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Increasing Integration Among Asia Pacific Equity Markets

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Increasing Integration among Asia Pacific Equity Markets

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Abstract

This research examines whether recent stock market crashes have affected the inter-relationships between 12 equity markets in the Asia-Pacific, thereby affecting investment decisions across the region. One of the major concepts underlying portfolio management and investment decisions is the reduction of risk by diversifying investments across non-integrated assets.

"The argument often heard in favor of international investment is that it lowers risk without sacrificing expected return. A prerequisite for this argument is that various capital markets of the world have somewhat independent price behaviour." (Solnik 2000)

Conventional asset allocation decisions are made on the basis of short term integration. However, Long term relationships can differ significantly. I therefore examined the impact of these crashes on both short term and long term integration.

The instances of significant short term correlation increased over the period, as did long term integration, implying that diversification opportunities across the region fell. However, there were numerous instances when the level of short term and long term integration between specific markets differed. In addition, I found many specific combinations of markets that may still result in risk diversification.

Introduction

Over recent decades, global equity markets have suffered a number of significant stock market crashes. This research examines whether such shocks to the international financial system have affected the inter-relationships between equity markets in the Asia-Pacific region. The issue is of interest since it has important implications for investment decisions across the region.

One of the major concepts underlying portfolio management and investment decisions is the reduction of risk by diversifying investments across a number of assets. One form of diversification could be to choose assets from different countries. (An example could be equity assets, represented by equity market indices from each country). The less integrated these assets are, the more successful diversification is likely to be.

This concept is usually applied by seeking to invest in portfolios of assets with low historical return correlations. However, although this identifies short term integration, it fails to explain how the relationships move over the long term. Long term integration can be tested using cointegration analysis.

I examined the impact of four major stock market crashes and determined their impact on both short term and long term equity market relationships. As the results show, both short term and long term integration increased over the period, although there are still numerous opportunities for diversification. Another interesting result is that in the case of specific asset allocation decisions, conclusions drawn from the short run analysis can differ from those drawn from the long run analysis.

Methodology

I used monthly equity index price data, sourced from Bloomberg, for 12 countries in the Asia-Pacific region (Australia, China, Hong Kong, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Singapore, South Korea, Taiwan and Thailand) over the period from January 1980 to December 2003.[1] I chose the indices that were most widely accepted as proxies for their respective markets. However, data were not available for some indices for the entire period.[2]

I used local currency price information, to reduce the impact of exchange rate volatility, which may have masked the effects of integration.

Plotting the natural log of the index prices revealed there were four stock market crashes that had a major impact across all the equity markets - *Black Monday* of October 1987, the *Tokyo Crash* of January 1990, the *Asian Flu* of October 1997 and the *NASDAQ Rash* of April 2000.[3] Omitting the months of these crashes created five periods for analysis[4]:

1 Some studies of this nature use weekly or daily data. However, Pan et al. (Pan, Chiou et al. 1991) claimed that daily returns could produce biased results due to missing and infrequent trading of some of the constituent stocks, or inadequate records. In addition, Solnik (Solnik 1991) argued that as stock return series are autocorrelated, it takes a few days for a shock to be fully discounted. The problem may be compounded by non-contemporaneous returns across different countries, due to time differences. This evidence implies that the use of weekly data may be ideal for the short run analysis. However, given the inefficiencies associated with many of these less developed markets, this problem may be of little importance. The long run analysis should be unaffected because it is based on the time series properties of the system, rather than the frequency of the data.

2 Contact the author for details.

3 This is the terminology used by Rigobon (2002)

4 Since the short run analysis involved taking the first difference of the log series, I omitted two months for this analysis – the month of the crash, and the subsequent month.

Table 1: Sub-periods created as a result of stock market crashes

Period 1:	January 1980 to September 1987
Period 2:	November 1987 to December 1989
Period 3:	February 1990 to September 1997
Period 4:	November 1997 to March 2000
Period 5:	May 2000 to December 2003

Throughout the analysis, I used the natural log series of the monthly stock market indices. These had the advantage of producing one period (monthly) share index returns when differenced once. All the econometric tests were conducted at a 5% significance level to ensure that the conclusions were homogeneous.

Spurious correlation was avoided by examining the correlation between monthly returns. As these new series were equivalent to first differencing the log series, they were effectively stationary. [5] I calculated the correlation coefficients for Periods 1, 2, 3, 4 and 5 separately and tested whether they were significantly different from zero. [6] [7]

For the long run analysis, I only included Periods 1, 3 and 5, since Periods 2 and 4 covered too short a time span to test for the presence of unit roots with much accuracy. [8] I used the *Johansen Maximum Likelihood Procedure* to test for cointegration, and only included non-stationary variables.

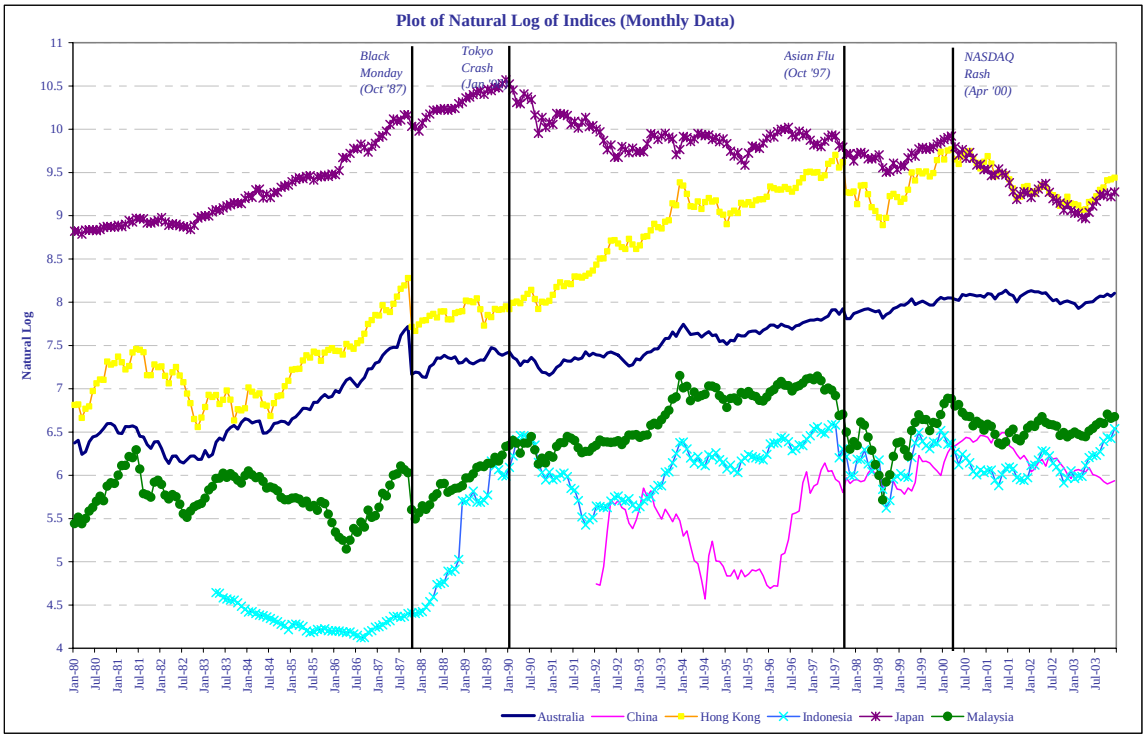
5 This approach implicitly assumes there are no series in the system which are integrated of order two [I(2)] or higher.

