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ABSTRACT

This article focuses on the reaction of Asean economies to international financial shocks. The crises in emerging markets at the end of the last century underlined the vulnerability of emerging Asean economies to international financial fluctuations and a lack of sustainability in their exchange rate regime. A Structural VAR model is used to analyze the efficiency of the measures adopted by these countries, after this crisis episode, to protect their economies against speculative attacks. The results reveal that the impact of the current subprime crisis on emerging Asean countries is less significant than that observed in industrialized ones.

JEL Classification: C32, F41, G15.

Keywords: Asean countries, international financial fluctuations, macroeconomic impact, regional integration, SVAR Model.

RÉSUMÉ

Cet article se concentre sur la réaction des économies de l'Asean à des chocs financiers internationaux. Les crises qui ont marqué la fin du siècle dernier ont souligné la vulnérabilité des pays émergents de la région à des fluctuations financières internationales ainsi qu'un manque de soutenabilité de leur régime change. Un modèle VAR structurel est utilisé pour analyser l'efficacité des mesures adoptées par ces pays après cet épisode de crise pour protéger leurs économies contre les attaques spéculatives. Les résultats révèlent que l'impact négatif de la crise actuelle sur les pays émergents de l'Asean est moins important que celui observé dans les pays industrialisés.

Classification JEL: C32, F41, G15.

Mots-clés: Asean, fluctuations financières internationales, impact macro-économique, intégration régionale, modèle SVAR.

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1. Introduction

The last decade has been characterized by the development of many trade areas in Europe (EMU, EU, Cefta), Latin America (Mercosur) and Asia (Asean). During this period, many emerging countries opened their economy to international trade in order to benefit from the growth opportunities resulting from economic integration. Today, most of them have reinforced their commercial and financial links to form common markets, which correspond to the third stage of the Balassa (1961) classification, and are attempting to adopt a common currency in order to form a monetary union. The main problem linked to this type of monetary integration is due to external asymmetric shocks because the countries have kept their national interest rate and exchange rate as instruments of adjustment in the event of shocks (Flood, 1979). This problem is particularly significant in emerging markets (Edwards, 2006). The main condition for adopting a sustainable monetary union is the ability of the countries to resist these shocks. Respecting the traditional criteria of the Optimal Currency Areas theory (Mundell, 1961, McKinnon, 1963, Kenen, 1969) is not sufficient today to protect countries against exogenous fluctuations. It is important to consider the international changes that have taken place since this period. More precisely, the recent crises in emerging markets have underlined the fact that it is important to enlarge the concept of sustainability: in addition to the lasting stability of economic fundamentals, it is essential to consider the strength of the country's banking and financial sectors and the risk of illiquidity in a context of information asymmetry. This would help to avoid speculative attacks and the spread of financial shocks between countries in the same block during periods of international crisis (Corsetti *and al.*, 1999, Chang *and al.*, 2000). But the numerous financial crises that occurred in emerging markets at the end of the last century - in Asia in 1997-1998, in Latin America in 1994, 1999 and 2001 and in

Eastern Europe in 1998 and 2001 - have highlighted the inability of these countries to adopt this common exchange rate solution. In general, the crisis had harmful effects on all the countries of the region where it occurred and sometimes infected more distant regions. For example, a "fast and furious" episode of contagion followed the Thai crisis (Kaminsky *and al.,* 2003) and most emerging countries of the area that adopted a fixed or quasi-fixed exchange rate were forced to let their currency float.

But, today, it seems that emerging markets have learned some lessons from these crises and have reinforced their structures to protect their banking and financial sectors from international fluctuations and speculative attacks. In fact, the subprime crisis, which originated in the United States in July 2007, seems to have had spillover effects on the banking and financial sectors of Western European countries and Japan and less significant impact on emerging markets. Therefore, it is extremely interesting to analyze the different effects of these crises on countries in a commercial area according to their economic characteristics (industrialized or emerging) and during different crisis episodes. More precisely, the purpose of this article is to underline the progress of the emerging countries since the nineties crisis episode and their capacity to resist the subprime crisis and to draw some conclusions concerning their ability to adopt, in the future, a monetary union. The study concentrates on the case of the Asean (Association of Southeast Asian Nations) +3 countries[2]. Two reasons justify this choice. Firstly, this is one of the regions most hit by financial crises at the end of the last decade; it is interesting to analyze the evolution of the different countries in their ability to stabilize their banking and financial sectors in order to guarantee the confidence of international

lenders. Secondly, this commercial block is made up of industrialized and emerging economies; therefore it is important to compare the strength and the duration of the shock resulting from different crisis episodes according to these countries' economic characteristics.

Many econometric instruments can be used to measure the vulnerability of countries to an external shock; in particular Vector Auto-Regression (VAR) models (Calvo *and al*., 2000; Bordo *and al*., 2006). But Structural Auto-Regression methodology (SVAR) seems to be more accurate because it makes it possible to impose identifying restrictions on relationships between the model's variables, in reference to the economic theory; it enables one to include real and nominal variables and ensures a better interpretation of results.

A second section deals with the choice of the method, sample and variables used in our analysis. In a third section, the results obtained are analyzed. In a fourth section, the similarities between the countries are underlined thanks to a correlation test concerning their responses to a common shock. A group of countries that have a close economic and financial profile and consequently the same reaction to a common shock is identified before concluding.

2. An empirical analysis

2.1. The structural VAR model

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[2] Brunei Darussalam (1984), Cambodia (1999), Indonesia (1967), Laos (1997), Malaysia (1967), Myanmar (1997), Philippines (1967), Singapore (1967), Thailand (1967), Vietnam (1995) + China, Japan and South Korea (1997).

The representation of the reduced form of the vector auto-regression model VAR(q) is:

$$Y_t = \sum_{i=1}^{q} A_i Y_{t-i} + e_t \qquad (1)$$

Where q is the number of lags, e_t is a white noise. .

In order to simplify the representation, the variables are divided into two blocks: y_{1t} represents the exogenous variable and y_{2t} the domestic variables.

Thus we have:

$Y_t = \begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix}$ with Y_{t-1} the vector of lagged variables,

$A_i = \begin{pmatrix} a_{11}^{(i)} & a_{12}^{(i)} \\ a_{21}^{(i)} & a_{22}^{(i)} \end{pmatrix}$ the n x n matrix of the model's parameters,

$e_t = \begin{pmatrix} e_{1t} \\ e_{2t} \end{pmatrix}$ The error vector whose variance-covariance matrix has no restrictions,

that is to say $E(e_t, e_t^T) = \Omega$ and $E(e_t) = 0$.

L is the lag operator. Consequently, the VAR(q) model can be written as:

$$A(L)Y_t = e_t \qquad (2)$$

In order to obtain the shock response functions and the forecast error variance decomposition, it is necessary to write the process in the Moving Average infinite structural form. An intermediate step consists in "reversing" the canonical VAR model according to the Wold Theorem in order to obtain its moving average form:

$$Y_t = \sum_{j=0}^{\infty} C_j e_{t-j} = C(L)e_t \qquad (3)$$

where e_t represents the vector of canonical innovations.

Thus, the structural Moving Average representation is:

$$Y_t = \sum_{j=0}^{\infty} \Theta_j \varepsilon_{t-j} = \Theta(L)\varepsilon_t \tag{4}$$

with $$e_t = P\varepsilon_t \tag{5}$$

where P is an invertible matrix n x n which has to be estimated in order to identify the structural shocks. The short-run constraints are imposed directly on P and correspond to some elements of the matrix set to zero. The Θ_j matrix represents the response functions to shocks ε_t of the elements of Y_t. The different structural shocks are supposed to be non-correlated and to have a unitary variance:

$$E(\varepsilon_t, \varepsilon_t^T) = I_n \tag{6}$$

Ω is the variance-covariance matrix of the canonical innovations e_t, thus :

$$E(e_t, e_t^T) = PE(\varepsilon_t, \varepsilon_t^T)P^T = PP^T = \Omega \tag{7}$$

2.2. The choice of variable

Our study is based on Asean+3 countries[3] for the period 1990M1-2009M7. This is divided into two sub-periods[4] which correspond to the two main crisis episodes which hit Asean countries: the Thai crisis in 1997-1998 and the subprime crisis in 2007-2009. For each crisis episode, the purpose is to measure the reaction of Asean countries to this international disturbance and to make comparisons between the periods and the countries.

