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Alicia García-Herrero

Discussion Paper No. 2014-E-12

IMES

INSTITUTE FOR MONETARY AND ECONOMIC STUDIES

BANK OF JAPAN

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CHUO-KU, TOKYO 103-8660
JAPAN

IMES Discussion Paper Series 2014-E-12
December 2014

How Close is Asia to an Optimal Currency Area in Terms of Business Cycle Co-Movement?

Alicia García-Herrero*

Abstract

The paper assesses how close Asian countries are to an Optimal Currency Area in terms of business cycle synchronization, with a focus on supply shock asymmetry. Based on a Structural VAR model, the importance of symmetric and asymmetric supply shocks is teasted for all ASEAN+3 countries. In addition, a spatial approach is used to analyze its impact on the whole Asian region and on pairs of Asian countries. The conclusion is that there is evidence of increasing symmetry of supply shocks although the situation differs largely on a country by country basis. Such finding would support a multi-speed process of monetary integration in the region.

Keywords: Business cycle synchronization; Optimal Currency Area; Asian economic integration; Structural Vector Auto Regression; ASEAN+3

JEL classification: E32, F40, F44

***Chief Economist, Emerging Markets at BBVA and Visiting Professor at CEBIS (E-mail: alicia.garcia-herrero@bbva.com)

At the time the article was written, the author was a visiting scholar at the Institute for Monetary and Economic Studies of the Bank of Japan. During this period, the author was affiliated with the Bank of Spain and the Johns Hopkins University. The author thanks Xavier Argente for his valuable help and Jingye Dong for her assistance. Comments have been received by Eiji Ogawa, Daniel Santabarbara and Carmen Broto. The views expressed in this paper are those of the author and do not necessarily reflect the official views of the Bank of Japan.

1. Motivation

During the last couple of decades, the world has witnessed a move towards regional integration as opposed to multilateralism of trade and other economic relations. The East Asian region is of no exception, as exemplified by the creation of the Association of Southeast Asian Nations (ASEAN), starting in 1967. ASEAN was created with the purpose of fostering regional cooperation, accelerating economic growth and social progress, as well as protecting regional peace and security. Member States include Brunei, Cambodia, Indonesia, Lao, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam. Starting from the 1990s, this list has been expanded to include the ASEAN+3 (People's Republic of China, Japan and South Korea) and the East Asia Summit (All the countries under the ASEAN+3, Australia, India, New Zealand, Russia and the United States).In 1998, in the aftermath of the Asian crisis, ASEAN+3 embarked in joint economic surveillance, which culminated in the adoption of the Joint Statement on East Asia Cooperation at the Manila Summit in 1999. A number of free trade agreements between ASEAN and Japan (2003), China (2010) and Korea (2010) have been signed since.

Policies under ASEAN have resulted in an increase of trade volume and foreign direct investment (FDI) flows towards this region (see figures 1 and 2). More specifically, Japan's interregional merchandise trade has been experiencing a sharp increase since the aftermath of the Asian Financial Crisis, when trade within the region was dampened by economic conditions (see figure 3). Although FDI within the regional peers is less concentrated than trade (China dominates interregional FDI, accounting for about 80% of total FDI), overseas investment is still important, as increased trade and FDI have led to regional economic structure convergence (figure 4).

Interregional efforts on the aspects related to monetary cooperation have started later and are less concrete, but still relevant. The Chiang Mai Initiative (a multilateral currency swap agreement among the ASEAN+3 set up in March 2010) was created to offer countries a cushion in case of a future financial crisis. Since then, efforts have been made to multilateralize these arrangements, which could turn funds for rainy days much more similar to those of the IMF. Other steps taken include moving towards bond market regional integration, for example, through the Asian Bond Funds (ABF1 in 2003 and ABF2 in 2004).

In parallel, there have been different proposals to increase exchange rate coordination. One is a basket-peg or a semi-pegged system such as an Exchange Rate Mechanism (ERM) type arrangement; another, which is much bolder,is the proposal to create a monetary union in a phased approach.

Even if distant and unlikely, a monetary union would imply such an important change for Asian countries that careful thinking is needed. According to Mundell (1961), the economic feasibility of a monetary union is generally assessed by the closeness of countries to an Optimal Currency Area (OCA). How close a country is to an OCA depends on a number of factors: (i) symmetric shocks, particularly those affecting the supply side (as demand side shocks are easier to accommodate); (ii) factor mobility (labor and capital); and (iii) wage and fiscal flexibility.

Having similaror symmetric shocks can be seen as being the most important criteria of an optimal currency area, as different or asymmetric shocks make it very hard for the Central Bank of a Monetary Union to create coordinated Monetary Policy. In fact, if shocks are sufficiently symmetric, factor mobility and wage flexibility may not be needed.

The positive impact of trade and FDI links on business cycle synchronization (as shown empirically by Garcia-Herrero and Ruiz, 2005) suggests that shocks in

Asian countries should be more symmetric over time. This is in fact this paper's testable hypothesis. Initial results support the theory that supply shocks are becoming increasingly symmetric in Asia, although this situation differs widely from country to country.

2. Literature

We can identify two main strands of literature. The first strand refers to the symmetry of supply shocks while the other relates to which factors are more relevant and which origins they have.

The first strand of literature is fairly optimistic; however, the results vary depending on tools and approaches used. A comparison of the multiple results and methodologies shows that there is a relatively high symmetry of supply shocks that can generally be found through different methodologies. In several cases, it resembles the situation of Europe before the creation of the European Monetary Union. For instance, Bayoumi and Eicheengreen (1996) argue that the East Asia Region meets the requirements to be considered an optimal currency area in economic terms, as adjustment to shocks is fast while supply and demand disturbances are small and symmetric even by European standards. Furthermore, the authors state that increasing trade links within the region would also benefit from a currency that is not pegged or weighted to the dollar or the yen, thereby reducing uncertainty in the markets. However, from the institutional and political points of view, they note that there are some drawbacks to consider. For instance, there is abundant evidence showing that the region lacks uniformity in financial conditions – some economies are open financial centers while others are struggling to develop their financial system. Another major difference from Europe is the lower level of united political actions towards external shocks.

Along the same lines, Baek and Song (2002) make use of the closed-economy model and the Blanchard-Quah decomposition to investigate the potential correlation of shocks. Their results show that interregional trade in the East Asia

Region is as high as that of Western Europe in 1999. They also find that supply and demand disturbances are significantly correlated between Hong Kong, Indonesia, Japan, Korea, Malaysia, Thailand and, to a lesser degree, Taiwan.

Conversely, Girardin (2005) studies the coexistent correlation of the probability of two regimes: growth-recession and rapid growth. Through this integrated framework where cross-country correlations depend on the phase of the business cycle, the author finds that the synchronization with Japan is never present in the normal-growth regime and therefore concludes that it may be somewhat premature to engage in exchange rate arrangements with the yen.

The second strand of literature stresses that global factors are more relevant than regional ones. As reference points to create a dynamic factor model, Kose, Otrok and Whiteman (2003) investigate the common dynamic properties of business cycle fluctuations across countries, regions and the world. Lee, Park and Shin (2004) find that there is some evidence of regional financial integration in East Asia based on the gravity model of cross-border portfolio asset and bank claim holdings. However, they also note that East Asia tends to be relatively more linked to the global markets than integrated with one another in the region, particularly compared with Europe.

Conversely, Blanchard-Quah, Clavel et al. (2005) use variance decomposition and principal component analysis apart from correlation to test the commonality of shocks within a Structural Vector Auto Regression (SVAR) framework but they adopt sign-restriction for identification.

Excluding the aforementioned literature, we found very little literature covering the change in the degree of asymmetry of shocks (i.e. convergence) given Asia's rapid development. Similarly, investigations on the differences in the degree of asymmetry across groups of countries are very limited. This paper aims to make a contribution to the literature in relation to these two issues.

3. Objective

The main objective of this paper is to assess how close Asian countries are to an OCA with a focus on supply shock asymmetry. A preliminary approach points out that demand shocks should converge if common monetary policy is introduced, as well as fiscal rules.

