can have profound strategic implications in the context of international portfolio diversification where the investment can be made in different markets to reduce risk - a strategy of not putting all eggs in one basket (market), but this phenomenon is beyond the scope of this study and may require further investigations which can suggest optimal portfolio strategy for which new lines of inquiry can be opened.

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