The variables are selected so as to see the impact of the international financial shock on the countries' economic, monetary and financial sectors. If it hits only the financial sphere and involves only a small outflow of capital, we can conclude that the harmful consequences of the international disturbance are limited. But, if the shock is propagated into the real sector and induces a reaction of the monetary authorities in order to stabilize the economies, all sectors are weakened and the time necessary to eliminate the negative impact of the crisis is going to be long.

In our model, each Asean economy is described by the following vector of endogenous variables:

$$Y = \begin{pmatrix} external \\ y \\ ner \\ fa \\ r \end{pmatrix}$$

The external disturbances (*external*) retained to represent the different episodes of volatility are a positive shock of emerging markets' composite stock exchange index

[3] Because of the availability of data our sample is only made up of 8 countries: Indonesia, Malaysia, the Philippines, Singapore, Thailand, China, Japan and South Korea.

[4] 1990M1-1999M12 and 2000M1-2009M7.

(*MSCI*)[5] and a positive shock of the variation of the United States' stock exchange index (*SP*)[6]. The purpose of the paper is to study the impact of the international crisis revealed by extreme fluctuations on financial markets. Consequently, the realized volatility[7] of these indexes is measured. *y* is industrial production, *ner* is the nominal exchange rate (units of foreign currency for one unit of US Dollar)[8], *fa* is the share of foreign assets held by the central bank and *r* is the nominal interest rate. The succession of variables has been chosen in order to make possible the introduction of restrictions.

The variables are used in logarithm, except for the interest rate. They are seasonally adjusted. It is not necessary to test the stationnarity and the cointegration of the model's variables by following the postulate of Sims (1988), Sims *and al.* (1991) because a Bayesian inference is used and the model is not then affected by the presence of a unit root.

The variables chosen are traditionally used in the literature on structural VAR in order to simplify the identification of the model with the inclusion of restrictions generally employed in SVAR reference studies. However, some of them have been inspired by

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[5] The MSCI emerging markets index is drawn from *Morgan Stanley Capital International database*. It is composed of 24 emerging market country indices. It is a float-adjusted market capitalization index. It makes it possible to measure the equity market performance of emerging markets.

[6] The S&P500 index includes the 500 largest US industrial companies quoted. It covers more than 75% of the US equity market.

[7] The realized volatility is well adapted in the case of high-frequency data. It is an *ex-post* nonparametric and unbiased volatility estimator (Andersen *and al.,* 2006, 2009).

The monthly realized volatility is measured by the standard error of the daily returns for each month.

recent financial crisis theory. Thus, the variables *y*, *ner* and *r* can be found in studies concerning the impact of monetary fluctuations on economic cycles which underline the role of the exchange rate in the spread of the shock (Cushman *and al*., 1997, Kim *and al*., 2000, Canova, 2005, Mackowiak, 2007). The decomposition between supply and demand shocks follows the postulate of Gali (1992), Cushman *and al.* (1997) which is based on an ISLM model. Moreover, the literature on the "third generation of crisis" has recently underlined the necessity of considering the country's illiquidity risk in the spread of the crisis and thus, the role of international reserves in a national economy (Corsetti *and al.*, 1999, Chang *and al.*, 2000). Finally, the importance of taking into account the vulnerability of emerging markets to international fluctuations has been demonstrated by Canova (2005), Mackowiak (2007).

The originality in this analysis is the inclusion of the two variables of stock exchange volatility. This choice is inspired by the recent mechanism of financial contagion during crisis episodes in economies whose banking system is vulnerable and illiquidity risk significant. Even if the origins of the crisis are different (the 1997 Asian crisis started on the foreign exchange markets and the 2008 subprime crisis began in the housing sectors) the consequences are identical. The shock causes considerable stock exchange volatility. And international lenders' loss of confidence after a crisis in a country can generate a portfolio reallocation on the behalf of these investors in order to limit their exposure to risk. This situation creates a considerable outflow of capital from economies which have the same characteristics as the first country hit by the crisis (Calvo, 1999, Kaminsky *and al.*, 1999, Kodres *and al.*, 2002). International reserves decrease and the monetary

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[8] It can be noticed that we use a Bayesian inference. So, in this case, it is not necessary to test the stationnarity and the cointegration of the model's variables by following the postulate of Sims (1988), Sims

authority may increase the interest rate which can produce a reduction in economic growth.

Consequently the structural disturbances vector linked to each variable is:

$$\varepsilon_t = \begin{pmatrix} \varepsilon_{ext} \\ \varepsilon_s \\ \varepsilon_{ner} \\ \varepsilon_{fi} \\ \varepsilon_{ms} \end{pmatrix}$$

Where ε_{ext} , ε_s , ε_{ner} , ε_{fi} , ε_{ms} represent respectively the external shock, that is to say the emerging markets index or the United States stock exchange volatility, a real supply shock, a shock in the nominal exchange rate, a financial shock, and a monetary supply shock.

2.3. The contemporaneous restrictions

The purpose of the study is to analyze the economies' response to financial shocks in the short term. Therefore, the period of analysis concerning the impact of the disturbances has been reduced to 12 months. We thus impose only contemporaneous restrictions in our model and we use the Bayesian procedure proposed by Sims *and al.* (1995, 1999)[9].

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and al. (1991) because the model is not affected by the presence of a unit root.

[9] We used MONTEZHA.PRG Rats procedure which corresponds to Sims-Zha's approach for overidentified structural VAR.

Our objective is to identify the n^2 elements of the P matrix. The Ω matrix is symmetric, consequently $n(n+1)/2$ orthogonalization constraints are already imposed. It is necessary to determine the $n(n-1)/2$ remaining constraints; we have chosen to impose 11 short term restrictions in reference to the economic literature, thus the model is over-identified.

Firstly, we consider the external variables (*MSCI* and *SP*) to be exogenous (Cushman *and al.,* 1997, Mackowiak, 2007). Secondly, we follow the postulate of the authors who believed that the monetary authority's function of reaction, that is to say the interest rate, does not react immediately to a shock in price and production. Then we suppose that the monetary policy's response to these shocks and to financial disturbances[10] is postponed for a month because of information delay (Sims *and al.*, 1995, 1999, Kim *and al.*, 2000). Finally, the hypothesis of a lag in the response of economic activity to international and national financial disturbances and to monetary shock is retained (Kim *and al.*, 2000).

Thus:

$$P_{12} = P_{13} = P_{14} = P_{15} = 0$$
$$P_{21} = P_{23} = P_{24} = P_{25} = 0$$
$$P_{51} = P_{52} = P_{54} = 0$$

Following the information criteria of Schwartz, Akaike and Hannan-Quinn, four lags have been retained for all models and complementary tests underlined the absence of autocorrelation in the residuals[11]

The model is now identified. We can report, in the following section, the empirical results.

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[10] National and international.

[11] Detailed information concerning the tests and their results is available on request.

3. The results

The countries' exchange rate regime is an important parameter to take into consideration as it influences the orientation of economic policies and subsequently their responses to a common shock. Over the periods of analysis, according to a *de facto* classification[12], China is the only country which maintained a perfect fixed exchange rate with a peg to US Dollar until 2005 and then adopted a crawling peg. Some countries of the region experienced an intermediate regime before 1997 (Indonesia, Malaysia and Thailand) but, except for Malaysia, they were obliged to let their currency float after the Asian crisis. The other countries of the region have either made independent or managed floating regimes since 1990 (Japan, Korea, Philippines and Singapore). However, it is important to note that during the second period of analysis, Japan and Singapore are the only countries in the sample which have not used inflation or a monetary target.