First, we test the importance of different types of shocks for each country using variance decomposition. We will then proceed to analyze the size of supply shocks and the speed of adjustment. Next, we focus on the symmetry or asymmetry of supply shocks. On a spatial approach, we analyze its impact on the whole region and on pairs of countries. We will use the common factor obtained from principal components to test the importance of different shocks and we obtain our results through Pearson correlation coefficients. As for its evolution over time, or test of convergence, we use Kalman filter.

Finally, we will test the “leadership hypothesis” (i.e. regional leader´s influence over other countries’ supply shocks) and will cluster countries in terms of symmetry of supply shocks vis-à-vis the leaders. Should this hypothesis be refuted, we would proceed with the more influential countries: Japan and China.

4. Methodology

The theoretical benchmark is a typical neoclassical model used for a small open economy. It is based on previous Structural Vector Auto Regression (SVAR) models for open economies (Ahmed and Park, 1994 and Hoffmeister and Roldós, 1997). In this method, we start from a small economy model (Bayoumi and Eichengreen,1996) featuring only aggregate supply (AS) and aggregate demand (AD) shocks and introduce a mirror model for the rest of the world.

With regards to the impact on domestic output, external demand (ED) and domestic demand (DD) shocks do not have a long run impact (Y) but external supply (ES) and domestic supply (DS) shocks do. On the price (P) front, ED and DD will push up higher prices, while ES and DS lower prices.

Outputs and prices influenced by demand and supply shocks in short run and long run are summarized here:

Table 1: Impact of demand and supply shocks on outputs and prices

ε^{s^*} (Y*)				ε^{d^*} (P*)				ε^{s}				ε^{d}			
Short run		Long run		Short run		Long run		Short run		Long run		Short run		Long run	
Y	P	Y	P	Y	P	Y	P	Y	P	Y	P	Y	P	Y	P
+	-	+	-	+	+	no	+	+	-	+	-	+	+	no	+

For each country we estimate a four-equation SVAR model. In order to do so we apply a Blanchard-Quah (1989) decomposition of temporary and permanent shocks with a number of long-run restrictions for identification:

1. Small open economy (cannot influence external output (Y*) and external prices (P*)):

$$a_{13i} = 0;\ a_{14i} = 0;\ a_{23i} = 0;\ \text{and}\ a_{24i} = 0$$

2. A domestic AD shock does not influence Y in long run:

$$a_{34i} = 0$$

3. An external AD shock does not influence Y in the long run but external AS shock (Y*) could influence Y:

$$a_{32i} = 0$$

4. P* does not affect Y* (but Y* may affect P*): opposite restriction tested:

$$a_{12i} = 0$$

As a result, the system is identified as:

$$\begin{bmatrix} \Delta Y_t^* \\ \Delta p_t^* \\ \Delta Y_t \\ \Delta P_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21i} & 1 & 0 & 0 \\ a_{31i} & 0 & 1 & 0 \\ a_{41i} & a_{42i} & a_{43i} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{y^*t} \\ \varepsilon_{p^*t} \\ \varepsilon_{st} \\ \varepsilon_{dt} \end{bmatrix}$$

Meanwhile, in order to carry out the test of convergence in symmetry of shocks, we deploy the Kalman-filter:

$$X_t^j - X_t^i = \alpha_t + \beta_t \left(X_t^j - X_t^k \right)$$

X represents shocks, j is the country of interest, i is the Asian country the convergence is tested against, and k is the United States (US). In addition, alpha and beta are characterized by the following transition equations:

$$\alpha_t = \alpha_{t-1} + \eta_{1t}$$
$$\beta = \beta_{t-1} + \eta_{2t}$$

5. Data

As a proxy, we use the quarterly US GDP growth and inflation as external output (Y*) and external prices (P*) and quarterly domestic GDP growth (Y) and inflation (P) for Asian countries (including ASEAN+3, India, Australia and New Zealand):

Y* : quarterly real GDP growth

P*: quarterly CPI inflation for the US

Y: Quarterly real GDP growth for ASEAN+3 countries, India, Australia, and New Zealand

P: Quarterly inflation for ASEAN+3 countries, India, Australia, and New Zealand

6. Results

After conducting the relevant tests, we make out that all series are stationary, or I(0). Moreover, the optimal number of lags for SVAR was chosen on the basis of Akaike and Schwartz information criteria. As a general rule, we opted for 1-2 lags, except for Japan and China, where we used 4.

As for the response to shocks, we obtained generally good responses to the four shocks from impulse response functions. Results showed that supply shocks, both domestic and external, tend to increase output and reduce prices, while demand shocks tend to increase output in the short term and prices also in the long term. We have not found an awkward behavior of prices to domestic demand shocks (i.e. a fall) in any country, as has sometimes been said of emerging countries (Maskay, 1998).

As can be seen in annex figure 5, different kinds of shocks are generally uncorrelated. However, special attention must be given to the case of Korea and its responses to shocks, as can be seen from annex figure 6.

Another analysis is the effect of each type of shock coming from different countries of the region on US output and prices, both external and domestic (For a summary table of the results, see figure 7).

Results tend to be robust to other specifications. If the EU economy is included for external variables or if US Fed fund rate is included as external demand shock instead of inflation, robustness of the tests remains unaltered. The same happens when we introduce the terms of trade as external supply shock instead of US real GDP growth.

External prices (P*) does affect external output (Y*)

In order to test the large closed-economy hypothesis, we have used a 2-equation SVAR for China, India and Japan. Results show that external prices and external output influence these countries but not the opposite.

As for the importance of shocks, the variance decomposition of each country's SVAR shows that the significance of different types of shocks for domestic output and prices is rather similar across Asian countries. While domestic supply shocks mostly influence domestic output, inflation is mostly influenced by domestic demand shocks. (See annex figure 8, 9 and 10 for a summary of the results)

In comparison with existing results of the literature, domestic shocks are also found to dominate output fluctuations in Clavel et al. (2005) and also in Kose, Otrok and Whiteman (2003). Nevertheless, external shocks are slightly more important for Clavel et al. (2005) than for us. However, it must be noted that they use world output instead of US output as a proxy for external output.

In a similar fashion to this study, Clavel et al. (2005) find that China´s output is most affected by external shocks. Similarly relevant external shocks on prices also affect China, Japan and Singapore.

As it can be seen in annex figure 11, external shocks do not Granger-cause domestic ones and, therefore, they are not more important in an intertemporal sense.

Annex figure 12 portrays how countries like Korea and Japan stand out from the rest when it comes to the speed of adjustment and the size of shock. As in Bayoumi and Eichengreen (1996), the size of the estimated domestic supply shocks are very similar except for Philippines and Thailand. It is likely that the Philippines has smaller DS shocks as it was less influenced by debt crisis in the 1980s, while Thailand's shocks may reach a greater extent due to Asian crisis. Our results are also similar to their estimates of size of shocks for Europe, although ours are smaller for Latin America. As for the speed of adjustment, there is a slower adjustment speed now but it is still higher than their estimates for Europe.

A shock symmetry analysis through common factor shows that the first component explains 44% of variance of DS shocks in ASEAN-5, which is very close to the 0.5 size of regional factor in Lee, Park and Shin (2005) (see annex figure 13). If we do so through bilateral correlation, we see that correlation is obviously very high for external supply shocks, while the correlation of domestic supply shocks is high only in a number of cases. There is a high positive correlation between Malaysia and Philippines, as well as between Korea and these two countries (annex figure 14 and 15).

In comparison with Bayoumi and Eichengreen (1996), correlation is in general lower, although still higher than that of Clavel et Al. (2005). This indicates that, to a large extent, results on bivariant correlations depend on identification methodology for SVAR and the sample period. For the first issue, it is probably better to look at principal components, while for the second, it is better to use a time-variant coefficient as the Pearson correlation is too static.

To analyze the convergence of domestic supply shocks and answer the question on whether they become more similar over time, the Pearson correlation once again is not adequate as it only shows a static picture. For these reasons, it is

better to use a Kalman filter. Results show that domestic supply shocks converge in practically all cases –against both Japan and China as well as compared to the US.

Domestic supply shocks tend to converge with those of Japan in all countries but Thailand and (only recently) India. The speed of convergence is the fastest in Indonesia but can also be found in the cases of Malaysia, Philippines and Korea. Similarly, after some divergence, Singapore is converging very rapidly too (annex figures 16 and 17).