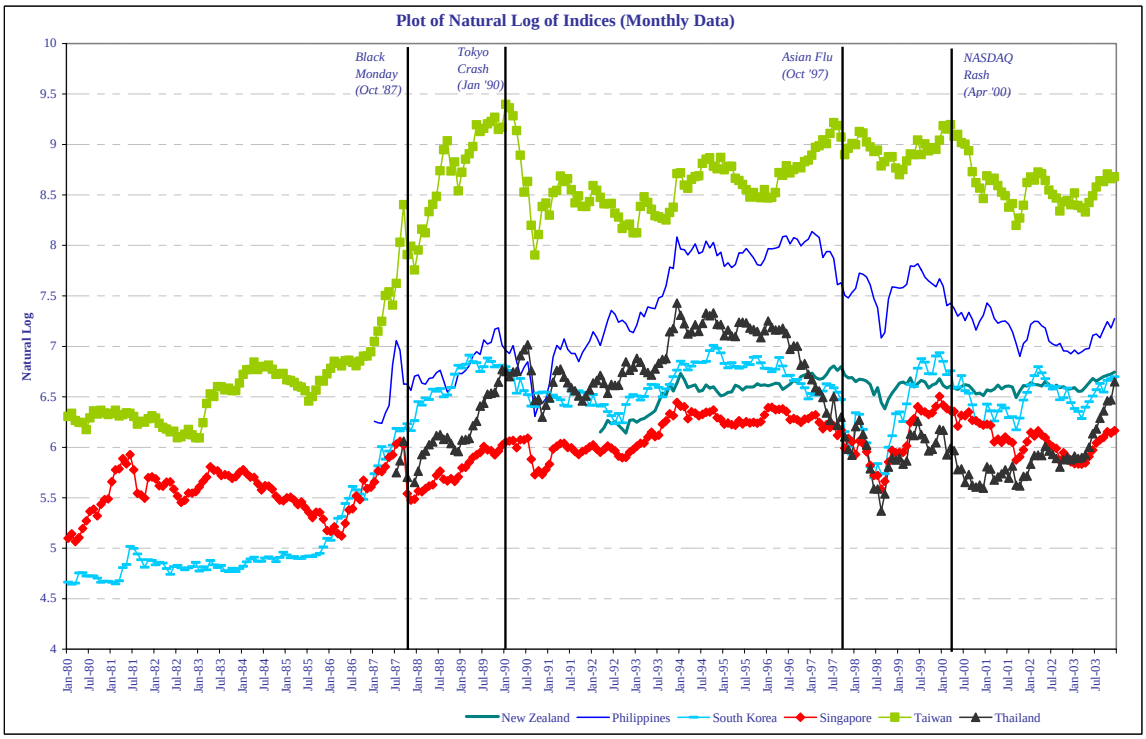
6 Contact the author for details.

7 I also tested for significant changes in the degree of correlation, but since the power of the test was very weak, I have not reported the results.

8 I plotted each log series, for each time period, to determine how to test for non-stationarity using the Augmented Dickey-Fuller (ADF) unit root test. Only non-stationary variables were included in the cointegration tests. Looking at cointegration within a system of equations, made it possible to search for multivariate relationships. (The short run analysis was limited to bivariate relationships). I used the Johansen Maximum Likelihood Procedure which involved a sequential method of searching for the maximum number of cointegrating vectors in the system (r).

Figure 1: Stock Market Crashes affecting all Indices





Source: Bloomberg

Empirical Results

Short Run Analysis

The number of significant correlating pairs of markets within the region has increased across the periods. This implies that integration has increased, thereby decreasing potential short run portfolio risk diversification opportunities. However, although the majority of pairwise relationships displayed significant correlation coefficients by Period 5, most were only weakly correlated, indicating that there could still be many short term opportunities for some portfolio risk reduction through diversification.

Period 1

Figure 2: Period 1 Pairwise Correlation Coefficients, shows that although 61.9% of the pairs were correlated, all but one of the correlation coefficients were very low. The exception, Singapore – Malaysia, was very highly correlated (0.906). This may have been due to dual listings on both exchanges.

Correlation between South Korea and all other markets, apart from Japan, was not significant. Australia and Malaysia displayed significant (but low) correlations with all other markets, apart from South Korea.

Figure 2: Period 1 Pairwise Correlation Coefficients

	Australia	*Hong Kong*	*Japan*	*Malaysia*	*South Korea*	*Singapore*	*Taiwan*
Australia	1						
Hong Kong	0.331	1					
Japan	0.263	0.107	1				
Malaysia	0.346	0.260	0.175	1			
South Korea	0.023	0.088	0.314	0.105	1		
Singapore	0.315	0.262	0.136	0.906	0.153	1	
Taiwan	0.237	0.126	0.249	0.256	0.093	0.255	1

Key: *Correlation coefficients are significantly different from zero*

Period 2

Figure 3: Period 2 Pairwise Correlation Coefficients shows a fall in significant pairwise correlation coefficients (from 13 to nine) after Black Monday. Only 25.0% of the pairs were significantly correlated, but the magnitude of the correlation coefficients generally increased. The exception, Singapore – Malaysia, fell to 0.782.

Since the number of significantly correlated relationships fell, the degree of market integration must have fallen across the region. Hence diversification opportunities should have increased.

The tests for Period 2 also included Indonesia and the Philippines. Indonesia did not display significant correlation with any markets apart from South Korea, which itself was not significantly correlated with any other market. Taiwan and the Philippines had a significant, negative correlation of -0.345. Thus, investing in both these markets during this period should have provided investors with major benefits in reducing portfolio risk.

In contrast to Period 1, Australia did not display significant correlation with any of the other markets in Period 2.

It seems that Black Monday may have drastically reduced regional integration.

Period 3

Figure 4: Period 3 Pairwise Correlation Coefficients shows that in contrast to Period 2, the bulk of the pairwise relationships (88.9%) displayed significant positive correlation coefficients. In fact, apart from the relationship between Indonesia and Japan, all the relationships that did not display significant correlation coefficients involved South Korea. This is in keeping with my findings for both Period 1 and Period 2, during which time South Korea was not significantly correlated with many other markets. However, most of the relationships involving South Korea switched from being significantly correlated in Period 2 to being uncorrelated in Period 3, or vice versa.

In general, the correlation coefficients for markets in Period 3 appear to have been higher than those in Period 2 (although the highest correlation, between Malaysia and Singapore, fell marginally in Period 3 to 0.781). This indicates that integration may have increased and the opportunities for short term portfolio risk diversification may have fallen. However, since the majority of significant correlation coefficients in Period 3 were weak (below 0.6) there should still have been many opportunities for portfolio risk diversification.

The tests for Period 3 also included Thailand. Thailand displayed significant correlations with all markets apart from South Korea, and showed fairly high correlations with Malaysia, the Philippines and Singapore.

It is possible that the Tokyo Crash of January 1990 may have triggered an increase in integration.

Period 4

Figure 5: Period 4 Pairwise Correlation Coefficients shows that the bulk of relationships in Period 4 (75.8%) displayed significant positive correlation coefficients. However, the majority of these coefficients were still below 0.6, indicating that correlation (and therefore integration) was low. Thus, there could have been opportunities for short term portfolio risk diversification.

In Period 4, the highest correlation coefficient was 0.846, between Singapore and Hong Kong. This may have been an indication of both of these markets' relative strengths at weathering the Asian Flu. However, their respective correlation coefficients with Australia, another of the region's stronger markets, were low.