We can suppose that the economies' responses to a common financial shock were divergent in the first period of analysis; many economic differences existed between developed and emerging countries and they had diverse exchange rate regimes. But after the Asian crisis, we can expect a better convergence in the countries' reaction for three main reasons. Firstly, most of them have adopted a floating regime. Secondly, most of them have been harmed by the Asian crisis and have taken different measures to protect their economy against short term capital flows. Finally, all of them have decided to cooperate in order to reduce the risk of financial crisis with the implementation of the

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[12] Bubula, A., Ötker-Robe, I., 2002, "The evolution of Exchange Rate Regimes since 1990: Evidence from De Facto Policies", IMF Working Paper, 155.

IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions, 1990-2008.*

Chang Mai Initiative[13]. The main objective is to reinforce regional financial surveillance and to develop assistance mechanisms in the event of financial difficulties and lack of liquidities in one of the countries of the region (development of bilateral swaps and repurchase agreement facilities in addition to the expansion of the ASEAN regional Swap Arrangement). Moreover, the financial integration of the Asean+3 countries was strengthened in 2003 with the Asian Bond Market Initiative which aims to develop regional liquid bond markets.

The graphics, in appendix 1, show the reaction of domestic variables after a one-standard-deviation positive variation of the external variable. They reveal the significance level of the results if the interval of confidence does not include the 0 axis.

3.1. The vulnerability of Asean economies at the end of the last century

First of all, we concentrate on the period 1990M1-1999M12 and we study the responses of Asean economies to a volatility shock on *MSCI* and *SP* (Appendix 1, figures 1 to 16). Overall, the results underline the considerable vulnerability of emerging Asean countries to the *SP* shock. This phenomenon can be explained by the fact that the countries' exchange rates were linked to the US Dollar. Moreover, during this first period of analysis, there was a particularly strong influence of the US stock market in the global financial system (Kim *and al.,* 2009).

The reaction of the countries converges. However, the impact of the *SP* shock is more pronounced in emerging ones. This shock generates an immediate loss in international investors' confidence, particularly significant in Thailand, Korea and Malaysia which experienced a large capital outflow (*fa*). In the developed countries the reaction of this

[13] May 6, 2000, Chiang Mai, Thailand.

variable is less significant because, in the nineties, they were the developing Asean economies' main creditors; in order to limit their exposure to risk on international markets they massively removed their investments in short-term capitals from these countries and did not experience an outflow of capital. Similarly, the impact on China's capital flows is not significant because, during the nineties, the financial openness of the country was limited and the flows of international reserves controlled.

This phenomenon is at the origin of a depreciation of the nominal exchange rate in the short term in all emerging countries of the region (*ner*), except China whose exchange rate stayed pegged to the US Dollar. We can notice a slight devaluation in the medium term in Singapore, which can be explained by an intervention of the Monetary Authority in this direction. Moreover, in the short term, Japan which exported 40% of its products to Asean countries experienced a short decrease in its growth rate and a temporary depreciation of its currency. But it was one of the world's largest holders of currency reserves at the time and the situation was quickly rectified.

In order to limit the negative effects of this shock, the central bank of all countries in the region increased the nominal interest rate during the first months following the crisis (*r*). On this point, a slight difference exists between countries with fixed and floating exchange rates. The countries dependent on the United States' monetary policy experienced a less pronounced variation in their interest rate. They were influenced by the decrease in the US interest rate aimed at stimulating domestic economic growth. Finally, the increase in the interest rate level and/or the decrease of international reserves in the countries were at the origin of a decline in production in the entire region, more pronounced in emerging markets (*y*).

During the same period, the countries' reactions to an *MSCI* shock are quite different except for Korea. The more industrialized countries (Japan and Singapore) and China were not significantly impacted by this shock. In the other countries, we note an outflow of international reserves revealing the investors' loss of confidence (*fa*). This situation generates a devaluation of the nominal exchange rate (*ner*) less pronounced than those produced by an *SP* shock. But the main difference lies in the response of the nominal interest rate (*r*) which decreases in emerging Asean countries in order to boost economic growth (*y*) (particularly in Thailand, Malaysia and Indonesia). This situation can be linked to less variation in capital outflows.

During this period, volatility shocks explain more than 10% of the variation in international reserves in the year following the shock. Moreover, they were at the origin of nearly 10% of production variation in most countries of the region (appendix 2, tables 1 and 2). All the region's emerging countries were hit by the shock. It spread from the financial to the real sector of the economy. This underlines the vulnerability of emerging Asean countries to international fluctuations during the nineties and their incapacity to limit the negative consequences. This situation was due to their early capital account openness, at the beginning of the century, followed by excessive risk-taking, which is shown by the banking and financial indicators' deterioration during the four years preceding the Thai crisis. To be more precise, the situation of the banking and financial sectors in Asean countries worsened after 1994 because of a large decrease in banking liquidities and a rise in short-term debt, increasing the total amount of external debt which was responsible for international lenders' loss of confidence (Corsetti *and al.*, 1999, Chang *and al.*, 2000, Gimet, 2007). Our results demonstrate a spread of the crisis in all the region's emerging countries that corresponds to the "Fast and Furious" episode of contagion defined by Kaminsky *and al.* (2003).

3.2. The impact of the subprime crisis in Asean countries

Secondly, we analyze the impact of the subprime crisis in the same economies (Appendix 1, figures 17 to 32). A volatility shock seems to have many different effects on these economies. These divergences cannot be explained by the exchange rate regime because all these countries, except China, have a free or managed floating exchange rate regime. However, the emerging Asean countries less dependent on the United States have been more vulnerable to an *MSCI* shock (appendix 2, table 4) due to their more pronounced economic and to a certain extent financial integration with the countries of the block and the other emerging markets (Kim *and al.*, 2009)..

After an *SP* shock, the countries which suffer from a significant inflow of capitals are the developed ones (*fa*). China has experienced capital flow volatility due to the gradual deregulation of its financial markets. Thailand and Indonesia have seen their international reserves decrease but only in the short run. Consequently, the impact on the other macroeconomic and financial variables is reduced in comparison to the last crisis episode in all emerging countries: the nominal exchange rate does not fluctuate significantly (*ner*) and the impact on production is limited (Malaysia, Korea, Indonesia), or not significant (Philippines, Thailand) (*y*). Thus, the monetary policy does not react massively. On the other hand, we note action on the interest rate by Singapore's central banks (*r*) and a pronounced decrease in production in Japan, Singapore and China. Finally, the crisis is at the origin of more significant volatility in these countries' exchange rate except in China which has maintained its crawling peg.

The reactions of the Japanese economy to an *MSCI* shock are equivalent to those of an *SP* shock. The country has experienced an outflow of capital and a reduction in its production. Similarly, China's growth has been reduced (*y*). Symmetrically, some

emerging markets (the Philippines, Thailand) that have not been vulnerable to an *SP* shock have not been impacted by an *MSCI* shock. However, we notice a small outflow of capital (*fa*) in Korea, Malaysia and Indonesia followed by a short devaluation of the nominal exchange rate (*ner*) and a slight increase in the interest rate (*r*) which contribute to a decrease of growth (*y*). Even if these countries' responses are less marked than during the first crisis episode, the economy's behavior reveals some weaknesses.

Thus when we compare these results with those of the previous period of analysis, we can make many comments. Firstly, the main differences in the countries' reaction can be explained by several factors. To begin with, the situation has changed at an international level. In recent years, international reserves have been concentrated in emerging countries which have become the new international lenders (in particular in China and OPEC countries) and the most developed economies, the new creditors. This situation explains these markets' greater vulnerability. Moreover, some emerging Asean countries which experienced the very negative impacts of their last crisis have decided to adopt prudential measures in order to protect their economies against speculative attacks and reduce their vulnerability to international financial shocks. More precisely, they have limited short-term capital inflows and consolidated their banking sector. Then, even if the amount of international flows of capitals in emerging markets has been more important than those in the first period of analysis (the region[14]'s gross external assets and liabilities has gained 57 points of GDP from 1990 to 2006, Kim *and al.,* 2009), the macroeconomics impacts were lower. Our analysis reveals the efficiency of these measures, in particular in Thailand and the Philippines. But some progress would be necessary in order to protect the entire region against these financial fluctuations for certain emerging countries

[14] Japan excluded.

(Korea, Malaysia and Indonesia) were still experiencing difficulties during the second period of analysis.