In the case of convergence with China (annex figure 18 and 19), Singapore's DS shocks converge very quickly, in a similar fashion as Malaysia and, to a lesser extent, Philippines and Korea. As for the rest, there is little convergence, albeit no divergence. Except for Singapore (with much faster convergence with China), there are similar levels of convergence against Japan and China.

Notwithstanding convergence between most countries and Japan or China, their DS shocks do not seem to Granger cause those of other countries. The implication here is that the leadership hypothesis is not confirmed. Japan's DS shocks do not anticipate DS shocks in any other country and China's DS shocks Granger cause those of Malaysia (and those of Singapore) (see annex figure 20).

The next step is to group Asian countries in terms of the symmetry of supply shocks. We will take Japan and China, the largest and most influential countries, as benchmarks and proceed to use a cluster analysis through standard methodology. Hierarchical agglomeration is calculated with Euclidean distance:

$$(x,y) = \{ i (xi - yi)2 \}^{1/2}$$

As linkage rule, we will use a weighted average. The distance between clusters is calculated as the average distance between all pairs of objects weighted by

the size of the respective cluster. This method is preferred because the cluster size is expected to be uneven.

The variables chosen for clustering countries, depending on their similarity with Japan's S shocks, are:

- *Similarity of importance of shocks:* It is constructed as the inverse of the difference (in absolute value) between the percentage of variance explained by DS shocks for a given country and Japan (Same for ES shocks).
- *Size* shocks of DS and ES shocks (constructed as above)
- *Speed of adjustment* (constructed as above)
- *Bivariate correlation* of DS and ES shocks
- *Speed of convergence* of the symmetry of DS shocks against Japan (see annex figure 21 for Japan, and 22 for China).

As for the robustness of grouping, the results are very robust to different linkage rules (simple average, median, single linkage, centroid, wardslinkage). However, it should be well noted that these groupings are only on the basis of similarity of S shocks and that we would probably reach different results if a larger group of variables were taken.

7. Conclusions

After analyzing the results, we conclude that there is evidence of increasing symmetry of domestic supply shocks. These are the most relevant shocks for an Optimal Currency Area, as external supply shocks are less relevant in terms of variance decomposition and domestic demand shocks should be reduced via the implementation of single monetary policy and common fiscal policy rules.

Nevertheless, the situation differs largely on a country by country basis. There are different clusters of countries in terms of the symmetry of domestic supply shocks that can be found for Japan and China. We thus come to the conclusion that the current situation calls for a multi-speed process of monetary integration in the region.

This statement about the pace of adjustment is in line with ADB President Kuroda's vision for Asia:

> *"The most pragmatic scenario would be a multi-track, multi-speed approach that allows the various countries and subregions to embrace regional cooperation and integration according to their particular needs and levels of development "*
>
> Speech in Boao, April 22, 2006

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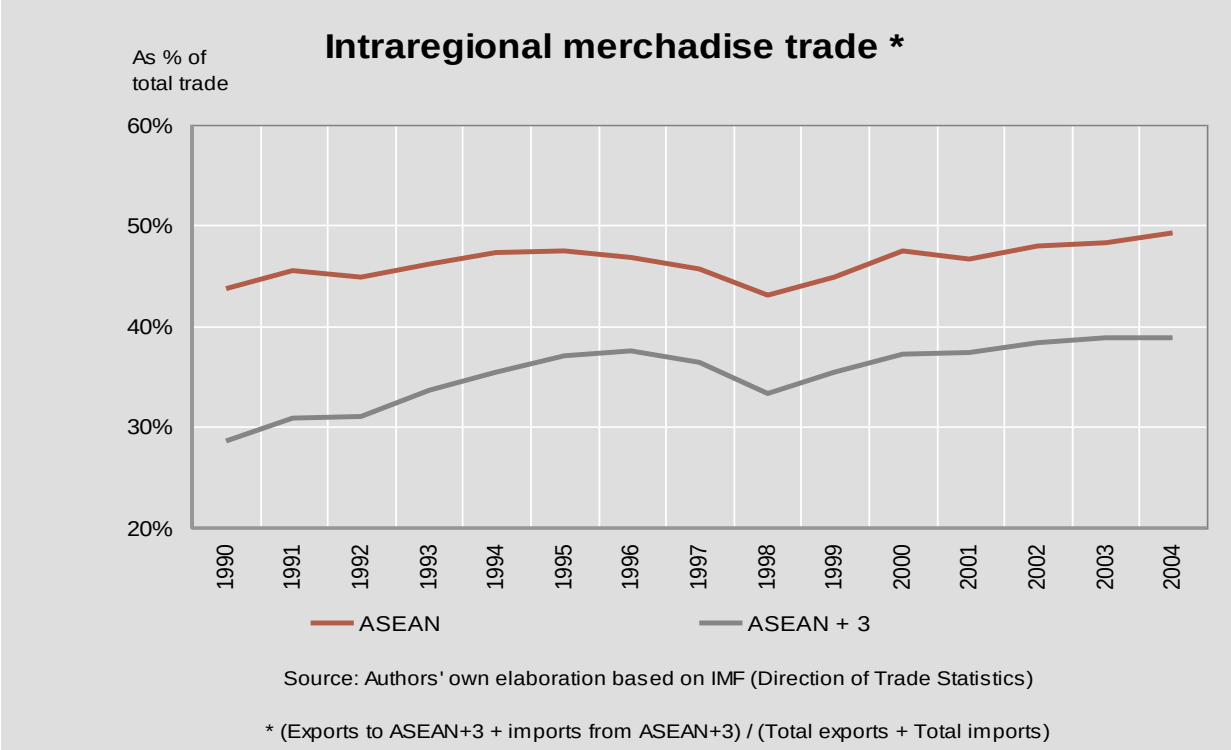
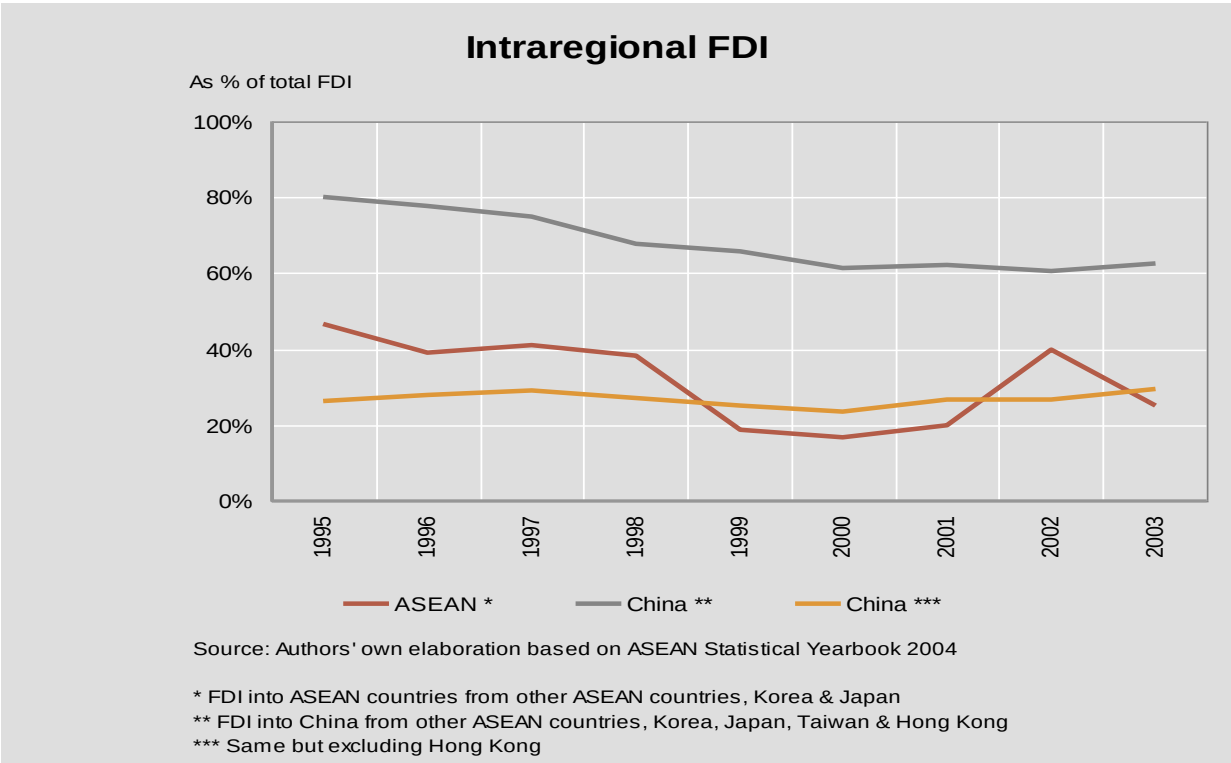
Figure 1:



Source: Authors' own elaboration based on IMF (Direction of Trade Statistics)

* (Exports to ASEAN+3 + imports from ASEAN+3) / (Total exports + Total imports)

Figure 2:



Source: Authors' own elaboration based on ASEAN Statistical Yearbook 2004

* FDI into ASEAN countries from other ASEAN countries, Korea & Japan
** FDI into China from other ASEAN countries, Korea, Japan, Taiwan & Hong Kong
*** Same but excluding Hong Kong

Figure 3:

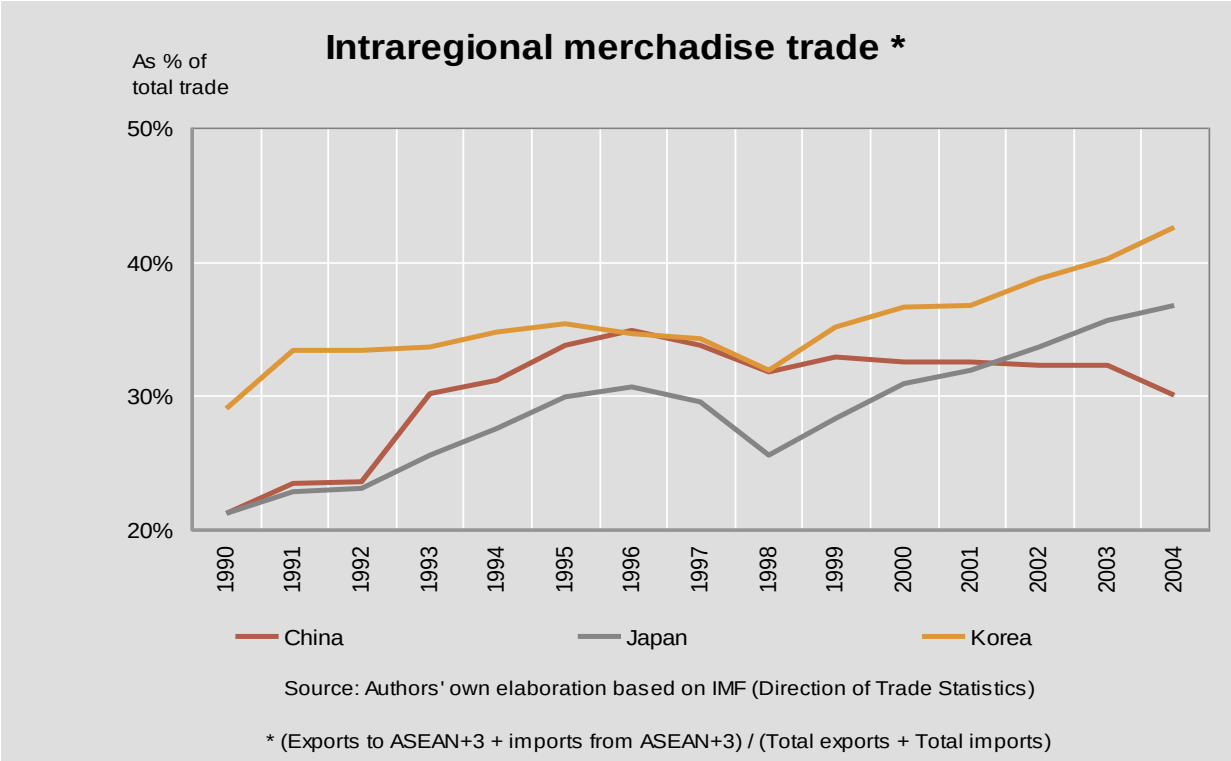


Figure 4:

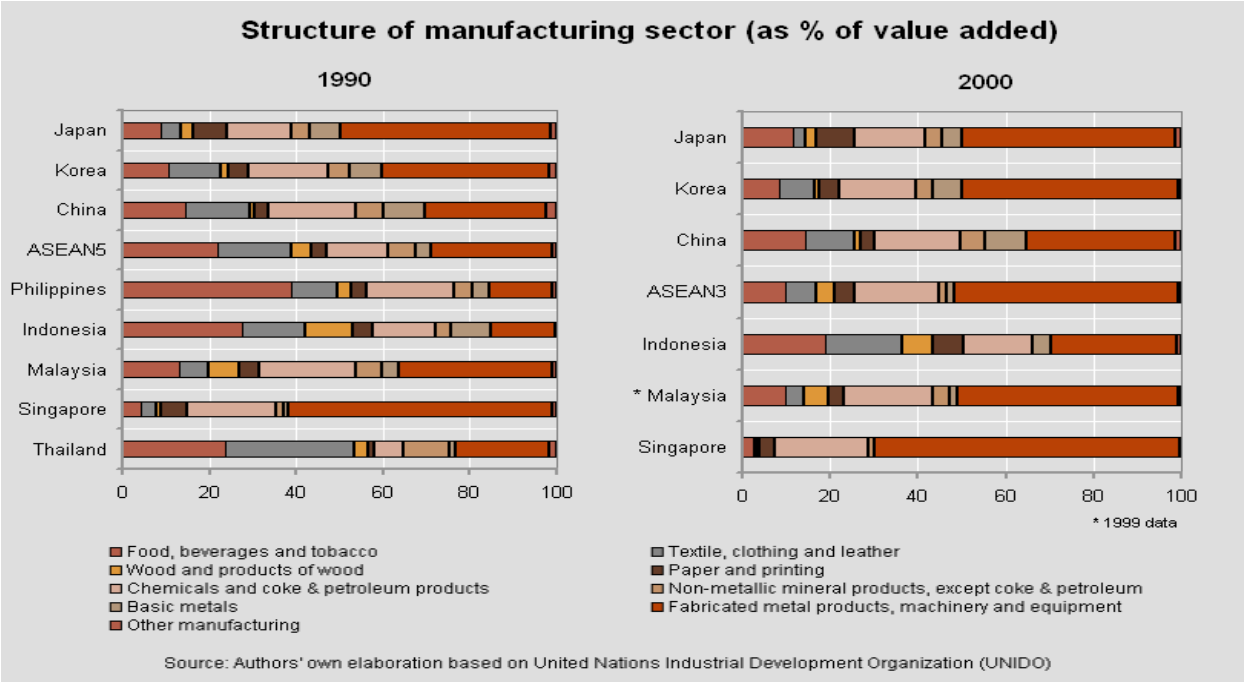


Figure 5

INDONESIA	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.210	1.000		
Domestic supply shock	-0.154	0.409	1.000	
Domestic demand shock	0.110	-0.335	-0.653	1.000

MALAYSIA	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.286	1.000		
Domestic supply shock	-0.128	0.138	1.000	
Domestic demand shock	-0.067	-0.004	-0.229	1.000

PHILIPPINES	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.274	1.000		
Domestic supply shock	0.107	0.002	1.000	
Domestic demand shock	-0.132	-0.063	-0.272	1.000

SINGAPORE	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.227	1.000		
Domestic supply shock	0.030	0.034	1.000	
Domestic demand shock	-0.221	0.472	-0.126	1.000

THAILAND	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.085	1.000		
Domestic supply shock	0.191	0.022	1.000	
Domestic demand shock	-0.175	0.308	-0.114	1.000

CHINA	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.165	1.000		
Domestic supply shock	0.147	0.323	1.000	
Domestic demand shock	-0.032	0.198	-0.021	1.000