In contrast to Period 3, when it was significantly correlated with all other markets, Taiwan ceased to be correlated with Australia and South Korea in Period 4. Thus, asset

allocation decisions involving Taiwan and either of these markets may have reduced portfolio risk. Conversely, diversification opportunities involving South Korea were reduced in Period 4 because it became significantly correlated with all markets (apart from Hong Kong, Taiwan and China) in this period.

Thailand, the market that triggered the Asian Flu, was significantly, positively correlated with all markets (apart from China) in Period 4, the period immediately following the crisis. In fact, in relation to four of these markets (Malaysia, the Philippines, South Korea and Singapore), Thailand displayed high correlation coefficients (0.602, 0.785, 0.789 and 0.686 respectively).

China and New Zealand were also included in Period 4. Japan and Taiwan were the only markets that displayed significant (but low) correlation with China. Thus, by adding China into a portfolio, risk could have been reduced. New Zealand was significantly correlated with all markets apart from China and Taiwan, although most of its correlation coefficients were low – the exceptions were Australia, at 0.692, the Philippines, at 0.644 and Singapore, at 0.616.

Period 5

Figure 6: Period 5 Pairwise Correlation Coefficients shows that the bulk of the pairwise relationships (77.3%) were positively correlated in Period 5. This indicates that integration across the region was high, although the majority of correlation coefficients were low (less than 0.6), implying that there may still have been short run portfolio risk diversification opportunities.

China was not significantly correlated with any market. Thus, including China could have been beneficial for diversifying risk.

In contrast to Period 4, Malaysia and Australia, and Malaysia and New Zealand were no longer significantly correlated. In addition, Malaysia and Japan, and Taiwan and

Indonesia remained uncorrelated, implying that asset allocation decisions involving these pairs could have benefited from reduced portfolio risk.

The highest correlation coefficient for Period 5 was 0.737, between Australia and Singapore. This increased markedly from 0.514 in Period 4. The relationship between Hong Kong and Singapore (the strongest relationship in Period 4) weakened from 0.846, but was still high at 0.691. In contrast to all the other periods, the correlation between Singapore and Malaysia for Period 5 was weak, at 0.536.

The relationship between Taiwan and South Korea became strongly significant again (with a correlation coefficient of 0.612), after being insignificant in Period 4, weakly significant in Period 3 and insignificant in Periods 1 and 2.

Figure 3: Period 2 Pairwise Correlation Coefficients

	Australia	*Hong Kong*	*Indonesia*	*Japan*	*Malaysia*	*Philippines*	*South Korea*	*Singapore*	*Taiwan*
Australia	1								
Hong Kong	0.174	1							
Indonesia	0.191	-0.139	1						
Japan	-0.043	0.454	-0.145	1					
Malaysia	0.223	0.573	-0.226	0.343	1				
Philippines	-0.009	0.295	0.120	-0.108	0.182	1			
South Korea	0.045	0.274	0.365	0.240	0.234	0.193	1		
Singapore	0.261	0.430	-0.137	0.409	0.782	0.251	0.177	1	
Taiwan	-0.075	-0.169	-0.318	0.341	-0.150	-0.345	-0.244	-0.049	1

Key: *Correlation coefficients are significantly different from zero*

Figure 4: Period 3 Pairwise Correlation Coefficients

	Australia	*Hong Kong*	*Indonesia*	*Japan*	*Malaysia*	*Philippines*	*South Korea*	*Singapore*	*Thailand*	*Taiwan*
Australia	1									
Hong Kong	0.530	1								
Indonesia	0.351	0.595	1							
Japan	0.413	0.273	0.127	1						
Malaysia	0.434	0.679	0.545	0.312	1					
Philippines	0.439	0.666	0.549	0.255	0.701	1				
South Korea	0.126	0.224	0.062	0.319	0.243	0.059	1			
Singapore	0.587	0.690	0.533	0.466	0.781	0.741	0.255	1		
Thailand	0.317	0.594	0.575	0.235	0.640	0.601	0.124	0.644	1	
Taiwan	0.273	0.342	0.217	0.285	0.376	0.420	0.296	0.412	0.269	1

Key: *Correlation coefficients are significantly different from zero*

Figure 5: Period 4 Pairwise Correlation Coefficients

	Australia	*China*	*Hong Kong*	*Indonesia*	*Japan*	*Malaysia*	*New Zealand*	*Philippines*	*South Korea*	*Singapore*	*Thailand*	*Taiwan*
Australia	1											
China	0.112	1										
Hong Kong	0.524	0.033	1									
Indonesia	0.367	0.087	0.204	1								
Japan	0.444	0.321	0.245	0.619	1							
Malaysia	0.508	0.223	0.575	0.454	0.241	1						
New Zealand	0.692	-0.026	0.502	0.513	0.432	0.455	1					
Philippines	0.581	0.099	0.613	0.566	0.362	0.643	0.644	1				
South Korea	0.432	-0.026	0.313	0.503	0.487	0.318	0.492	0.509	1			
Singapore	0.514	0.109	0.846	0.489	0.372	0.713	0.616	0.774	0.448	1		
Thailand	0.501	0.145	0.487	0.551	0.459	0.602	0.501	0.785	0.789	0.686	1	
Taiwan	0.297	0.490	0.523	0.356	0.411	0.535	0.263	0.480	0.157	0.533	0.526	1

Key: *Correlation coefficients are significantly different from zero*

Figure 6: Period 5 Pairwise Correlation Coefficients

	Australia	*China*	*Hong Kong*	*Indonesia*	*Japan*	*Malaysia*	*New Zealand*	*Philippines*	*South Korea*	*Singapore*	*Thailand*	*Taiwan*
Australia	1											
China	-0.061	1										
Hong Kong	0.599	0.144	1									
Indonesia	0.387	-0.061	0.334	1								
Japan	0.527	0.136	0.573	0.333	1							
Malaysia	0.219	-0.061	0.323	0.344	0.077	1						
New Zealand	0.629	0.008	0.420	0.277	0.444	0.241	1					
Philippines	0.387	-0.127	0.391	0.503	0.390	0.314	0.363	1				
South Korea	0.688	0.024	0.648	0.358	0.590	0.302	0.503	0.482	1			
Singapore	0.737	-0.085	0.691	0.454	0.397	0.536	0.534	0.495	0.606	1		
Thailand	0.583	-0.049	0.470	0.439	0.491	0.503	0.544	0.638	0.639	0.630	1	
Taiwan	0.479	0.073	0.477	0.197	0.363	0.647	0.548	0.404	0.612	0.567	0.624	1

Key: *Correlation coefficients are significantly different from zero*

Long Run Analysis

Since I was not able to test for long run integration in Periods 2 and 4, it is difficult to draw reliable conclusions about how long run integration has changed. This problem is further compounded by changing datasets. However, there is some evidence of increased cointegration (long run integration) between Periods 1, 3 and 5.

Period 1

Data for Period 1 were available for Australia, Hong Kong, Japan, Malaysia, Singapore, South Korea and Taiwan and all series were non-stationary. I conducted 50 cointegration tests, analysing the Group of 7, Groups of 6, Groups of 5 and pairwise combinations. The results are detailed in *Figure 7: Period 1 Cointegration Tests*.

The Group of 7 and all of the Groups of 6 displayed cointegration, indicating that this group of equity markets was well integrated over the long run. Thus, it may have been difficult to diversify risk across regional equity portfolios that included at least six of these markets.

Many combinations from the Groups of 5 were not cointegrated. All of these (tests 9, 15, 16, 17, 20, 21 and 24) included both Australia and Hong Kong, implying they may not have been strongly integrated with the other markets. Thus, including Australia and Hong Kong may have been beneficial for risk diversification. In contrast, of all the combinations that did display cointegration, only two (tests 18 and 19) did not include South Korea, implying that it was well integrated, and including it would not have aided risk diversification. This is very different from the conclusions that may be drawn from the short run analysis for Period 1, during which time South Korea only displayed significant correlation with Japan. 66.7% of the tests involving the Groups of 6 displayed cointegration.