4. The similarities in responses to a common shock

In order to compare the countries' reactions to each common shock, we propose an analysis of the correlation of the Asean economies' significant responses during the year following the shock (Appendix 3).

Symmetry in the countries' reaction and the economies' low vulnerability reveal a structural economic and financial convergence of these economies towards sustainable levels that guarantees international lenders' confidence.

For the first crisis episode, our results show a convergence in the response of all the domestic variables of Indonesia, Korea, the Philippines, Malaysia and Thailand to a common *SP* volatility shock (table 5). In particular, the outflow of capital (*fa*) is very strong in these five countries. All the countries were forced to devaluate their exchange rate, except Japan where this devaluation was limited. The evolution of the variable *ner* is then correlated between most countries in the region. The reaction of the monetary authorities (*r*) was quite similar between countries, except for China which fixed its exchange rate and Japan that experienced a nominal interest rate at a low level. The crisis spread in the real sector and generated a reduction in production (*y*) in all the countries of the region, in particular the emerging ones.

Some variables, like the interest rate, did not have the same evolution after an *MSCI* shock and thus the impact on the production is different. We can note a less important correlation in the emerging Asean economies' responses, in particular for Korea. Japan and Singapore were less vulnerable to this shock.

We can conclude that emerging markets were the most vulnerable to the financial shock during this crisis episode, in particular to the *SP* shock. The convergence in their reactions underlines the fact that, whatever the size and the exchange rate regime of these economies, they were hit by the crisis which spread from the financial to the real sector. Their intermediate exchange rate regimes were not sustainable. On the other hand, the financial and real impacts in industrialized countries are limited. China was an exception because its financial and economic openness was weak during this period. Thus, the reaction of its domestic variables is less correlated with the other Asean countries. Moreover, the disparity in the responses to *MSCI* shocks underlines the lack of structural convergence in the region during this period.

For the current crisis, our results are different from those of the previous period of analysis (table 6). We can note similarities in the reaction of industrialized countries, in particular Japan and Singapore, which experience an outflow of assets (*fa*) after a shock in *SP* and *MSCI*. At the same time, their exchange rate (*ner*) and their production (*y*) move in a similar direction.

The responses of the domestic variables of Indonesia, Korea and Malaysia are quite similar but these countries are less vulnerable and their reactions to international shocks are more limited than in the previous period of analysis. The main negative impact in these three economies is on production. The Philippines and Thailand do not react significantly to these shocks.

China maintains its crawling peg and its responses to the common financial shock are different from those of other countries in the region, except regarding its interest rate.

We can thus conclude that the most industrialized countries are those most harmed by the crisis which spreads in the real sector of their economy. Moreover, a group of countries

formed by the Philippines and Thailand, which were the countries most vulnerable to the Thai crisis, have made significant progress in protecting their economy against international financial shock and in reinforcing their structural convergence. But many disparities still exist between the countries of the region and greater structural convergence is necessary in order to deepen their integration and envisage a monetary union.

5. Conclusion

Our results highlight the negative impact of the financial crisis in emerging Asean economies at the end of the last century. They were very vulnerable to international financial fluctuations because their growth depended mainly on the confidence of international lenders who invested a considerable amount of short term capital in these economies. This situation reveals the inability of emerging Asean countries to prevent and absorb these types of shocks during this period. The fact that all the region's emerging economies were hit by the crisis shows that the exchange rate regimes in place during this period were not sustainable.

But the comparison of these results with those from the second period of analysis allows us to observe several significant differences. In fact the recent stock exchange volatility seems to have had limited impacts on certain emerging Asean countries. On the other hand, the negative effects are more significant in industrialized ones, including China. We can conclude that the measures adopted by the emerging Asean economies at the beginning of this decade have been very efficient. They decided to limit their dependence on short-term capital flows, to reduce the risk of illiquidity of their economy and to consolidate their banking sector. These actions have made it possible, to a certain extent, to maintain international lenders' confidence in a period of international

fluctuations and thus to limit capital outflows. Today, a group of emerging markets constituted by the Phillipines, Thailand and, to a certain extent, Malaysia, Indonesia and Korea, has made significant progress in improving its capacity to limit the negative impact of international financial fluctuations. Moreover, the similarities in the responses of the Phillipines and Thailand to a common shock highlight a better structural financial convergence between them and towards a sustainable level.

We can conclude that the recent financial crisis has spread in the most advanced countries directly through the financial channel which includes both banking exchanges between the countries and variations in financial assets. The crisis has extended from the financial to the real sector in these countries. Thus, the fundamental contagion of the crisis in emerging markets is indirect and is propagated through the real channel of trade links between them and industrialized countries.

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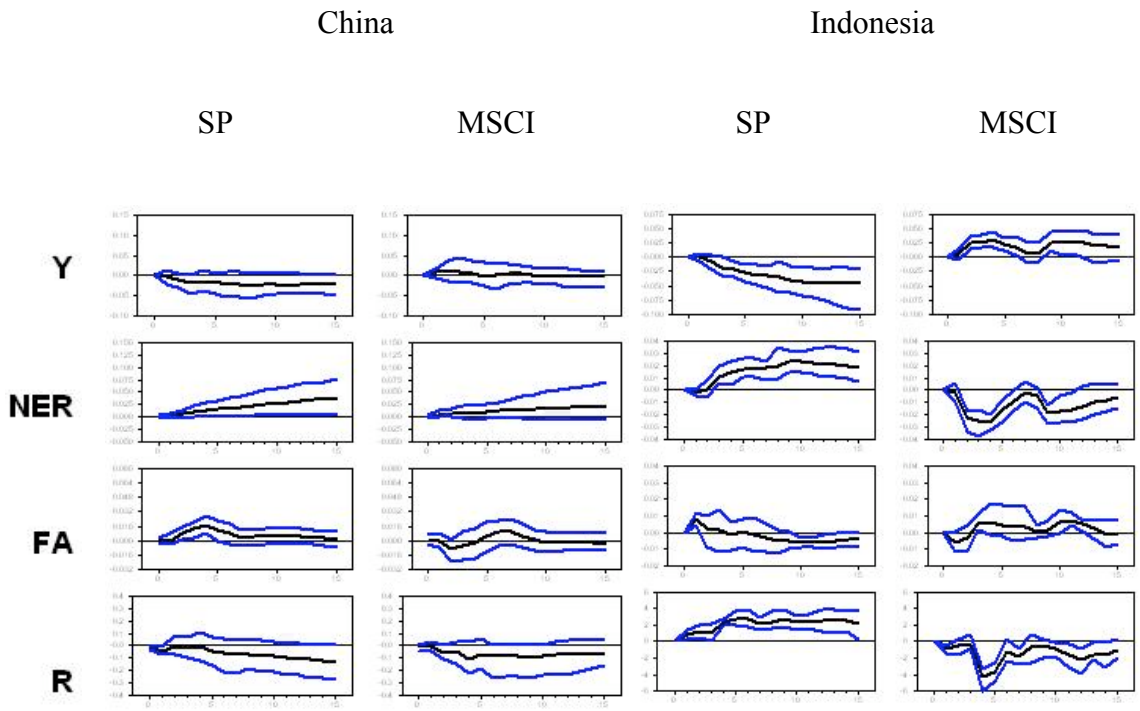
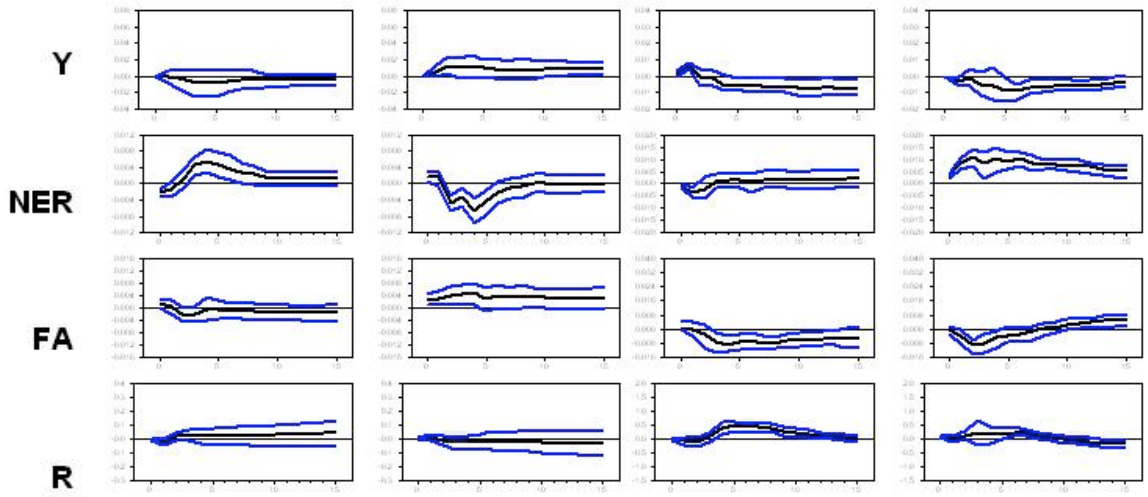
Appendix 1. Asean countries responses to a *MSCI* and a *SP* shock

Figures 1 to 16. Asean countries responses to a *SP* and *MSCI* shock during the first period.