JAPAN	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.023	1.000		
Domestic supply shock	0.089	0.234	1.000	
Domestic demand shock	0.225	-0.063	-0.148	1.000

KOREA	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.256	1.000		
Domestic supply shock	-0.026	0.162	1.000	
Domestic demand shock	-0.069	0.108	-0.451	1.000

AUSTRALIA	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.234	1.000		
Domestic supply shock	0.253	-0.129	1.000	
Domestic demand shock	-0.467	0.275	-0.057	1.000

INDIA	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.166	1.000		
Domestic supply shock	0.130	0.532	1.000	
Domestic demand shock	0.428	-0.239	-0.020	1.000

NEW ZEALAND	External supply shock	External demand shock	Domestic supply shock	Domestic demand shock
External supply shock	1.000			
External demand shock	-0.230	1.000		
Domestic supply shock	-0.107	0.066	1.000	
Domestic demand shock	-0.283	0.238	0.198	1.000

HIGH POSITIVE CORRELATION

MEDIUM POSITIVE CORRELAT

Figure 6

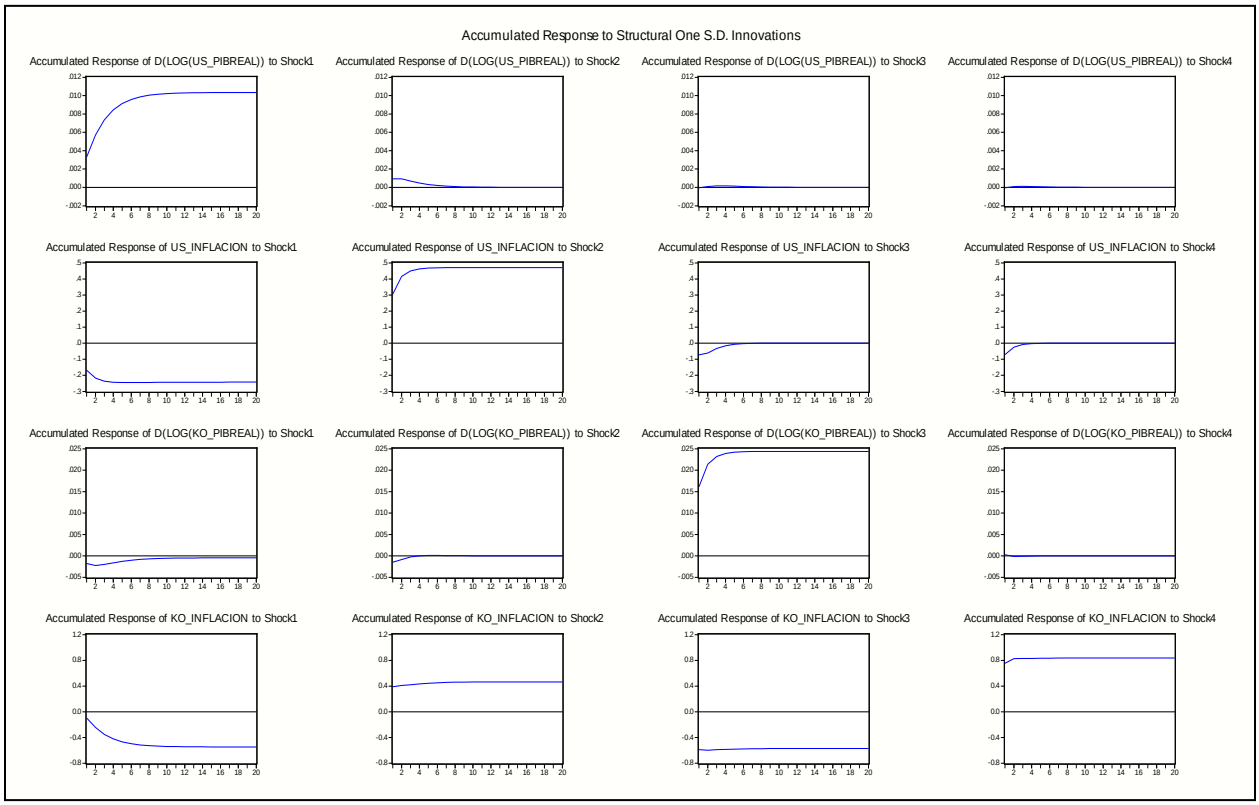


Figure 7

		Effects of each type of shock on US output (Y*), US prices (P*), domestic output (Y) and domestic prices (P)																											
		External agg. supply shock								External agg. demand shock								Domestic agg. supply shock								Domestic agg. demand shock							
		Y*		P*		Y		P		Y*		P*		Y		P		Y*		P*		Y		P		Y*		P*		Y		P	
	Lags	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T	S-T	L-T
Hypothesis		+	+	-	-	+	+	-	-	+	0	+	+	+	0	+	+		0		0	+	+	-	-		0		0	+	0	+	+
Indonesia	2	+	+	-	-	-	-	+	+	+	0	+	+	-	0	+	-	+	0	-	0	+	+	-	-	+	0	+	0	+	0	+	+
Malaysia	1	+	+	-	-	0	+	+	+	+	0	+	+	-	0	+	+	-	0	-	0	+	+	-	-	-	0	-	0	-	0	+	+
Philippines	1	+	+	-	-	+	+	+	-	+	0	+	+	+	0	+	+	0	0	+	0	+	+	-	-	-	0	-	0	+	0	+	+
Singapore	2	+	+	-	-	+	+	-	-	+	0	+	+	-	0	+	+	0	0	-	0	+	+	-	0	+	0	-	0	-	0	+	+
Thailand	1	+	+	+	+	+	-	+	+	-	0	+	+	+	0	+	+	+	0	-	0	+	+	-	-	-	0	+	0	+	0	+	+
China	4	+	+	-	+	+	-	-	-	-	0	+	+	+	+	+	-	+	0	-	0	+	+	+	+	+	0	+	0	-	-	+	+
Japan	4	+	+	-	0	+	+	+	+	+	0	+	+	+	0	+	+	-	0	-	0	+	+	-	-	-	0	+	0	+	0	+	+
Korea	1	+	+	-	-	-	0	-	-	+	0	+	+	-	0	+	+	+	0	-	0	+	+	-	-	+	0	-	0	+	0	+	+
Australia	1	+	+	-	-	+	+	-	-	+	0	+	+	+	0	+	+	-	0	+	0	+	+	+	0	+	0	-	0	+	0	+	+
India	1	+	+	-	0	+	-	+	+	+	0	+	+	+	0	-	-	0	0	+	0	+	+	+	+	0	0	+	0	-	0	+	+
New Zealand	1	+	+	-	-	+	+	+	-	+	0	+	+	+	0	+	+	0	0	+	0	+	+	-	-	-	0	-	0	+	0	+	+