None of the pairwise cointegration tests displayed any evidence of cointegration, although 61.9% of the pairs displayed significant, albeit low, short run correlation. This

implies that investors may have achieved long term portfolio risk reduction by confining their investments to pairs of markets.[9] This contradicts conventional theories which generally promote diversification across a number of assets.

These results highlight the dangers of only relying on pairwise analysis to determine integration between markets. Based on the results of the short run analysis and pairwise cointegration tests, one might mistakenly assume that, with the exception of Singapore and Malaysia, there was no integration between these markets.

Period 3

Data for Period 3 were available for Australia, Hong Kong, Indonesia, Japan, Malaysia, the Philippines, Singapore, South Korea, Taiwan and Thailand. Since the series for Australia and Japan were stationary, I conducted 58 tests cointegration tests on the other eight markets. I analysed the Group of 8, Groups of 7, Groups of 6 and pairwise combinations. The results are detailed in Figure 8: Period 3 Cointegration Tests.

The Group of 8 and all but two of the tests involving the Groups of 7 (tests 2 and 3) displayed cointegration, indicating that this group of equity markets was well integrated over the long run. Thus, it may have been difficult to diversify risk across regional equity portfolios that included at least seven of these markets.

From the results of tests 2 and 3, it would seem that either Taiwan or Thailand needed to be included to produce a cointegrating system. This is consistent with the results of the tests of the Groups of 6 and the Pairs, in which all of the tests that displayed cointegration included Taiwan or Thailand. Thus, by avoiding equity investments in Taiwan or Thailand, investors may have benefited from long run diversification.

The tests on the Groups of 6 (tests 38 to 65) also show that Singapore was included in all of the tests that were not cointegrated, and that all of the tests that did not include

[9] This can be tested further using cointegration tests on all combinations of Groups of 4 and Groups of 3 markets.

Singapore were cointegrated. Thus, Singapore may not have been as heavily integrated as some of the other markets, and including Singapore may, in some instances, have assisted with long run diversification. However, as the tests involving pairs show, Singapore and Taiwan were cointegrated during Period 3. 46.4% of the tests involving Groups of 6 displayed cointegration.

Almost all of the pairs of markets that were cointegrated in Period 3 were also integrated in the short run. The exception was South Korea - Thailand, which displayed long run integration but no significant short run integration. In contrast, many pairs that were significantly correlated were not cointegrated. This highlights the danger of relying solely on correlation analysis for diversification decisions; investors may have missed out on potential long term diversification. Only 25% of the pairs of markets were cointegrated, whilst 88.9% of the pairs were correlated.

Figure 7: Period 1 Cointegration Tests

Test	Countries Included							Maximum Number of Cointegrating Vectors (r)		
	Australia	*Hong Kong*	*Japan*	*Malaysia*	*Singapore*	*South Korea*	*Taiwan*	*Based on Maximal Eigenvalue*	*Based on Trace*	***Conclusion***
	Group of 7									
1	x	x	x	x	x	x	x	2	2	**2**
	Groups of 6									
2	x	x	x	x	x	x		0	2	**2**
3	x	x	x	x	x		x	0	1	**1**
4	x	x	x	x		x	x	1	1	**1**
5	x	x	x		x	x	x	0	1	**1**
6	x	x		x	x	x	x	1	1	**1**
7	x		x	x	x	x	x	1	2	**2**
8		x	x	x	x	x	x	2	2	**2**
	Groups of 5									
9	x	x	x	x	x			0	0	**0**
10	x	x	x	x		x		0	1	**1**
11	x	x	x		x	x		0	1	**1**
12	x	x		x	x	x		0	1	**1**
13	x		x	x	x	x		0	2	**2**
14		x	x	x	x	x		1	1	**1**
15	x	x	x	x			x	0	0	**0**
16	x	x	x		x		x	0	0	**0**
17	x	x		x	x		x	0	0	**0**
18	x		x	x	x		x	0	1	**1**
19		x	x	x	x		x	0	1	**1**
20	x	x	x			x	x	0	0	**0**
21	x	x		x		x	x	0	0	**0**
22	x		x	x		x	x	0	1	**1**
23		x	x	x		x	x	1	1	**1**
24	x	x			x	x	x	0	0	**0**
25	x		x		x	x	x	0	1	**1**
26		x	x		x	x	x	1	1	**1**
27	x			x	x	x	x	1	1	**1**
28		x		x	x	x	x	1	1	**1**
29			x	x	x	x	x	1	1	**1**
	Pairs									
30	x	x						0	0	**0**
31	x		x					0	0	**0**
32	x			x				0	0	**0**
33	x				x			0	0	**0**
34	x					x		0	0	**0**
35	x						x	0	0	**0**
36		x	x					0	0	**0**
37		x		x				0	0	**0**
38		x			x			0	0	**0**
39		x				x		0	0	**0**
40		x					x	0	0	**0**
41			x	x				0	0	**0**
42			x		x			0	0	**0**
43			x			x		0	0	**0**
44			x				x	0	0	**0**
45				x	x			0	0	**0**
46				x		x		0	0	**0**
47				x			x	0	0	**0**
48					x	x		0	0	**0**
49					x		x	0	0	**0**
50						x	x	0	0	**0**

Key: *Cointegration exists*

Figure 8: Period 3 Cointegration Tests

Test	Countries Included								Maximum Number of Cointegrating Vectors (r)		
	Hong Kong	*Indonesia*	*Malaysia*	*Philippines*	*Singapore*	*South Korea*	*Taiwan*	*Thailand*	*Based on Maximal Eigenvalue*	*Based on Trace*	***Conclusion***
	Group of 8										
1	x	x	x	x	x	x	x	x	0	1	**1**
	Groups of 7										
2	x	x	x	x	x	x	x		0	0	**0**
3	x	x	x	x	x	x		x	0	0	**0**
4	x	x	x	x	x		x	x	0	1	**1**
5	x	x	x	x		x	x	x	1	2	**2**
6	x	x	x		x	x	x	x	0	1	**1**
7	x	x		x	x	x	x	x	0	1	**1**
8	x		x	x	x	x	x	x	0	1	**1**
9		x	x	x	x	x	x	x	0	1	**1**
	Pairs										
10	x	x							0	0	**0**
11	x		x						0	0	**0**
12	x			x					0	0	**0**
13	x				x				0	0	**0**
14	x					x			0	0	**0**
15	x						x		1	1	**1**
16	x							x	0	0	**0**
17		x	x						0	0	**0**
18		x		x					0	0	**0**
19		x			x				0	0	**0**
20		x				x			0	0	**0**
21		x					x		1	1	**1**
22		x						x	0	0	**0**
23			x	x					0	0	**0**
24			x		x				0	0	**0**
25			x			x			0	0	**0**
26			x				x		1	0	**0**
27			x					x	0	0	**0**
28				x	x				0	0	**0**
29				x		x			0	0	**0**
30				x			x		1	1	**1**
31				x				x	0	0	**0**
32					x	x			0	0	**0**
33					x		x		0	1	**1**
34					x			x	0	0	**0**
35						x	x		1	1	**1**
36						x		x	1	1	**1**
37							x	x	1	1	**1**
	Groups of 6										
38			x	x	x	x	x	x	0	1	**1**
39		x		x	x	x	x	x	1	1	**1**
40		x	x		x	x	x	x	0	0	**0**
41		x	x	x	x		x	x	1	1	**1**
42		x	x	x	x	x		x	1	1	**1**
43		x	x	x	x	x	x		0	0	**0**
44	x			x	x	x	x	x	0	1	**1**
45	x		x		x	x	x	x	0	1	**1**
46	x		x	x	x		x	x	0	0	**0**
47	x		x	x	x	x		x	0	0	**0**
48	x		x	x	x	x	x		0	0	**0**
49	x	x			x	x	x	x	0	0	**0**
50	x	x		x	x		x	x	0	0	**0**
51	x	x		x	x	x		x	0	0	**0**
52	x	x		x	x	x	x		0	0	**0**
53	x	x	x		x		x	x	0	0	**0**
54	x	x	x		x	x		x	0	0	**0**
55	x	x	x		x	x	x		0	0	**0**
56	x	x	x	x	x			x	0	0	**0**
57	x	x	x	x	x		x		1	1	**1**
58	x	x	x	x	x	x			0	0	**0**
59	x	x	x	x		x	x		0	1	**1**
60	x	x	x	x		x		x	1	1	**1**
61	x	x	x	x			x	x	1	1	**1**
62		x	x	x		x	x	x	0	1	**1**
63	x		x	x		x	x	x	0	1	**1**
64	x	x		x		x	x	x	0	1	**1**
65	x	x	x			x	x	x	0	1	**1**

