CHAPTER 5

CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

In this concluding chapter, we shall highlight the main findings of this study on the changing patterns of the behaviour of the ASEAN-5 markets over the period straddling the 1997 Asian financial crisis. It is reasonable to acknowledge that the results of most studies are restricted by some degree of limitations. Therefore, here, we shall also discuss the limitations that we have to be mindful of when we interpret the results. As the scope of this study can duly be extended, we shall make some suggestions for future research.

5.1 Conclusion

This study investigates how the individual as well as the collective behaviour of the ASEAN-5 equity markets changes over the period straddling the Asian financial crisis. All the findings obtained point towards a definite change in the patterns of market interdependence, both short-term and long-term. A preliminary study on the characteristics of the five markets is obtained by examining the means and standard deviations of the market returns for each period. The changing of the signs of the mean returns in these three periods indicate clearly that the returns of these markets are generally trending upwards before the financial crisis, then turning down at the onset of the crisis and

thereafter attempting to trend upwards again in the post-crisis period. As expected, the crisis period recorded the highest volatility. By using the dummy variable approach, we have justified our contention that the financial crisis did bring about structural changes in the behaviour of the market returns.

An analysis on the correlation matrices of the returns for the three periods underlines several facts regarding the short-term co-movements of the ASEAN-5 equity markets. Comparing across the three periods, the highest correlation coefficients are found in the crisis period. This reflects the contagion effect of the financial crisis. Categorically, it means that the contemporaneous movement of the returns in any one ASEAN market would have relatively greater impact on the movement of another ASEAN market during the crisis period. With respect to the individual ASEAN markets, the pair-wise correlations of the returns of Singapore, Indonesia, Thailand and the Philippines have strengthened during the post-crisis period as compared to the pre-crisis period. This implies an increase in the degree of contemporaneous movements among these markets after the financial crisis. On the contrary, the pair-wise correlations of Malaysia and each of the other four ASEAN countries have weakened considerably. This observation coincides with the implementation of capital controls by the Malaysian government in its effort to prevail over the effects of the financial crisis. This move insulated the Malaysian economy and resulted in a reduced influence from the other ASEAN markets.

It is important to ascertain that the five ASEAN stock indices are integrated of the same order before the cointegration test can be applied. Each stock index in the

level form is shown to have a unit root and is therefore non-stationary. Like in other studies, the first difference of the stock index is found to be stationary. The Johansen's multivariate cointegration test suggests that the five ASEAN stock indices share one long-term equilibrium relationship in the pre-crisis period, none in the crisis period and two in the post-crisis period. Under normal market conditions, we would expect a geographically linked group of stock markets to trend together in long run. On the other hand, in a period of high volatility where the directions of the markets are rather tentative, the absence of such long-run linkage among the markets is not unexpected.

The significance of the coefficient of the lagged ECT in the regression equation of the error correction model (ECM) implies long-run equilibrium relationship. In the pre-crisis period, there are only two significant coefficients in the ECM, one each in the regression equations of the Philippines and Indonesia. In the post-crisis period where there are two cointegrating equations, both the coefficients of the ETCs in the regression equations of the Philippines, Indonesia and Malaysia are significant, only one of the two is significant in Singapore and none in the Philippines. The implication of these findings is that when there is any deviation from the long-term equilibrium during the pre-crisis period, the short-term adjustment to clear the imbalance would be through the Philippines and Indonesian markets. In the post-crisis period, this adjustment is through all the ASEAN markets, except that of Thailand. From these findings, we can also infer that although long-term equilibrium relationships are similarly found in both the pre-crisis and the post-crisis periods, there are actually more markets involved in the short-term adjustment during the post-crisis period.

The Granger causal relationships among the returns of the ASEAN-5 equity markets are derived through the active short-run channels in the ECM or the VAR. Judging solely by the number of causal relationships, there seems to be a decrease in short-term market interdependence from the pre-crisis to the crisis period and then an almost three-fold increase from the volatile crisis period to the post-crisis period. This finding is consistent with the results obtained in most other studies (for instance, Yang and Lim, 2002; Jang and Sul, 2002) whereby there is an increase in market interdependence after the financial crisis.

The findings of the Granger causality test also reveal the lead-lag relationships between the ASEAN-5 stock markets over the three periods. There seems to be no clear-cut dominance of any one market during the crisis period. In the pre-crisis period, the Malaysian market appears to be leading but it loses this role after the financial crisis. As explained earlier, the insulation effect from the imposition of capital controls by the Malaysian government could be the reason for this. On the other hand, the Singapore and the Thai markets seem to have taken over the dominant role during the post-crisis period.