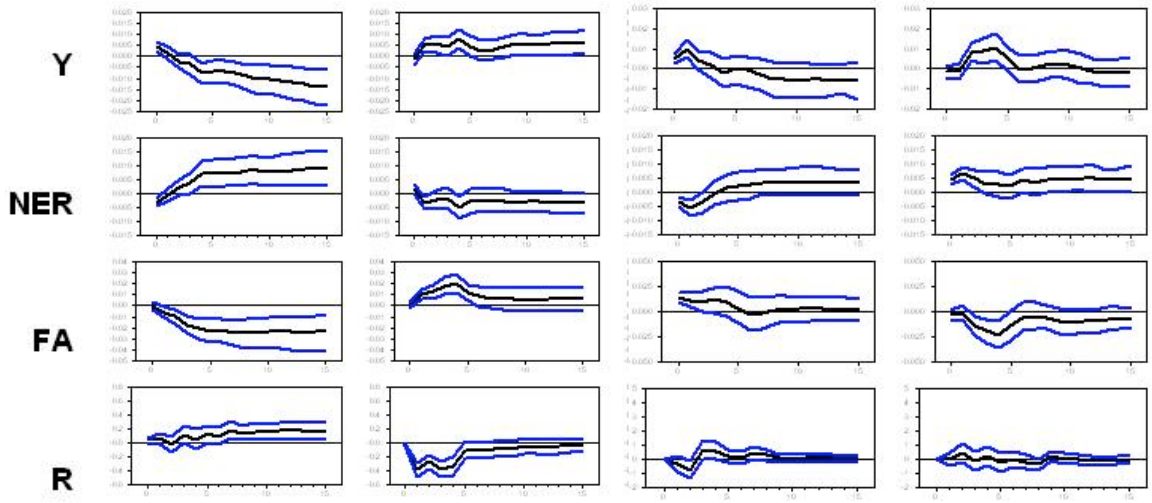
Japan Korea

SP MSCI SP MSCI



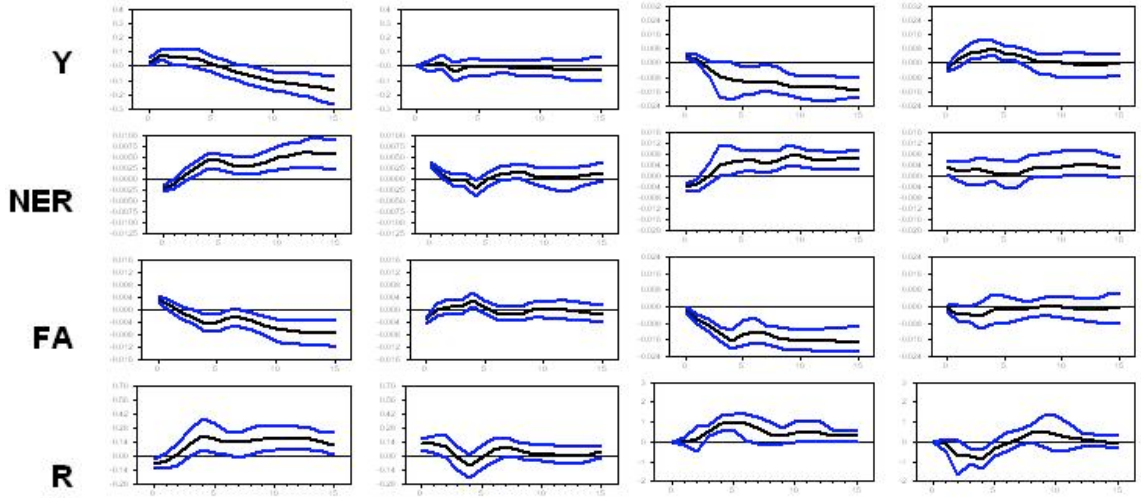
Malaysia Philippines

SP MSCI SP MSCI

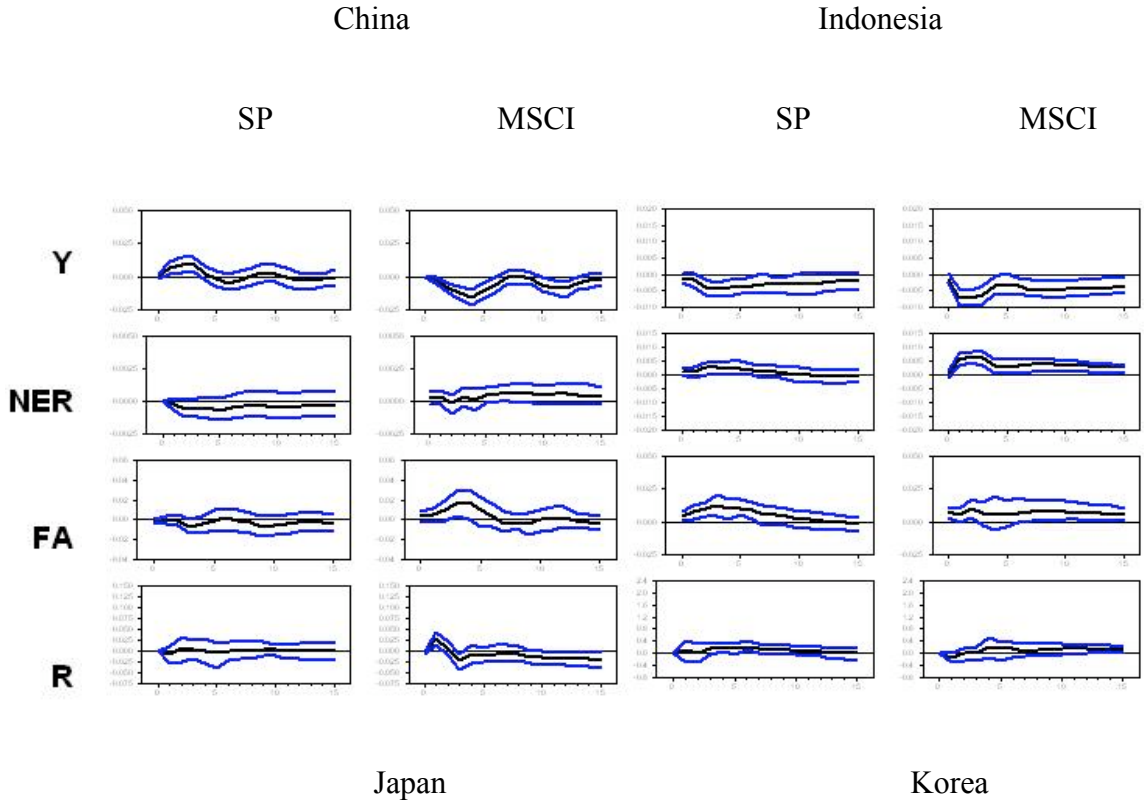


Singapore Thailand

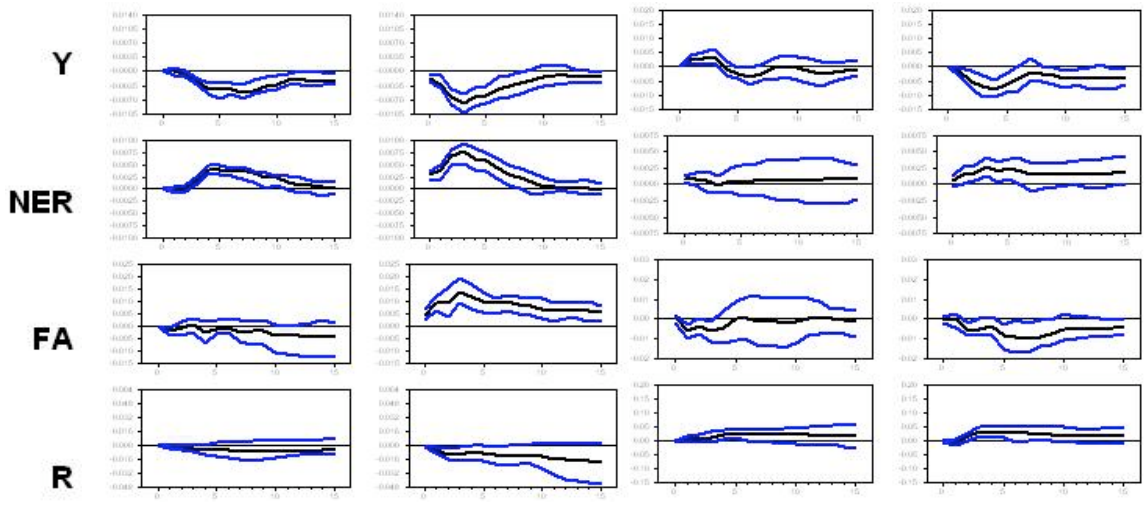
SP MSCI SP MSCI



Figures 17 to 32. Asean countries responses to a *SP* and *MSCI* shock during the second period

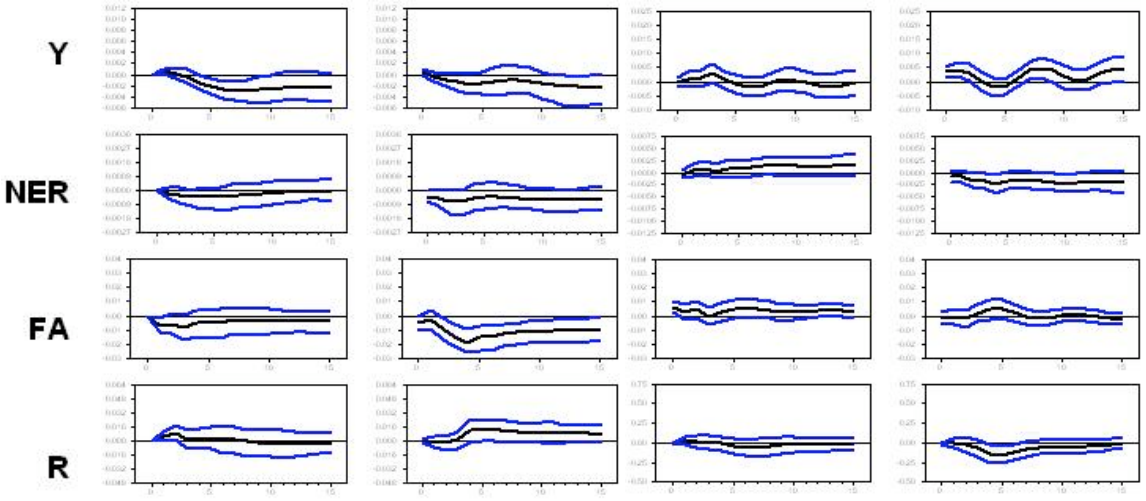


SP MSCI SP MSCI



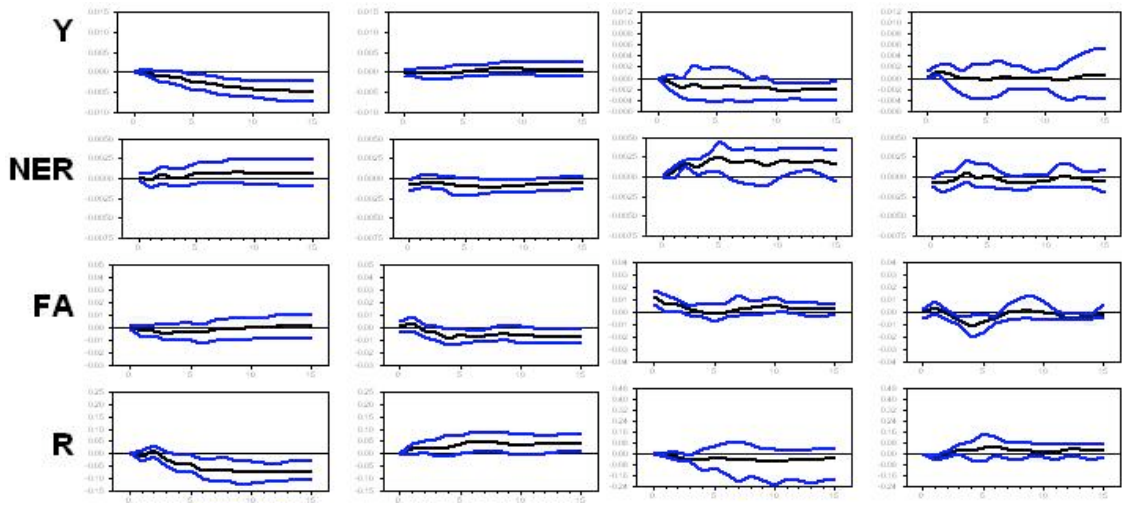
Malaysia Philippines

SP MSCI SP MSCI



Singapore Thailand

SP MSCI SP MSCI



Appendix 2. Forecast error variance decomposition further to a *MSCI* and a *SP* shock

Tables 1 & 2. Forecast error variance decomposition further to a *SP* shock (1st period)

Country	period	*y*	*ner*	*fa*	*r*
Malaysia	1	1.290	0.067	3.427	10.004
	2	3.912	0.261	5.473	9.081
	3	4.697	0.280	8.192	8.349
	6	7.890	4.721	8.262	8.303
	9	7.823	6.340	8.338	8.716
	12	8.662	6.733	8.226	8.653
Philippines	1	1.359	0.993	5.879	1.946
	2	2.196	2.753	7.168	1.792
	3	4.656	3.429	7.038	3.289
	6	11.695	8.339	9.086	3.583
	9	12.939	10.972	9.226	3.341