Key: *Cointegration exists*

Period 5

Data for Period 5 were available for all 12 markets, but the series for Malaysia was stationary. I therefore conducted 452 cointegration tests on various combinations of the other 11 markets. I analysed the Group of 11, Groups of 10, Groups of 9, Groups of 8, Groups of 3 and pairwise combinations. The results are detailed in *Figure 9: Period 5 Cointegration Tests*.

The Group of 11, and all of the Groups of 10, Groups of 9 and Groups of 8 displayed cointegration. This indicates that in Period 5, this group of equity markets was extremely well integrated over the long run. Thus, over the long term, it may have been difficult to diversify risk across regional equity portfolios that included at least eight of these markets.

In contrast, only 21.2% of the tests involving Groups of 3 displayed cointegration. This implies that there may have been many long term opportunities for diversification by investing in three markets across the region. However, of all the 35 tests involving Groups of 3 that displayed cointegration, only four did not include Thailand, implying that investors may have had a better chance of achieving long term diversification by excluding Thailand. This conclusion is further supported by the results of the tests involving Pairs. Only 14.5% (nine) of these tests displayed cointegration, and of these, only two did not include Thailand. The two other Pairs that were cointegrated were Indonesia – New Zealand and Hong Kong – Taiwan. Surprisingly, the Indonesia – New Zealand combination did not feature in any of the cointegrating Groups of 3. The Hong Kong - Taiwan combination was included in one cointegrating Group of 3, but this included Thailand, so cointegration may have been more strongly attributable to the inclusion of Thailand.

All four tests of the Groups of 3 that displayed cointegration, but excluded Thailand, included both Hong Kong and Japan. However, Hong and Japan were not cointegrated when tested as a pair.

As with the results of the pairwise correlation tests, the long term pairwise tests for integration indicated that China was not integrated with any other market.

Only 14.5% of the tests for long term pairwise integration were positive, compared with 77.3% of the tests for short term pairwise integration. Yet again, this highlights the dangers of drawing conclusions about integration by only looking at one of these measures.

Figure 9: Period 5 Cointegration Tests

Test	Countries Included: Australia	China	Hong Kong	Indonesia	Japan	New Zealand	Philippines	Singapore	South Korea	Taiwan	Thailand	Maximum Number of Cointegrating Vectors (r): Based on Maximal Eigenvalue	Based on Trace	*Conclusion*
	Group of 11													
1	x	x	x	x	x	x	x	x	x	x	x	5	6	**6**
	Groups of 10													
2		x	x	x	x	x	x	x	x	x	x	5	5	**5**
3	x		x	x	x	x	x	x	x	x	x	2	4	**4**
4	x	x		x	x	x	x	x	x	x	x	3	5	**5**
5	x	x	x		x	x	x	x	x	x	x	4	5	**5**
6	x	x	x	x		x	x	x	x	x	x	1	5	**5**
7	x	x	x	x	x		x	x	x	x	x	3	5	**5**
8	x	x	x	x	x	x		x	x	x	x	2	5	**5**
9	x	x	x	x	x	x	x		x	x	x	3	5	**5**
10	x	x	x	x	x	x	x	x		x	x	3	5	**5**
11	x	x	x	x	x	x	x	x	x		x	4	4	**4**
12	x	x	x	x	x	x	x	x	x	x		4	4	**4**
	Groups of 9													
13			x	x	x	x	x	x	x	x	x	4	4	**4**
14		x		x	x	x	x	x	x	x	x	2	4	**4**
15		x	x		x	x	x	x	x	x	x	4	4	**4**
16		x	x	x		x	x	x	x	x	x	4	4	**4**
17		x	x	x	x		x	x	x	x	x	4	4	**4**
18		x	x	x	x	x		x	x	x	x	2	3	**3**
19		x	x	x	x	x	x		x	x	x	3	3	**3**
20		x	x	x	x	x	x	x		x	x	2	4	**4**
21		x	x	x	x	x	x	x	x		x	5	5	**5**
22		x	x	x	x	x	x	x	x	x		3	3	**3**
23	x			x	x	x	x	x	x	x	x	2	2	**2**
24	x		x		x	x	x	x	x	x	x	2	3	**3**
25	x		x	x		x	x	x	x	x	x	1	4	**4**
26	x		x	x	x		x	x	x	x	x	2	4	**4**
27	x		x	x	x	x		x	x	x	x	2	3	**3**
28	x		x	x	x	x	x		x	x	x	2	3	**3**
29	x		x	x	x	x	x	x		x	x	2	3	**3**
30	x		x	x	x	x	x	x	x		x	4	4	**4**
31	x		x	x	x	x	x	x	x	x		1	2	**2**
32	x	x			x	x	x	x	x	x	x	3	4	**4**
33	x	x		x		x	x	x	x	x	x	3	4	**4**
34	x	x		x	x		x	x	x	x	x	3	4	**4**
35	x	x		x	x	x		x	x	x	x	1	3	**3**
36	x	x		x	x	x	x		x	x	x	3	3	**3**
37	x	x		x	x	x	x	x		x	x	2	5	**5**
38	x	x		x	x	x	x	x	x		x	2	4	**4**
39	x	x		x	x	x	x	x	x	x		2	3	**3**
40	x	x	x			x	x	x	x	x	x	2	4	**4**
41	x	x	x		x		x	x	x	x	x	3	4	**4**
42	x	x	x		x	x		x	x	x	x	3	3	**3**
43	x	x	x		x	x	x		x	x	x	3	4	**4**
44	x	x	x		x	x	x	x		x	x	3	4	**4**
45	x	x	x		x	x	x	x	x		x	4	4	**4**
46	x	x	x		x	x	x	x	x	x		2	3	**3**
47	x	x	x	x			x	x	x	x	x	1	4	**4**
48	x	x	x	x		x		x	x	x	x	1	4	**4**
49	x	x	x	x		x	x		x	x	x	2	3	**3**
50	x	x	x	x		x	x	x		x	x	2	4	**4**
51	x	x	x	x		x	x	x	x		x	3	4	**4**
52	x	x	x	x		x	x	x	x	x		1	3	**3**
53	x	x	x	x	x			x	x	x	x	2	3	**3**
54	x	x	x	x	x		x		x	x	x	3	3	**3**
55	x	x	x	x	x		x	x		x	x	2	3	**3**
56	x	x	x	x	x		x	x	x		x	4	4	**4**
57	x	x	x	x	x		x	x	x	x		2	3	**3**
58	x	x	x	x	x	x			x	x	x	2	4	**4**
59	x	x	x	x	x	x		x		x	x	2	3	**3**
60	x	x	x	x	x	x		x	x		x	3	3	**3**
61	x	x	x	x	x	x		x	x	x		1	2	**2**
62	x	x	x	x	x	x	x			x	x	3	3	**3**
63	x	x	x	x	x	x	x		x		x	3	3	**3**
64	x	x	x	x	x	x	x		x	x		2	2	**2**
65	x	x	x	x	x	x	x	x			x	2	4	**4**
66	x	x	x	x	x	x	x	x		x		2	3	**3**
67	x	x	x	x	x	x	x	x	x			1	3	**3**
	Pairs													
68	x	x										0	0	**0**
69	x		x									0	0	**0**
70	x			x								0	0	**0**
71	x				x							0	0	**0**
72	x					x						0	0	**0**
73	x						x					0	0	**0**
74	x							x				0	0	**0**
75	x								x			0	0	**0**
76	x									x		0	0	**0**
77	x										x	1	1	**1**
78		x	x									0	0	**0**
79		x		x								0	0	**0**
80		x			x							0	0	**0**
81		x				x						0	0	**0**
82		x					x					0	0	**0**
83		x						x				0	0	**0**
84		x							x			0	0	**0**
85		x								x		0	0	**0**
86		x									x	0	0	**0**
87			x	x								0	0	**0**
88			x		x							1	0	**0**
89			x			x						0	0	**0**
90			x				x					0	0	**0**
91			x					x				0	0	**0**
92			x						x			0	0	**0**