SINGNIFICANT COUNTERINTUITIVE RESULTS
NON-SINGNIFICANT RESULTS
NOT CLEAR RESULTS

Figure 8

Impact of each type of shock on growth and inflation									
		External supply shock		External demand shock		Domestic supply shock		Domestic demand shock	
	Impact on	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation
Indonesia	Short term	12.0	8.0	8.5	0.1	61.3	87.0	18.2	4.9
	Medium term	11.0	8.4	17.4	1.7	49.9	85.3	21.7	4.5
	Long term	10.4	9.4	20.5	2.6	45.9	82.7	23.1	5.3
Malaysia	Short term	0.0	1.2	2.5	8.9	97.2	5.7	0.3	84.1
	Medium term	0.2	1.2	3.2	8.6	96.3	5.7	0.3	84.4
	Long term	0.4	1.3	3.3	8.6	95.9	5.7	0.3	84.5
Philippines	Short term	3.3	1.5	0.5	0.3	96.0	11.7	0.2	86.5
	Medium term	5.8	6.1	0.5	10.5	93.4	13.4	0.3	70.0
	Long term	7.1	7.9	0.5	13.0	92.1	13.8	0.3	65.3
Singapore	Short term	0.4	16.5	0.9	40.1	91.7	0.0	7.0	43.4
	Medium term	3.4	13.8	1.2	46.5	87.0	1.4	8.4	38.2
	Long term	4.4	12.9	1.4	48.1	85.7	1.8	8.5	37.3
Thailand	Short term	4.6	1.3	0.8	7.8	53.5	59.0	41.1	31.9
	Medium term	4.8	5.8	1.8	8.2	60.4	55.1	33.0	30.9
	Long term	6.8	9.0	2.0	8.2	61.0	52.6	30.2	30.2
China	Short term	23.2	43.4	49.3	1.3	25.3	53.8	2.2	1.5
	Medium term	23.2	39.6	44.0	5.5	27.8	50.8	5.0	4.0
	Long term	21.0	38.9	39.4	6.7	29.1	50.4	10.5	4.1
Japan	Short term	5.3	3.9	0.5	21.9	56.0	65.8	38.2	8.4
	Medium term	9.8	3.9	9.3	22.6	48.2	65.1	32.6	8.4
	Long term	12.1	3.6	13.6	25.8	46.1	62.6	28.2	8.1
Korea	Short term	1.2	0.9	0.8	14.0	97.9	32.2	0.0	52.9
	Medium term	1.2	3.0	0.9	13.7	97.8	31.4	0.1	51.9
	Long term	1.2	3.7	1.0	13.6	97.7	31.2	0.1	51.5
Australia	Short term	6.9	43.3	12.5	0.3	78.8	0.3	1.8	56.0
	Medium term	15.6	43.6	13.1	1.2	69.5	0.4	1.9	54.8
	Long term	17.7	43.7	13.2	1.4	67.2	0.4	1.9	54.6
India	Short term	1.1	15.1	0.3	42.3	98.4	11.2	0.2	31.3
	Medium term	2.8	14.6	0.8	40.7	96.1	11.2	0.3	33.4
	Long term	3.2	14.6	0.9	40.5	95.6	11.2	0.3	33.7
New Zealand	Short term	3.3	30.5	3.9	0.2	89.0	0.7	3.8	68.6
	Medium term	7.9	29.7	4.0	4.2	83.7	0.6	4.4	65.5
	Long term	9.0	29.5	4.2	5.2	82.3	0.6	4.5	64.7

MAINLY ES
SOME ES
MAINLY DS
SOME DS

Figure 9

Impact of external vs domestic shocks					
Evenly distributed		**Concentrated on external**		**Concentrated on domestic**	
Y	**P**	**Y**	**P**	**Y**	**P**
1	**6** ***mainly non ASEAN***	**0**	**0**	**10**	**5** ***mainly ASEAN***
China	Singapore China Japan Australia India NZ (less so)			All but China	Indonesia Malaysia Philippines Thailand Korea

Figure 10

Impact of supply vs demand shocks					
Evenly distributed		**Concentrated on supply**		**Concentrated on demand**	
Y	**P**	**Y**	**P**	**Y**	**P**
1	**4**	**9**	**2**	**1**	**5**
Indonesia	Thailand Korea Japan Australia	All except Indonesia and China	Indonesia China	Japan	Malaysia Philippines Singapore India New Zealand

Figure 11

	Supply		Demand	
	External shocks granger-cause internal shocks	Internal shocks granger-cause external shocks	External shocks granger-cause internal shocks	Internal shocks granger-cause external shocks
Indonesia	no	no	no	no
Malaysia	no	no	no	no
Philippines	no	no	no	no
Singapore	no	no	no	no
Thailand	no	no	no	no
China	no	no	no	no
Japan	no	no	no	no
Korea	no	no	no	no
Australia	no	no	no	no
India	no	no	no	no
New Zealand	no	no	no	no

Figure 12

Size of supply shocks and adjustment speed				
	External supply shock		Domestic supply shock	
	Size	Adjustment speed	Size	Adjustment speed
Indonesia	-0.029	0.740	0.040	0.975
Malaysia	0.005	0.518	0.025	0.986
Philippines	0.006	0.741	0.011	0.974
Singapore	0.005	0.904	0.031	1.141
Thailand	-0.014	0.129	0.035	0.749
Average ASEAN5	**-0.005**	**0.606**	**0.029**	**0.965**
China	-0.004	-0.435	0.005	0.445
Japan	0.002	2.943	0.011	0.577
Korea	0.000	3.500	0.024	0.981
Average CH-JP-KO	**-0.001**	**2.003**	**0.014**	**0.668**
Australia	0.008	0.881	0.007	0.970
India	-0.005	0.704	0.016	0.984
New Zealand	0.003	0.842	0.010	1.000
Average AU-IN-NZ	**0.002**	**0.809**	**0.011**	**0.984**

large size or fast adjustment spe
somewhat large size or adjustment speed

Figure 13

Percentage of variance explained by first principal component				
	External supply	External demand	Domestic supply	Domestic demand
ASEAN-5 *	91.67	91.59	44.14	40.09
ASEAN-5 + 3 **	86.83	86.27	37.97	35.23
ASEAN-5 + 3 + 3 ***	89.11	86.58	30.18	26.48

* Indonesia, Malaysia, Philippines, Singapore and Thailand.

** ASEAN-5, China, Japan and Korea.

*** ASEAN-5, China, Japan, Korea, Australia, India and New Zealand.

Figure 14

Correlation of external supply shocks											
	ID	**MY**	**PH**	**SG**	**TH**	**CH**	**JP**	**KO**	**AU**	**IN**	**NZ**
Indonesia	1.000										
Malaysia	0.849	1.000									
Philippines	0.864	0.943	1.000								
Singapore	0.873	0.900	0.901	1.000							
Thailand	0.864	0.946	0.939	0.896	1.000						
China	0.745	0.780	0.751	0.780	0.835	1.000					
Japan	0.645	0.725	0.748	0.722	0.801	0.769	1.000				
Korea	0.877	0.965	0.966	0.942	0.971	0.824	0.786	1.000			
Australia	0.832	0.952	0.944	0.905	0.949	0.812	0.781	0.978	1.000		
India	0.893	0.970	0.957	0.923	0.984	0.845	0.772	0.987	0.962	1.000	
New Zealand	0.864	0.938	0.942	0.920	0.933	0.794	0.773	0.974	0.968	0.968	1.000

Figure 15

Correlation of domestic supply shocks											
	ID	MY	PH	SG	TH	CH	JP	KO	AU	IN	NZ
Indonesia	1.000										
Malaysia	0.361	1.000									
Philippines	0.393	0.417	1.000								
Singapore	-0.143	-0.070	-0.085	1.000							
Thailand	0.323	0.240	0.078	0.118	1.000						
China	-0.092	-0.150	-0.226	0.388	0.104	1.000					
Japan	0.117	-0.035	0.201	0.112	-0.122	0.066	1.000				
Korea	0.371	0.573	0.646	-0.013	0.271	-0.247	-0.023	1.000			
Australia	-0.226	0.048	0.115	0.132	-0.052	0.086	-0.096	0.028	1.000		
India	0.157	-0.036	0.065	-0.060	-0.185	0.224	0.042	-0.076	-0.316	1.000	
New Zealand	0.233	0.034	0.225	-0.038	0.530	-0.126	-0.094	0.256	0.126	-0.054	1.000