	12	12.333	11.678	9.245	3.600
Singapore	1	1.596	0.269	14.686	0.291
	2	1.413	0.635	14.723	1.124
	3	4.839	1.631	14.331	1.941
	6	4.988	6.777	18.345	2.562
	9	4.927	6.717	19.625	2.637
	12	6.166	7.456	19.460	2.988
Thailand	1	1.794	0.219	0.047	5.037
	2	8.599	0.425	9.005	4.126
	3	9.150	1.222	9.209	4.486
	6	9.207	1.522	9.165	12.565
	9	9.180	2.596	8.812	14.249

Country	period	*y*	*ner*	*fa*	*r*
China	1	0.237	3.613	4.723	0.475
	2	2.356	3.272	5.698	1.929
	3	2.208	3.587	8.022	1.807
	6	2.118	3.668	10.685	2.098
	9	2.902	3.568	10.601	2.136
	12	3.289	3.837	10.722	2.095
Indonesia	1	0.718	0.006	2.122	1.965
	2	8.155	0.191	12.518	1.626
	3	8.128	1.287	12.570	1.587
	6	8.157	3.350	12.621	5.477
	9	8.973	3.777	12.939	6.235
	12	8.934	3.946	12.932	7.255
Japan	1	1.034	0.118	2.170	1.437
	2	0.835	1.519	2.293	1.612
	3	5.205	5.807	4.222	1.679
	6	8.396	7.861	4.530	3.079
	9	8.552	7.796	5.113	3.200
	12	8.577	7.999	5.219	3.619
Korea	1	14.152	0.530	0.620	0.007
	2	11.752	2.487	4.383	0.385
	3	16.394	2.353	4.170	2.846
	6	16.785	3.853	5.576	4.587
	9	18.354	3.667	5.523	5.282
	12	18.250	3.999	5.619	5.440