	Countries Included											Maximum Number of Cointegrating Vectors (r)		
Test	*Australia*	*China*	*Hong Kong*	*Indonesia*	*Japan*	*New Zealand*	*Philippines*	*Singapore*	*South Korea*	*Taiwan*	*Thailand*	*Based on Maximal Eigenvalue*	*Based on Trace*	***Conclusion***
93			x							x		0	0	**0**
94			x								x	1	1	**1**
95				x	x							0	0	**0**
96				x		x						1	1	**1**
97				x			x					0	0	**0**
98				x				x				0	0	**0**
99				x					x			0	0	**0**
100				x						x		0	0	**0**
101				x							x	0	0	**0**
102					x	x						0	0	**0**
103					x		x					1	0	**0**
104					x			x				0	0	**0**
105					x				x			0	0	**0**
106					x					x		0	0	**0**
107					x						x	1	1	**1**
108						x	x					0	0	**0**
109						x		x				0	0	**0**
110						x			x			0	0	**0**
111						x				x		0	0	**0**
112						x					x	1	1	**1**
113							x	x				0	0	**0**
114							x		x			0	0	**0**
115							x			x		0	0	**0**
116							x				x	1	1	**1**
117								x	x			0	0	**0**
118								x		x		0	0	**0**
119								x			x	1	1	**1**
120									x	x		0	0	**0**
121									x		x	0	0	**0**
122										x	x	0	0	**0**
	Groups of 8													
123				x	x	x	x	x	x	x	x	1	2	**2**
124			x		x	x	x	x	x	x	x	2	3	**3**
125			x	x		x	x	x	x	x	x	1	3	**3**
126			x	x	x		x	x	x	x	x	3	3	**3**
127			x	x	x	x		x	x	x	x	2	3	**3**
128			x	x	x	x	x		x	x	x	2	3	**3**
129			x	x	x	x	x	x		x	x	2	2	**2**
130			x	x	x	x	x	x	x		x	4	4	**4**
131			x	x	x	x	x	x	x	x		2	2	**2**
132		x			x	x	x	x	x	x	x	2	3	**3**
133		x		x		x	x	x	x	x	x	3	3	**3**
134		x		x	x		x	x	x	x	x	2	3	**3**
135		x		x	x	x		x	x	x	x	1	1	**1**
136		x		x	x	x	x		x	x	x	1	2	**2**
137		x		x	x	x	x	x		x	x	1	5	**5**
138		x		x	x	x	x	x	x		x	1	3	**3**
139		x		x	x	x	x	x	x	x		1	2	**2**
140		x	x			x	x	x	x	x	x	3	4	**4**
141		x	x		x		x	x	x	x	x	1	3	**3**
142		x	x		x	x		x	x	x	x	1	3	**3**
143		x	x		x	x	x		x	x	x	3	3	**3**
144		x	x		x	x	x	x		x	x	2	3	**3**
145		x	x		x	x	x	x	x		x	4	4	**4**
146		x	x		x	x	x	x	x	x		1	2	**2**
147		x	x	x			x	x	x	x	x	2	3	**3**
148		x	x	x		x		x	x	x	x	1	2	**2**
149		x	x	x		x	x		x	x	x	2	2	**2**
150		x	x	x		x	x	x		x	x	2	3	**3**
151		x	x	x		x	x	x	x		x	4	3	**3**
152		x	x	x		x	x	x	x	x		2	2	**2**
153		x	x	x	x			x	x	x	x	2	2	**2**
154		x	x	x	x		x		x	x	x	3	3	**3**
155		x	x	x	x		x	x		x	x	2	3	**3**
156		x	x	x	x		x	x	x		x	4	3	**3**
157		x	x	x	x		x	x	x	x		1	2	**2**
158		x	x	x	x	x			x	x	x	0	3	**3**
159		x	x	x	x	x		x		x	x	1	2	**2**
160		x	x	x	x	x		x	x		x	3	3	**3**
161		x	x	x	x	x		x	x	x		2	1	**1**
162		x	x	x	x	x	x			x	x	2	3	**3**
163		x	x	x	x	x	x		x		x	3	3	**3**
164		x	x	x	x	x	x		x	x		1	1	**1**
165		x	x	x	x	x	x	x			x	2	4	**4**
166		x	x	x	x	x	x	x		x		1	2	**2**
167		x	x	x	x	x	x	x	x			3	2	**2**
168	x				x	x	x	x	x	x	x	2	2	**2**
169	x			x		x	x	x	x	x	x	2	2	**2**
170	x			x	x		x	x	x	x	x	2	2	**2**
171	x			x	x	x		x	x	x	x	1	1	**1**
172	x			x	x	x	x		x	x	x	2	2	**2**
173	x			x	x	x	x	x		x	x	2	2	**2**
174	x			x	x	x	x	x	x		x	2	2	**2**
175	x			x	x	x	x	x	x	x		1	1	**1**
176	x		x			x	x	x	x	x	x	0	3	**3**
177	x		x		x		x	x	x	x	x	1	2	**2**
178	x		x		x	x		x	x	x	x	3	3	**3**
179	x		x		x	x	x		x	x	x	2	3	**3**
180	x		x		x	x	x	x		x	x	2	2	**2**
181	x		x		x	x	x	x	x		x	3	4	**4**
182	x		x		x	x	x	x	x	x		1	2	**2**
183	x		x	x			x	x	x	x	x	2	3	**3**
184	x		x	x		x		x	x	x	x	1	3	**3**
185	x		x	x		x	x		x	x	x	2	2	**2**
186	x		x	x		x	x	x		x	x	2	2	**2**
187	x		x	x		x	x	x	x		x	4	4	**4**
188	x		x	x		x	x	x	x	x		1	2	**2**
189	x		x	x	x			x	x	x	x	2	3	**3**
190	x		x	x	x		x		x	x	x	2	2	**2**
191	x		x	x	x		x	x		x	x	2	2	**2**
192	x		x	x	x		x	x	x		x	3	3	**3**
193	x		x	x	x		x	x	x	x		1	2	**2**
194	x		x	x	x	x			x	x	x	2	3	**3**