HIGH POSITIVE CORRELATION
MODERATE POSITIVE CORRELATION
HIGH NEGATIVE CORRELATION
MODERATE NEGATIVE CORRELATION

Figure 16

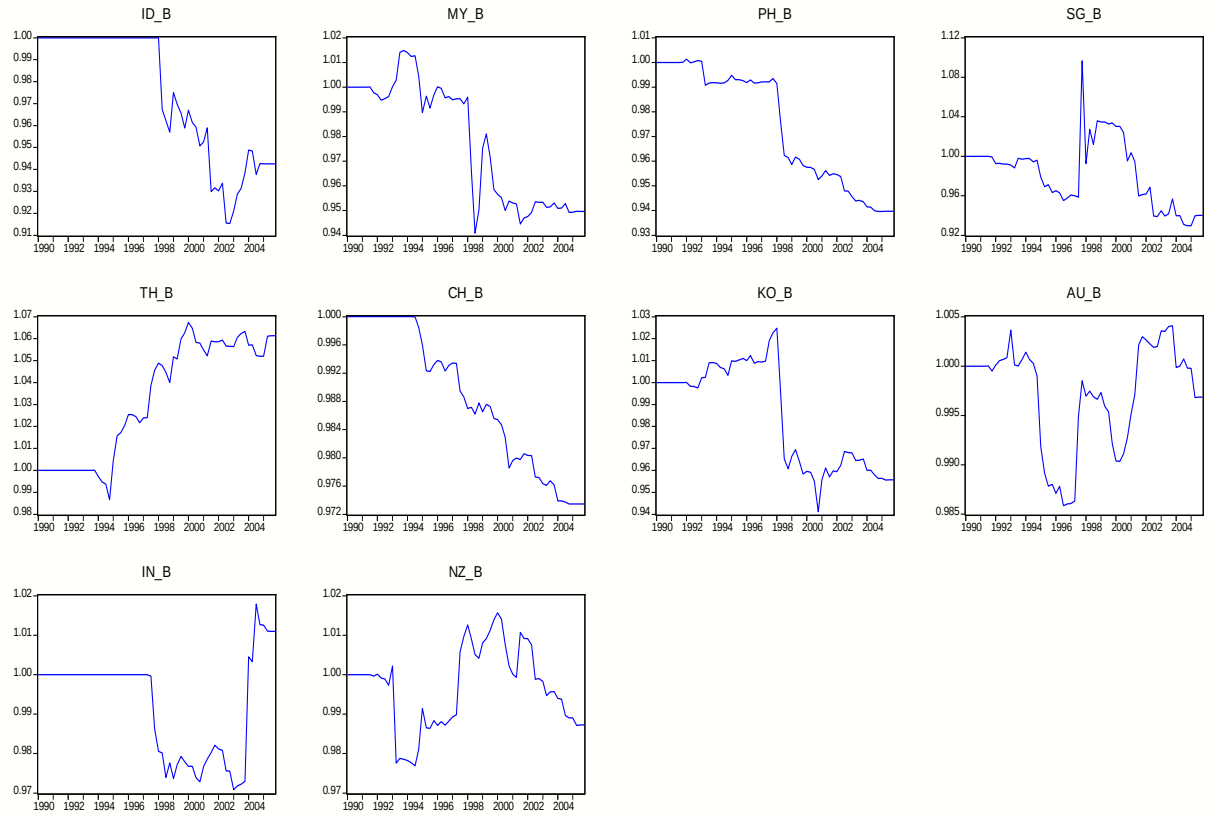


Figure 17

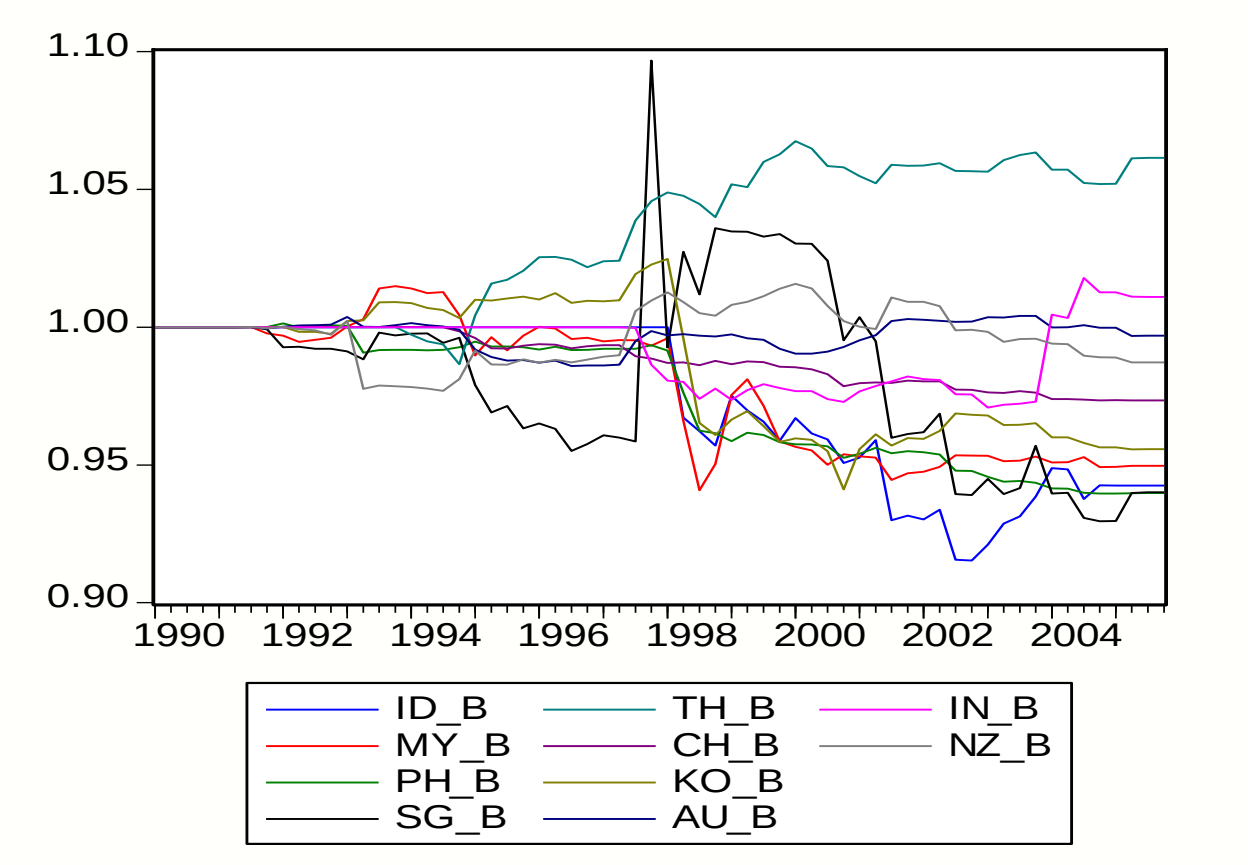

1.10
1.05
1.00
0.95
0.90
1990
1992
1994
1996
1998
2000
2002
2004
ID_B
TH_B
IN_B
MY_B
CH_B
NZ_B
PH_B
KO_B
SG_B
AU_B

Figure 18

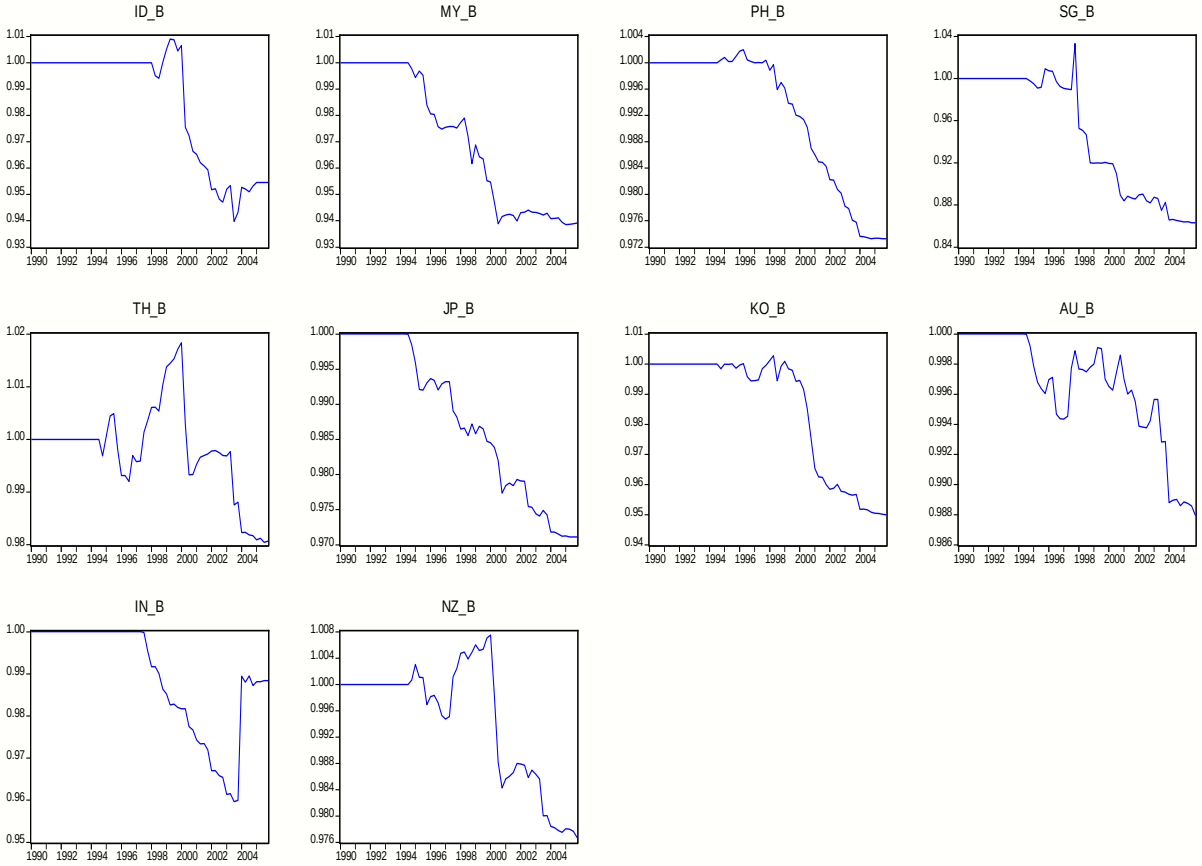


Figure 19

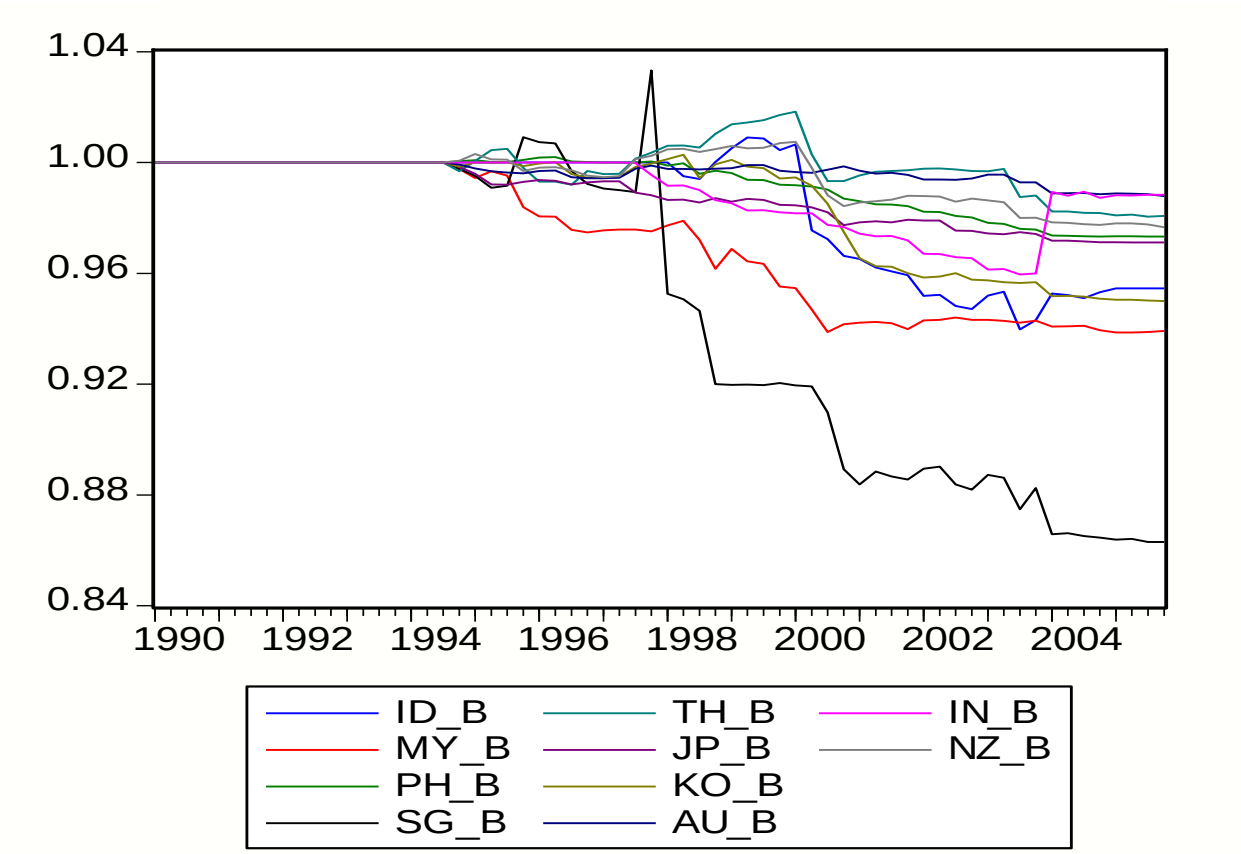