Tables 3 & 4. Forecast error variance decomposition further to a MSCI shock (1st period)

Country	period	*Y*	*ner*	*fa*	*r*
Malaysia	1	1.006	6.376	0.000	0.182
	2	3.065	8.700	0.260	4.477
	3	6.856	8.306	0.248	4.346
	6	8.909	10.423	1.616	6.194
	9	12.400	11.462	2.351	6.420
	12	12.265	11.782	2.811	6.454
Philippines	1	1.962	0.105	4.300	0.955
	2	3.020	1.092	4.425	2.435
	3	6.847	1.760	4.078	2.353
	6	6.174	7.237	4.092	2.084
	9	8.450	7.634	5.252	2.243
	12	8.806	7.941	5.634	2.506
Singapore	1	2.040	7.755	0.030	0.670
	2	2.023	9.713	1.231	2.464
	3	1.795	12.862	11.260	2.484
	6	3.214	11.643	10.150	7.379
	9	4.714	13.671	10.584	7.439
	12	4.437	15.256	12.534	6.955
Thailand	1	0.009	0.085	0.140	0.004
	2	3.639	0.238	0.140	9.986
	3	3.533	3.736	1.744	9.622
	6	3.654	4.154	3.912	13.288
	9	3.608	4.061	5.051	13.576

Country	period	*y*	*ner*	*fa*	*R*
China	1	0.154	0.231	3.119	0.743
	2	0.420	0.815	3.147	1.598
	3	0.735	0.729	4.533	8.626
	6	1.791	0.900	4.682	14.787
	9	1.959	1.434	4.736	14.559
	12	1.963	1.937	4.846	14.705
Indonesia	1	1.005	0.213	0.391	1.904
	2	0.801	13.975	0.334	7.314
	3	0.977	13.599	0.495	8.663
	6	1.988	10.885	4.893	10.000
	9	3.029	10.773	6.260	12.974
	12	3.780	10.507	6.678	13.485
Japan	1	0.062	21.035	0.212	0.017
	2	2.354	20.656	0.204	1.216
	3	2.155	18.882	1.852	1.388
	6	3.972	22.168	3.219	1.314
	9	4.516	22.079	3.116	2.022
	12	4.487	22.347	3.115	2.050
Korea	1	9.525	4.505	0.263	0.133
	2	8.689	10.621	0.754	0.572
	3	9.086	10.112	3.238	3.023
	6	9.112	10.886	3.530	2.801
	9	8.725	11.795	5.925	2.815
	12	8.532	11.278	7.660	3.670

Tables 5 & 6. Forecast error variance decomposition further to a SP shock (2nd period)

Country	period	*y*	*ner*	*fa*	*r*
Malaysia	1	1.969	2.172	0.167	0.192
	2	2.463	2.482	1.201	0.220
	3	3.035	2.718	1.095	0.197
	6	3.406	3.054	1.698	0.571
	9	3.283	4.716	2.906	1.071
	12	3.297	5.178	2.935	1.418
Philippines	1	0.638	1.492	7.501	10.598
	2	0.636	6.276	7.187	10.817
	3	1.226	10.647	6.234	9.257
	6	2.585	9.332	9.600	17.080
	9	3.610	8.600	12.847	17.034
	12	4.146	8.809	13.794	16.536
Singapore	1	0.461	0.905	0.037	5.850
	2	1.055	3.411	2.733	6.435
	3	4.218	3.513	2.189	5.222
	6	4.949	4.160	6.408	4.525
	9	4.976	3.962	7.130	4.818
	12	5.577	3.854	7.018	4.748
Thailand	1	0.433	0.005	4.142	0.002
	2	0.639	1.368	4.458	1.015
	3	2.157	2.045	4.161	1.363
	6	5.336	2.872	5.440	2.960
	9	6.670	6.665	5.479	4.637

Country	period	*y*	*ner*	*fa*	*r*
China	1	0.259	0.009	0.011	0.001
	2	0.263	0.066	2.373	0.736
	3	0.738	1.402	2.347	1.742
	6	0.753	2.467	2.685	3.030
	9	1.125	3.048	2.659	3.932
	12	1.180	3.384	2.930	4.217
Indonesia	1	2.880	0.037	1.165	1.809
	2	2.621	0.075	1.787	1.788
	3	11.197	0.169	1.522	2.529
	6	10.532	1.231	3.990	2.804
	9	10.222	2.096	5.983	3.151
	12	10.217	2.817	6.446	3.320
Japan	1	0.177	0.000	7.090	0.017
	2	2.019	0.019	6.245	0.224
	3	2.745	3.566	4.854	0.886
	6	3.867	10.431	4.566	1.216
	9	6.830	11.860	4.247	2.357
	12	6.857	14.175	3.876	5.466
Korea	1	1.424	0.958	0.009	7.247
	2	1.146	14.386	0.327	18.976
	3	1.088	15.997	0.707	20.223
	6	1.428	14.222	0.757	21.903
	9	2.178	16.138	1.156	20.676

Tables 7& 8. Forecast error variance decomposition further to a MSCI shock (2nd period)

Country	period	*y*	*ner*	*fa*	*r*
Malaysia	1	0.219	0.241	22.059	0.380
	2	0.543	0.416	22.771	0.713
	3	0.542	0.839	21.678	0.889
	6	0.562	3.689	25.062	0.898
	9	0.548	3.620	24.449	0.983
	12	0.577	3.780	24.322	1.115
Philippines	1	1.701	4.146	21.552	1.998
	2	1.917	5.266	22.038	1.957
	3	6.138	6.663	20.262	2.933
	6	7.630	8.743	18.676	8.576
	9	7.997	8.659	18.835	9.210
	12	8.118	9.066	18.887	9.331
Singapore	1	2.969	2.355	15.568	0.420
	2	5.043	6.741	16.015	6.924
	3	4.847	10.896	14.105	11.924
	6	9.827	10.020	15.779	12.120
	9	11.073	9.577	15.217	13.060
	12	11.719	9.399	15.368	13.133
Thailand	1	12.602	0.530	22.709	1.951
	2	12.442	2.743	21.203	1.935
	3	10.749	14.408	18.845	1.672
	6	11.496	19.484	20.481	1.725
	9	10.512	23.594	22.154	2.047

Country	period	*y*	*ner*	*fa*	*r*
China	1	7.884	12.336	0.741	0.370
	2	7.270	14.688	1.134	3.120
	3	6.876	14.619	1.135	3.066
	6	7.093	19.390	1.237	3.222
	9	10.802	19.005	1.577	3.436
	12	10.892	19.266	1.704	3.457
Indonesia	1	0.011	1.136	6.209	13.585
	2	5.241	1.413	8.170	11.964
	3	11.366	1.703	8.137	10.943
	6	10.830	2.874	11.836	11.555
	9	10.674	2.840	12.704	12.262
	12	10.688	2.887	12.700	12.257
Japan	1	8.671	3.585	0.000	4.698
	2	13.766	3.459	0.101	7.072
	3	12.185	6.351	0.671	6.107
	6	14.438	14.588	1.937	5.655
	9	14.168	20.649	1.807	5.992
	12	14.062	21.485	2.041	6.171
Korea	1	1.863	2.324	8.560	0.468
	2	3.689	10.238	8.929	1.150
	3	4.456	9.953	9.046	1.214
	6	5.735	12.028	9.605	3.442
	9	5.864	11.975	10.865	3.523

Appendix 3. Correlation of the responses of the Asean countries to each financial shock.