	Countries Included											Maximum Number of Cointegrating Vectors (r)		
Test	*Australia*	*China*	*Hong Kong*	*Indonesia*	*Japan*	*New Zealand*	*Philippines*	*Singapore*	*South Korea*	*Taiwan*	*Thailand*	*Based on Maximal Eigenvalue*	*Based on Trace*	***Conclusion***
195	x		x	x	x	x		x		x	x	1	2	**2**
196	x		x	x	x	x		x	x		x	3	3	**3**
197	x		x	x	x	x		x	x	x		1	1	**1**
198	x		x	x	x	x	x			x	x	2	2	**2**
199	x		x	x	x	x	x		x		x	2	3	**3**
200	x		x	x	x	x	x		x	x		1	1	**1**
201	x		x	x	x	x	x	x			x	2	3	**3**
202	x		x	x	x	x	x	x		x		0	2	**2**
203	x		x	x	x	x	x	x	x			2	3	**3**
204	x	x				x	x	x	x	x	x	2	3	**3**
205	x	x			x		x	x	x	x	x	2	3	**3**
206	x	x			x	x		x	x	x	x	2	3	**3**
207	x	x			x	x	x		x	x	x	3	3	**3**
208	x	x			x	x	x	x		x	x	2	5	**5**
209	x	x			x	x	x	x	x		x	3	3	**3**
210	x	x			x	x	x	x	x	x		1	2	**2**
211	x	x		x			x	x	x	x	x	2	2	**2**
212	x	x		x		x		x	x	x	x	1	2	**2**
213	x	x		x		x	x		x	x	x	1	2	**2**
214	x	x		x		x	x	x		x	x	1	4	**4**
215	x	x		x		x	x	x	x		x	1	3	**3**
216	x	x		x		x	x	x	x	x		2	2	**2**
217	x	x		x	x			x	x	x	x	1	2	**2**
218	x	x		x	x		x		x	x	x	2	2	**2**
219	x	x		x	x		x	x		x	x	1	3	**3**
220	x	x		x	x		x	x	x		x	2	2	**2**
221	x	x		x	x		x	x	x	x		2	2	**2**
222	x	x		x	x	x			x	x	x	2	2	**2**
223	x	x		x	x	x		x		x	x	1	3	**3**
224	x	x		x	x	x		x	x		x	2	2	**2**
225	x	x		x	x	x		x	x	x		0	1	**1**
226	x	x		x	x	x	x			x	x	2	3	**3**
227	x	x		x	x	x	x		x		x	2	2	**2**
228	x	x		x	x	x	x		x	x		2	2	**2**
229	x	x		x	x	x	x	x			x	2	4	**4**
230	x	x		x	x	x	x	x		x		0	3	**3**
231	x	x		x	x	x	x	x	x			1	2	**2**
232	x	x	x				x	x	x	x	x	2	3	**3**
233	x	x	x			x		x	x	x	x	0	3	**3**
234	x	x	x			x	x		x	x	x	2	3	**3**
235	x	x	x			x	x	x		x	x	0	4	**4**
236	x	x	x			x	x	x	x		x	0	3	**3**
237	x	x	x			x	x	x	x	x		2	2	**2**
238	x	x	x		x			x	x	x	x	2	2	**2**
239	x	x	x		x		x		x	x	x	2	3	**3**
240	x	x	x		x		x	x		x	x	2	2	**2**
241	x	x	x		x		x	x	x		x	1	3	**3**
242	x	x	x		x		x	x	x	x		1	2	**2**
243	x	x	x		x	x			x	x	x	2	3	**3**
244	x	x	x		x	x		x		x	x	1	3	**3**
245	x	x	x		x	x		x	x		x	4	3	**3**
246	x	x	x		x	x		x	x	x		1	2	**2**
247	x	x	x		x	x	x			x	x	2	3	**3**
248	x	x	x		x	x	x		x		x	3	4	**4**
249	x	x	x		x	x	x		x	x		1	2	**2**
250	x	x	x		x	x	x	x			x	2	4	**4**
251	x	x	x		x	x	x	x		x		1	3	**3**
252	x	x	x		x	x	x	x	x			1	2	**2**
253	x	x	x	x				x	x	x	x	1	2	**2**
254	x	x	x	x			x		x	x	x	1	2	**2**
255	x	x	x	x			x	x		x	x	2	2	**2**
256	x	x	x	x			x	x	x		x	3	2	**2**
257	x	x	x	x			x	x	x	x		2	2	**2**
258	x	x	x	x		x			x	x	x	1	3	**3**
259	x	x	x	x		x		x		x	x	1	2	**2**
260	x	x	x	x		x		x	x		x	1	2	**2**
261	x	x	x	x		x		x	x	x		0	1	**1**
262	x	x	x	x		x	x			x	x	1	3	**3**
263	x	x	x	x		x	x		x		x	1	2	**2**
264	x	x	x	x		x	x		x	x		2	2	**2**
265	x	x	x	x		x	x	x			x	2	2	**2**
266	x	x	x	x		x	x	x		x		1	2	**2**
267	x	x	x	x		x	x	x	x			1	2	**2**
268	x	x	x	x	x				x	x	x	1	3	**3**
269	x	x	x	x	x			x		x	x	1	1	**1**
270	x	x	x	x	x			x	x		x	1	2	**2**
271	x	x	x	x	x			x	x	x		1	2	**2**
272	x	x	x	x	x		x			x	x	2	2	**2**
273	x	x	x	x	x		x		x		x	3	3	**3**
274	x	x	x	x	x		x		x	x		1	2	**2**
275	x	x	x	x	x		x	x			x	1	2	**2**
276	x	x	x	x	x		x	x		x		1	1	**1**
277	x	x	x	x	x		x	x	x			2	2	**2**
278	x	x	x	x	x	x				x	x	0	3	**3**
279	x	x	x	x	x	x			x		x	1	3	**3**
280	x	x	x	x	x	x			x	x		1	2	**2**
281	x	x	x	x	x	x		x			x	1	2	**2**
282	x	x	x	x	x	x		x		x		1	1	**1**
283	x	x	x	x	x	x		x	x			1	1	**1**
284	x	x	x	x	x	x	x				x	2	2	**2**
285	x	x	x	x	x	x	x			x		1	2	**2**
286	x	x	x	x	x	x	x		x			1	1	**1**
287	x	x	x	x	x	x	x	x				0	2	**2**
	Groups of 3													
288	x	x	x									0	0	**0**
289	x	x		x								0	0	**0**
290	x	x			x							0	0	**0**
291	x	x				x						0	0	**0**
292	x	x					x					0	0	**0**
293	x	x						x				0	0	**0**
294	x	x							x			0	0	**0**
295	x	x								x		0	0	**0**
296	x	x									x	1	0	**0**