Figure 20

Results of Granger Causality tests on domestic supply shocks											
	ID	MY	PH	SG	TH	CH	JP	KO	AU	IN	NZ
Indonesia	--								X		
Malaysia		--				X					
Philippines			--								
Singapore		X	X	--				X			
Thailand					--						
China	X					--					
Japan							--				
Korea		X						--			
Australia					X				--		
India										--	
New Zealand			X								--

Figure 21

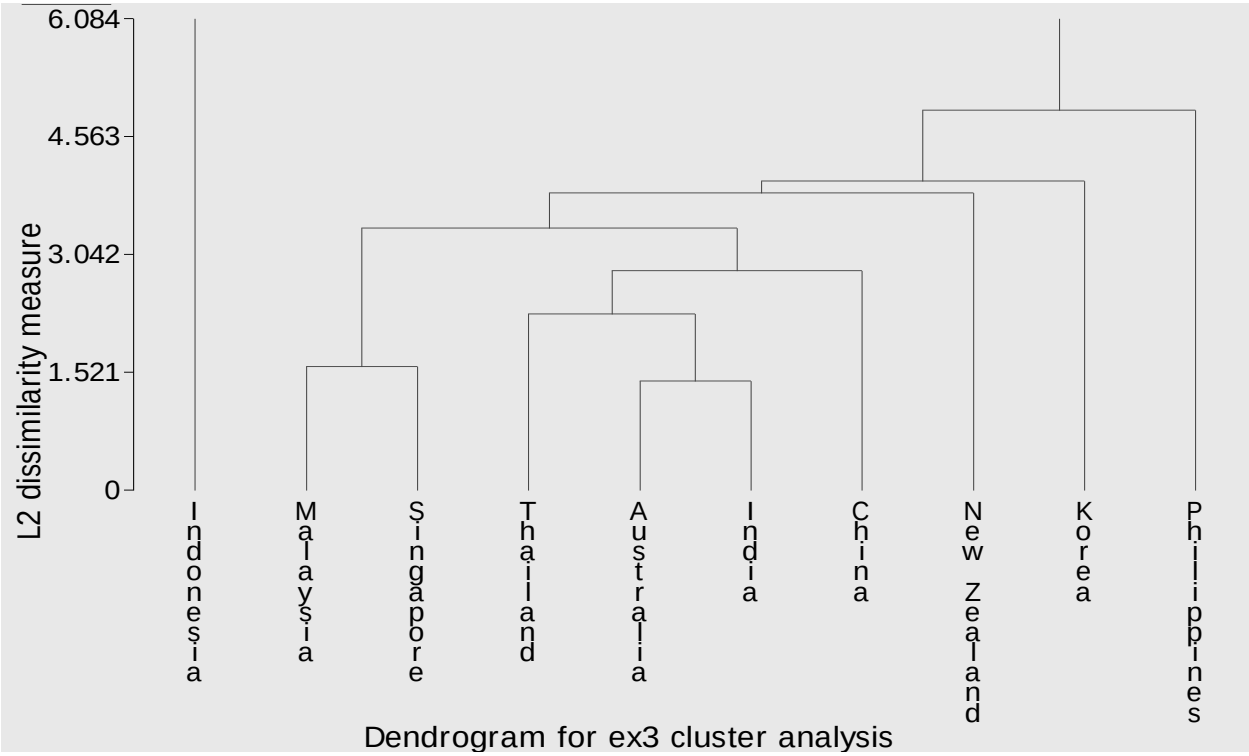


Figure 22