

A CO-INTEGRATION ANALYSIS OF PAKISTAN STOCK MARKET WITH ASIAN PACIFIC MARKETS

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Abstract

Globalization increases integration among markets which provide room to taste fruit of higher profitability at lowest cost by holding diversified portfolios internationally. This study is conducted to identify stock markets from Asian Pacific region, for those investors who hold investment in Pakistani stock market and want to diversify their portfolios. Weekly data of closing stock market indices is used in study ranging from 1997 to 2014. Unit root test confirmed that all variables are stationary at first difference. Johnson Week co-integration is confirmed through Johnson Co-integration test, correlation analysis is performed to check short run association and granger causality for causality between markets. It is observed that week long term association is contagion effect of US subprime crisis. Result indicated that best possible options for short term investment are Japan, Taiwan and China. Bi-variate analysis confirmed that Japan, Hong Kong, Korea, Malaysia, Indonesia and Singapore are available options for portfolio diversification for long term horizon.

Keywords: Integration, Portfolio, Diversification, Asian Pacific

JEL Classification: D78, E44, F15, F36

Introduction

Global integration of the stock markets is the matter of great importance. The effects of financial crises occurred in one financial market are felt internationally. As these international investment markets are linked together so due to these linkages an event in one market produces ripple effects in other markets as well even investors own home market.

It is commonly observed that changes in price of stocks in one market leads to change in stocks price of another markets. These are termed as co-movements. If these co-movements are positive then portfolio diversification can not reduce the risks as stated by Markowitz Portfolio Theory. Portfolio diversification is effective incase of negative co-movement. Negative co-movements are observed when increase in stocks prices of one market lead to decrease stocks prices of another market.

In every business cost and benefit analysis is performed for every activity. Jin & Li (2006) highlighted cost and benefits associated with diversification activities. Diversification is simply defined as spreading out the risk associated with the securities. the common saying regarding diversification is “Not to put all your eggs in one basket”. Investor must diversify his investemnt in order to meet his objective efficiently and effectively. US subprime crisis and its after shocks changed whole world market association that ignite the need to check the association between markets and managed portfolios.

In this study cointegration analysis is performed from the perspective of Pakistani investor to give him the idea about diversifying the portfolio internationally among asian pacific region inorder to minimize risk by maximizing the returns.

Literature Review

Area of research on market associations was pointed out by Grubel (1968) in his study. He studied correlation among the markets of United States of America, United Kingdom, Japan and Germany. Following his work as a base, many renowned researchers like Agmon (1972), Hilliard (1979)), Hamao et al. (1990) and Becker et al. (1990) perform similar studies. Main reason for focusing research on correlation of developed markets in above studies was due to identified benefits of international portfolio diversification. Results show that markets were associated but at low level due to low correlation value.

Now with the advancement of technology the more refined procedures were utilized for the analysis. Arshanapalli et al. (1995) find out association among stock markets after the market crash of 1987 which highlighted contagion effect. Along with that they confirmed the association exists among Asian markets. The result of this study was confirmed by the Liu et al. (1998) and Bose and Mukherjee (2006). Denis et al. (2002) studied market association by focusing on the linkages in United States Gas Industry (natural gas) by using co-integration rank test. The results showed that integration exists in the dispersed gas markets by having strong linkages. Around 20 pairs of markets were studied and found that more than 60% markets show perfect integration. Shik Lee (2004) also confirmed the results in his study. Mukherjee and Mishra (2005) confirmed the integration exist between Indian stock markets and the markets of Indonesia, Philippines,

Malaysia, Thailand and Korea.

Forbes and Rigobon (2001) define contagion effect as increase correlation among market after crisis. It is very much clear to understand that in post crisis period correlation is at moderate level. It is correct to say that it is defensive move in which portfolios are managed on active basis by keeping in view market focus. Rajwani and Mukherjee (2013) also explain contagion effect in the similar way and confirming previous justification.

Kanas (1999) studied association between USA and six of the largest European equity markets. The pairwise co-integration, Johansen's method and Bierens non-parametric test were used. The outcome of the study show that United States' stock markets were associated with any of the European stock markets. Arshanapalli and Kulkarni (2001) researched nature and degree of connection between US stock market and Indian stock market. The data used for this research consist of daily closing prices of indices for 10 years of BSE, the NYSE and NASDAQ. Result show that Indian Stock market was not affected by the movements in NYSE and NASDAQ. Masih and Masih (2001) studied configuration of dynamic association between national stock prices of Australia and four Asian stock markets like South Korea, Taiwan, Hong Kong and Singapore. This study covers both long and short term association with multivariate dynamic frameworks. Result showed that Hong Kong stock market was the major market which brought changes in Australian and other Asian stock markets.