	Countries Included											Maximum Number of Cointegrating Vectors (r)		
Test	*Australia*	*China*	*Hong Kong*	*Indonesia*	*Japan*	*New Zealand*	*Philippines*	*Singapore*	*South Korea*	*Taiwan*	*Thailand*	*Based on Maximal Eigenvalue*	*Based on Trace*	***Conclusion***
297	x		x	x								0	0	**0**
298	x		x		x							0	0	**0**
299	x		x			x						0	0	**0**
300	x		x				x					0	0	**0**
301	x		x					x				0	0	**0**
302	x		x						x			0	0	**0**
303	x		x							x		0	0	**0**
304	x		x								x	1	1	**1**
305	x			x	x							0	0	**0**
306	x			x		x						0	0	**0**
307	x			x			x					0	0	**0**
308	x			x				x				0	0	**0**
309	x			x					x			0	0	**0**
310	x			x						x		0	0	**0**
311	x			x							x	0	1	**1**
312	x				x	x						0	0	**0**
313	x				x		x					0	0	**0**
314	x				x			x				0	0	**0**
315	x				x				x			0	0	**0**
316	x				x					x		0	0	**0**
317	x				x						x	1	1	**1**
318	x					x	x					0	0	**0**
319	x					x		x				0	0	**0**
320	x					x			x			0	0	**0**
321	x					x				x		0	0	**0**
322	x					x					x	2	2	**2**
323	x						x	x				0	0	**0**
324	x						x		x			0	0	**0**
325	x						x			x		0	0	**0**
326	x						x				x	1	1	**1**
327	x							x	x			0	0	**0**
328	x							x		x		0	0	**0**
329	x							x			x	1	1	**1**
330	x								x	x		0	0	**0**
331	x								x		x	1	0	**0**
332	x									x	x	1	0	**0**
333		x	x	x								0	0	**0**
334		x	x		x							0	0	**0**
335		x	x			x						0	0	**0**
336		x	x				x					0	0	**0**
337		x	x					x				0	0	**0**
338		x	x						x			0	0	**0**
339		x	x							x		0	0	**0**
340		x	x								x	1	1	**1**
341		x		x	x							0	0	**0**
342		x		x		x						0	0	**0**
343		x		x			x					0	0	**0**
344		x		x				x				0	0	**0**
345		x		x					x			0	0	**0**
346		x		x						x		0	0	**0**
347		x		x							x	0	0	**0**
348		x			x	x						0	0	**0**
349		x			x		x					0	0	**0**
350		x			x			x				0	0	**0**
351		x			x				x			0	0	**0**
352		x			x					x		0	0	**0**
353		x			x						x	1	1	**1**
354		x				x	x					0	0	**0**
355		x				x		x				0	0	**0**
356		x				x			x			0	0	**0**
357		x				x				x		0	1	**1**
358		x				x					x	1	1	**1**
359		x					x	x				0	0	**0**
360		x					x		x			0	0	**0**
361		x					x			x		0	0	**0**
362		x					x				x	1	1	**1**
363		x						x	x			0	0	**0**
364		x						x		x		0	0	**0**
365		x						x			x	1	1	**1**
366		x							x	x		0	0	**0**
367		x							x		x	0	0	**0**
368		x								x	x	0	0	**0**
369			x	x	x							1	1	**1**
370			x	x		x						0	0	**0**
371			x	x			x					0	0	**0**
372			x	x				x				0	0	**0**
373			x	x					x			0	0	**0**
374			x	x						x		0	0	**0**
375			x	x							x	1	1	**1**
376			x		x	x						1	1	**1**
377			x		x		x					1	1	**1**
378			x		x			x				0	0	**0**
379			x		x				x			1	1	**1**
380			x		x					x		0	0	**0**
381			x		x						x	2	2	**2**
382			x			x	x					0	0	**0**
383			x			x		x				0	0	**0**
384			x			x			x			0	0	**0**
385			x			x				x		0	0	**0**
386			x			x					x	1	1	**1**
387			x				x	x				0	0	**0**
388			x				x		x			0	0	**0**
389			x				x			x		0	0	**0**
390			x				x				x	1	1	**1**
391			x					x	x			0	0	**0**
392			x					x		x		0	0	**0**
393			x					x			x	1	1	**1**
394			x						x	x		0	0	**0**
395			x						x		x	1	1	**1**
396			x							x	x	1	1	**1**
397				x	x	x						0	0	**0**
398				x	x		x					1	0	**0**
399				x	x			x				0	0	**0**
400				x	x				x			0	0	**0**

Test	Countries Included											Maximum Number of Cointegrating Vectors (r)		
	Australia	*China*	*Hong Kong*	*Indonesia*	*Japan*	*New Zealand*	*Philippines*	*Singapore*	*South Korea*	*Taiwan*	*Thailand*	*Based on Maximal Eigenvalue*	*Based on Trace*	***Conclusion***
401				x	x					x		0	0	**0**
402				x	x						x	1	1	**1**
403				x		x	x					0	0	**0**
404				x		x		x				0	0	**0**
405				x		x			x			0	0	**0**
406				x		x				x		0	0	**0**
407				x		x					x	0	1	**1**
408				x			x	x				0	0	**0**
409				x			x		x			0	0	**0**
410				x			x			x		0	0	**0**
411				x			x				x	1	1	**1**
412				x				x	x			0	0	**0**
413				x				x		x		0	0	**0**
414				x				x			x	0	1	**1**
415				x					x	x		0	0	**0**
416				x					x		x	0	0	**0**
417				x						x	x	0	0	**0**
418					x	x	x					0	0	**0**
419					x	x		x				0	0	**0**
420					x	x			x			0	0	**0**
421					x	x				x		0	0	**0**
422					x	x					x	1	1	**1**
423					x		x	x				1	0	**0**
424					x		x		x			0	0	**0**
425					x		x			x		1	0	**0**
426					x		x				x	2	2	**2**
427					x			x	x			0	0	**0**
428					x			x		x		0	0	**0**
429					x			x			x	2	1	**1**
430					x				x	x		0	0	**0**
431					x				x		x	1	1	**1**
432					x					x	x	1	1	**1**
433						x	x	x				0	0	**0**
434						x	x		x			0	0	**0**
435						x	x			x		0	0	**0**
436						x	x				x	1	1	**1**
437						x		x	x			0	0	**0**
438						x		x		x		0	0	**0**
439						x		x			x	2	1	**1**
440						x			x	x		0	0	**0**
441						x			x		x	1	0	**0**
442						x				x	x	0	0	**0**
443							x	x	x			0	0	**0**
444							x	x		x		0	0	**0**
445							x	x			x	1	1	**1**
446							x		x	x		0	0	**0**
447							x		x		x	1	1	**1**
448							x			x	x	1	1	**1**
449								x	x	x		0	0	**0**
450								x	x		x	1	1	**1**
451								x		x	x	1	1	**1**
452									x	x	x	0	0	**0**

Key: *Cointegration exists*

Conclusion

As the results show, both short term and long term integration increased over the period, implying that on balance, the stock market crashes had a negative impact on diversification opportunities.

The instances of significant short term correlation increased. Most markets are now positively correlated. Hence short term diversification opportunities have been reduced. The most notable exception is China. The instances of significant correlation fell as a result of the first crash, in October 1987, but increased as a result of the other crashes.

During the first sub-period, all seven markets appeared to be cointegrated, although there was no evidence of any pairwise cointegration between markets. However, long term integration between the markets appeared to increase over the whole period. By the fifth sub-period, I was able to test eleven markets for cointegration. For all possible combinations of ten markets, nine markets (and all eleven) the markets were cointegrated. In addition, 14.5% of the pairs of markets were cointegrated. This implied that long term opportunities for diversification across the region fell.

Despite the overall increase in integration, there are still numerous specific opportunities for diversification, due to weak correlations and lack of cointegration between specific markets. The results also show that in the case of specific diversification decisions, conclusions drawn from the short run analysis can differ from those drawn from the long run analysis. Thus, in making asset allocation decisions, investors could benefit from using both short term and long term relationships.

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