Table 9. Responses to a SP shock (1st period)

	y	*ner*	*fa*	*r*
China-Indo	0.0998	0.6379	-0.1219	-0.3393
China-Japan	0.7208	0.6909	0.3479	0.1437
China-Korea	-0.3590	-0.3076	-0.6455	0.6974
China- Malay	0.4624	0.9401	-0.1518	-0.3996
China-Phil	0.0667	0.9037	0.4850	-0.1848
China-Singa	0.3599	0.3957	0.1897	0.0479
China-Thai	0.2491	0.6255	0.2041	0.3378
Indo-Japan	0.2340	0.8211	0.2738	0.2567
Indo-Korea	0.6842	0.6473	0.6764	0.6356
Indo-Malay	0.8514	0.7066	0.6049	0.6988
Indo-Phil	0.2086	0.3708	0.2539	0.2445
Indo-Singa	0.7111	0.4387	0.0103	0.5170
Indo-Thai	0.9622	0.8511	0.2001	0.3257
Japan-Korea	-0.6987	0.3309	-0.2149	0.5144

Japan-Malay	0.6218	0.7546	0.4508	0.0703
Japan-Phil	0.4519	0.7963	0.5119	-0.3667
Japan-Singa	0.5866	0.4294	0.2972	0.3628
Japan-Thai	0.3281	0.9192	0.8767	0.6217
Korea-Malay	0.2431	0.2034	0.5056	0.225
Korea-Phil	0.4398	0.2880	0.2301	0.2187
Korea-Singa	0.0662	0.0519	-0.0195	0.3807
Korea-Thai	0.3014	0.4592	0.2967	0.6282
Malay-Phil	0.3293	0.8236	0.2711	0.5175
Malay-Singa	0.8456	0.5058	0.1968	0.0242
Malay-Thai	0.8939	0.7551	0.6286	0.4422
Phil-Singa	0.3097	0.2731	-0.2657	-0.0745
Phil-Thai	0.2519	0.7222	0.3217	0.1189
Singa-Thai	0.7109	0.5789	0.5288	0.1915

Table 10. Responses to a MSCI shock (1st period)

	y	*ner*	*fa*	*r*
China-Indo	0.0667	0.2535	-0.2099	0.2581
China-Japan	-0.6341	0.2829	0.4485	-0.2721
China-Korea	0.4686	0.5926	0.1264	-0.0160
China- Malay	-0.3494	-0.4294	0.2430	-0.1196
China-Phil	0.4833	0.8256	0.0926	0.0228
China-Singa	-0.3067	0.1895	-0.1902	-0.0795
China-Thai	0.3200	0.3144	0.2407	-0.2211
Indo-Japan	-0.1787	0.2244	0.1719	0.2025
Indo-Korea	0.1532	0.0639	0.2765	0.3222
Indo-Malay	0.1473	0.2573	0.1948	0.1873
Indo-Phil	0.4923	0.0346	-0.05615	0.02347
Indo-Singa	-0.5776	0.6776	0.8938	0.6302

Indo-Thai	0.5329	0.4127	0.6715	0.3243
Japan-Korea	-0.1599	0.7473	0.2172	0.6462
Japan-Malay	0.7680	-0.1330	0.1204	0.6255
Japan-Phil	-0.4000	0.3190	-0.3912	-0.6653
Japan-Singa	0.0841	0.4527	0.3019	0.2632
Japan-Thai	-0.0118	0.6705	0.4231	0.8313
Korea-Malay	-0.2634	-0.2500	0.8182	0.8567
Korea-Phil	0.8215	0.7667	-0.6160	-0.6772
Korea-Singa	-0.3942	0.1538	0.3091	0.0392
Korea-Thai	0.8338	0.7538	0.7063	0.7676
Malay-Phil	-0.2439	-0.5102	-0.1631	-0.1730
Malay-Singa	0.1310	0.1697	0.1329	-0.0860
Malay-Thai	0.0058	-0.2574	0.4429	0.7413
Phil-Singa	-0.3578	-0.1654	-0.6175	-0.3838
Phil-Thai	0.8848	0.4719	-0.0641	-0.0565
Singa-Thai	-0.5393	0.4779	0.6683	0.2030

Table 11. Responses to a SP shock (2nd period)

	y	*ner*	*fa*	*r*
China-Indo	0.7096	-0.8981	0.4778	0.1174
China-Japan	0.3153	-0.5830	0.7337	-0.0511
China-Korea	-0.4887	0.6095	-0.6583	0.4278
China- Malay	0.6795	0.5826	-0.2041	0.2424
China-Phil	-0.2080	-0.2847	0.0547	0.3266
China-Singa	-0.4371	0.4473	0.2757	0.0128
China-Thai	0.5136	-0.8589	-0.6497	0.1967
Indo-Japan	0.4302	0.7196	0.1138	0.6744
Indo-Korea	0.4737	0.4090	0.2040	0.6933
Indo-Malay	0.4677	0.4368	0.6399	0.4358
Indo-Phil	-0.1809	0.2188	-0.3566	0.0328
Indo-Singa	-0.1773	-0.4502	-0.5067	0.1684

Indo-Thai	0.3492	0.1410	0.1180	-0.5550
Japan-Korea	-0.6368	-0.6214	-0.2918	0.7057
Japan-Malay	0.0468	-0.2766	0.0604	0.7528
Japan-Phil	-0.3628	0.2998	0.1461	-0.1325
Japan-Singa	0.3703	0.2866	0.2376	-0.2242
Japan-Thai	0.3820	0.6352	-0.4744	-0.8157
Korea-Malay	0.4856	0.5228	0.1728	0.7458
Korea-Phil	0.3518	-0.0579	0.1330	0.1165
Korea-Singa	0.3770	0.6105	-0.4355	0.0475
Korea-Thai	-0.7097	-0.8189	0.3281	-0.3194
Malay-Phil	-0.3471	-0.2450	0.1728	-0.0987
Malay-Singa	0.0863	0.8323	0.5377	-0.0602
Malay-Thai	-0.2507	-0.7941	-0.0692	-0.3408
Phil-Singa	0.0438	-0.2711	0.2735	-0.0074
Phil-Thai	0.3432	0.2648	0.2951	0.2726
Singa-Thai	-0.6916	-0.7035	-0.5979	0.3786

Table 12. Responses to a MSCI shock (2nd period)

	y	*ner*	*fa*	*r*
China-Indo	-0.1415	0.1488	-0.3499	0.0483
China-Japan	-0.5386	-0.7141	-0.5262	0.0566
China-Korea	-0.3207	0.5450	0.2545	0.1352
China- Malay	-0.1708	0.6242	0.3104	0.1213
China-Phil	0.1754	-0.3816	-0.3416	-0.1316
China-Singa	0.1253	0.2531	-0.0467	0.1754
China-Thai	0.2021	-0.5353	0.0142	-0.0972
Indo-Japan	-0.5331	-0.1163	0.1842	0.1969
Indo-Korea	0.2640	0.2591	0.2971	0.1405
Indo-Malay	0.3053	0.1084	0.4284	0.4867
Indo-Phil	-0.0064	-0.1912	-0.3052	0.1353
Indo-Singa	-0.0190	0.6088	-0.4091	-0.1100

Indo-Thai	-0.8571	-0.4688	-0.4124	0.6789
Japan-Korea	0.5142	-0.6083	0.0160	0.7306
Japan-Malay	0.7145	-0.8422	-0.1199	0.5522
Japan-Phil	0.1283	0.2293	0.2293	0.1603
Japan-Singa	0.1487	0.2531	0.4348	0.1939
Japan-Thai	0.6251	0.0667	-0.5382	-0.2864
Korea-Malay	0.6315	0.5983	0.4428	0.6902
Korea-Phil	0.1550	-0.0360	0.1080	0.2928
Korea-Singa	-0.0853	-0.1139	-0.1799	0.6885
Korea-Thai	0.1054	-0.0006	-0.3177	-0.7056
Malay-Phil	0.1160	-0.1797	0.1496	0.3620
Malay-Singa	-0.0944	-0.3216	0.4095	0.6545
Malay-Thai	0.1660	0.0757	0.0168	-0.1507
Phil-Singa	0.0940	-0.2025	-0.0601	0.6108
Phil-Thai	0.1718	0.1233	0.2621	0.1142
Singa-Thai	0.0501	-0.6774	-0.1666	-0.4885