The findings of the variance decomposition and impulse response analyses also reveal observations that reaffirm the findings mentioned above. In the variance decomposition analysis, the percentages of forecast variance in any ASEAN-5 market generally converge at the five-day horizon. A rather interesting observation is found in the unusually high 33% and 35% of the forecast variance of Singapore that is explained by one standard deviation of shock in Malaysia in the pre-crisis period and the crisis period, respectively. The peculiarity of this

finding is further compounded by the drastic drop in the percentage to about 10% in the post-crisis period. Such observations are probably reflecting, in reality, the extent and the nature of the link between these two markets. The high percentages in the first two periods coincide with the time when the Singapore and Malaysian stock markets were closely and directly linked through CLOB, an over-the-counter market in Singapore that dealt mainly in Malaysian securities. The drastic drop of the percentage in the post-crisis period is most likely attributed to the closure of CLOB in Singapore and the imposition of capital controls in Malaysia at the beginning of the post-crisis period. Both incidents have undoubtedly lessened the economic link between these two markets.

Additionally, the drop of the percentage to about 10% in the post-crisis period is also consistent with the findings from the Granger causality test that the Malaysian market has lost its leading position while the Singapore counterpart seems to have assumed a more dominant role after the financial crisis. Overall, the percentages of forecast variance due to a shock in any of the ASEAN-5 markets seem to exhibit this general pattern of increase in the crisis period and then a pattern of substantial decrease in the post-crisis period. This observation can be further substantiated by studying the percentage of forecast error variance of each ASEAN market that is explained collectively by the other four 'foreign' ASEAN markets. These collective percentages are seemingly the highest in the crisis period for all five ASEAN markets. These findings possibly implicate the presence of high volatility during the crisis period, which in turn accounts for the lack of long-run equilibrium relationship during this period.

The findings of the impulse response analysis also confirm the findings of the variance decomposition analysis. The impulse response analysis shows an overall increase in the magnitude of responses of all the markets to shocks during the crisis period. Moreover, the responses also tend to be mostly short-lived (generally a duration of three days). Similar, these findings also support the results of the cointegration test that there is no long-term co-movement in the crisis period. In the other two periods, the time span for the response to fade completely is slightly longer (about five days). Such generally short time spans can be explained by the rapid and efficient propagation of information or news from one ASEAN-5 country to another due to the close geographical proximity and strong trade ties among them. For the three periods, the markets respond to the shock in another market in a similar fashion. The smaller market would respond immediately to a shock in the bigger market. On the hand, a shock in the smaller market would only elicit a response from the bigger market on or after the second day.

5.2   Limitations of this study

By using a common dataset for all five ASEAN markets, we are assuming that the start and the end of the crisis period are the same in each of them. However, this is not necessarily the case. A case in point is the Thai market, which experienced a sharp decline at a much earlier date than the other four markets (see the graphs in Figure 3.1). Therefore, the onset of the crisis period for Thailand was actually earlier than the period specified in this study.

Here, we are studying market interdependence of the ASEAN-5 markets in a closed system. There is a possibility that we could have discounted the driving force, permanent or temporary, from major markets like the U.S. and Japan. For instance, a Granger causal relationship between two ASEAN markets could due to the link of both markets to, say, the Japanese market and not due directly to each other. With the inclusion of these two influential markets, a different set of results may be obtained and thus, different conclusions would be drawn.

In this study, the inferences on short-run and long-run linkages are based on the ECM or VAR model. The drawback here is that such inferences are implicitly dependent upon the results from pre-tests of integration and cointegration. Like in most statistical tests, there are assumptions and axioms that we have to adopt when we interpret the results. In this study, to ensure robustness of the results with regard to the order of integration of the market indices and the returns, we used both the augmented Dickey-Fuller (ADF) and Phillips-Perron (P-P) tests. The underlying assumption in the ADF test is that the errors are statistically independent and have a constant variance. To ensure that this assumption is not violated, lagged terms are included in the regression equation (see Equations 3.9 and 3.10). The P-P test, which was developed later to circumvent these limiting assumptions, does not require the error term to be serially uncorrelated. Instead, it uses a non-parametric correction factor to the t-test statistic.

However, in the computation of the Johansen's cointegration test, we assumed that there is a linear deterministic trend in the data and that the cointegrating equations have only intercepts but no trends. With no knowledge of the exact

underlying data-generating process, we are making the best of the situation by assuming the data in this study are following that of the norm.

5.3 Suggestions for Future Research

The standard variance decomposition and impulse response analyses are sensitive to the ordering of the markets that enter the VAR model. In this study, we used the ordering based on the average market capitalization of the five countries for the years 1992 to 2002. This ordering is applied to all the three periods. Strictly speaking, the rankings of average market capitalization are different for all these three periods. However, if we were to use a different ordering for each period, we would not be able to compare the results across the periods.

In other research studies, different criteria are used in the orthogonalization procedure. Eun and Shim (1989) studied how the innovations in the U.S. market can be transmitted to other major markets. In their study, the orthogonalization is ordered as the U.S., the U.K., Switzerland, Japan, Hong Kong, Germany, France, Canada and Australia. Since the main aim of the study is to determine the exogeneity of the U.S. market, they adopted the results of the research by Doan and Litterman (1981) whereby any ordering that puts U.S. at the top would suffice. Eun and Shim (1989) stated in their report that when they change the order of the markets, the U.S. market, which is placed first, still emerges as the dominant market. Another researcher, Moon (2001), has a similar approach in his orthogonalization of the markets. In his study, he did a comparison on the

stock market integration of nine East Asian and nine European countries. The primary objective of his study is to investigate the extent of integration of these markets with the U.S. market after the Asian financial crisis. He used an ordering that follows the trading times of the stock markets, with the U.S. (lagged of one day) placed first and Japan last.

To overcome this shortcoming, a number of the latest research studies used an alternative generalized approach to forecast variance and impulse response analyses (see Pesaran and Shin,1998; Masih and Masih, 1999 and Roca, 2002). This generalized approach is invariant to ordering of the variables in the VAR. However, this methodology is not employed here in this study, as the software EViews 3 does not provide it. Perhaps, the results of the variance decomposition and impulse response analyses that are obtained in this study can be further improved by using different orderings (due to a different ranking of the market capitalization found in each period). This is only possible if the generalized approach, which is not sensitive to the ordering of the variables, is used. This approach is provided in Microfit version 4, which is not available to us.

As mentioned earlier in Section 5.1, by studying the ASEAN-5 markets in isolation, we could have discounted any direct influence from the two major markets, the U.S. and Japan. Including the U.S. and the Japanese markets can, thus, extend this study. Darrat and Zhong (2000) stressed the point that having shown the existence of significant cointegrating relations among a group of markets does not provide sufficient information on which of these market(s) moves or drives another. After finding a robust cointegrating relation linking each

of the eleven Asian-Pacific markets to both the markets of the U.S. and Japan, they proceeded to examine which one of these developed markets (or both) is the main driving force behind the stock market movements. They used weekly data from November 1987 through May 1999, without sub-dividing into sub-periods. The authors achieved their objective of the study by using the two procedures proposed by Johansen (1991) and Gonzalo and Granger (1995) to decompose the trivariate cointegrating systems (each comprising the U.S., Japan and each of the eleven Asian-Pacific countries) into their permanent and transitory components. Although the ASEAN-5 countries are included in this set of eleven countries, incorporating this methodology of determining the driving force could still extend the literature of this study, as we will be using a different sample period. In addition, our investigation will be based on the three defined periods and not a continuous sample period as used by Darrat and Zhong (2000).

In Chapter 1, we mentioned the two main categories of studies that contribute to an extensive wealth of literature on market interdependence. Most of the initial studies were primarily interested in finding out whether a specific group of markets are integrated. Subsequently, the more recent studies extend beyond this by investigating possible changes in equity market relationships. This study on the ASEAN-5 equity markets belongs to this second category since it encompasses the changing patterns of market linkages over the three periods. In contrast, very few studies attempt to determine the factors that contribute to such linkages. A recent study by Pretorius (2002) is one of such studies. He investigated whether certain factors, for example, bilateral trades between countries, interest rates, volatility, would have any effect on the market inter-

relationships among a group of Latin American countries. A similar examination could also be conducted for the East-Asian markets and this would certainly help to promote greater understanding of market linkages.

APPENDIX I

Market Capitalization of the ASEAN-5 Equity Markets: 1992 - 2002 (in US$ Millions)

Year	Singapore	Malaysia	Indonesia	Thailand	Philippines
1992	48818	94004	12038	58259	15282
1993	132742	220328	32953	130510	40327
1994	134516	199276	47241	131479	55519
1995	148804	222729	66585	141507	58859
1996	150215	307179	91016	99828	80649
1997	106317	93608	29105	23538	31361
1998	94469	98557	22104	34903	35314
1999	198407	145445	64087	58365	48105
2000	155125	113155	26815	29217	25261
2001	115688	118980	22997	35943	21245
2002	99806	125778	30067	45504	18507
*Average	107881.63	150318.30	34635.00	71624.00	38532.70

*The average market capitalization is the arithmetic mean of the total market capitalization over the eleven years.

Sources:
1. Emerging Stock Market Factbook (2000). New York: Standard & Poor's.
2. World Federation of Exchanges, Monthly Bulletin (Focus) Feb 2003, Vol. No. 120