Nath and Verma (2003) found that there was no integration between the Indian stock market with the stock markets of Taiwan and Singapore. Mukherjee and Mishra (2005) confirmed the integration exist between Indian stock markets and the markets of Indonesia, Philippines, Malaysia, Thailand and Korea.

Janor et al. (2007) discovered that due to crisis of 1997 association among five ASEAN countries was affected. This association was both on regional and global level. Research on integration of Asian stock markets which was on emerging stage, with developed markets were conducted by variety of researchers. In the most recent study of Rajwani and Mukherjee (2013) to check association between Indian market and other Asian markets give us clear depiction that there is no collective and individual linkages exists between the Indian and other Asian Markets.

Data Collection and Methodology

In this study data is collected from Yahoo Finance. Time period of study is eighteen years, starting from 1997 to 2014. Weekly data of stock market closing index declared in home currency is used in the study. The reason behind choosing weekly data is to overcome time zone difference. Augmented Dickey Fuller unit root test is applied to check data stationary conditions. Correlation analysis performed for short term relationship. Johansen Cointegration is applied for longer term association between markets. Pairwise Granger Causality Test applied to confirm direction of change. Figure 1 provided the graphical representation of the data.

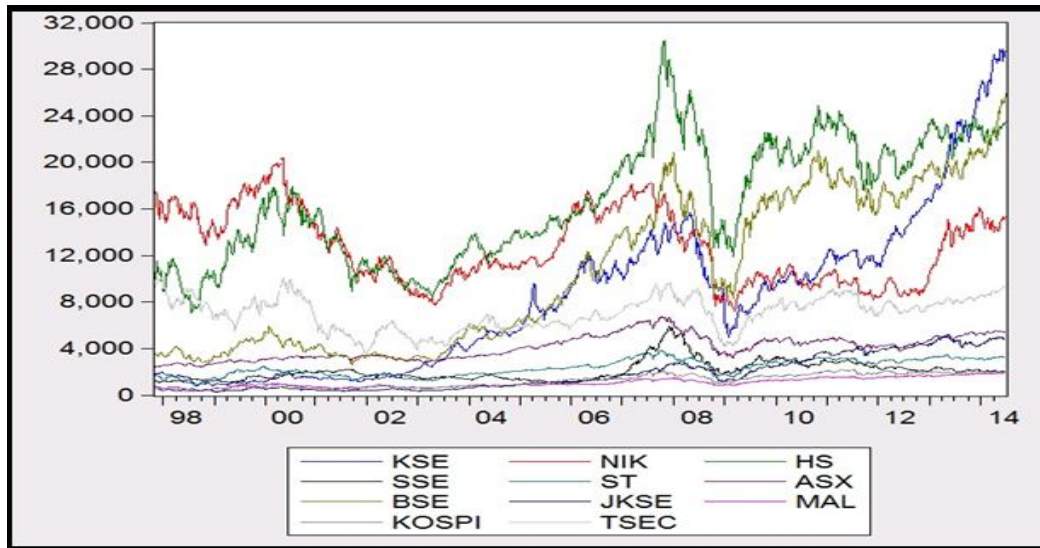


Figure 1 Contagion Effect and Market Integatrimon

Table 1 Indices of Asian Pacific Stock markets

1. Straits Times (Singapore) ST	8. Australian Stock Exchange (Australia) ASX
2. Hang Seng (Hong Kong) Stock Market	9. Jakarta Stock Exchange (Indonesia) JKSE
3. Kuala Lumpur Composite (Malaysia) Malaysia	10. Taiwan Stock Exchange (Taiwan) TWSE
4. Shanghai Composite (China) SSE	11. Karachi Stock Exchange (Pakistan) KSE
5. BSE SENSEX (India)	
6. Nikkei Stock (Japan)	
7. KOSPI (South Korea)	

Correlation Analysis

Table no 2 shows result of correlation analysis. It clearly shows that the association exists over the period of eighteen years among Asian Pacific markets. It means that in short run any event caused variation in one market leads to shake other markets as well. Fluctuations are strong in markets with high correlation. Correlation coefficient with value 0.5 and greater show strong relationship and vice versa.

Table 2 Correlation Analysis

	KSE	NIK	HS	SSE	ST	ASX	BSE	JKSE	MAL	KOSPI	TSEC
KSE	1.00										
NIK	-0.03	1.00									
HS	0.79	0.06	1.00								
SSE	0.44	-0.07	0.75	1.00							
ST	0.82	0.09	0.96	0.65	1.00						
ASX	0.80	0.13	0.86	0.65	0.90	1.00					
BSE	0.90	-0.14	0.92	0.64	0.92	0.82	1.00				
JKSE	0.90	-0.22	0.82	0.50	0.83	0.66	0.94	1.00			
MAL	0.91	-0.13	0.88	0.55	0.91	0.75	0.95	0.96	1.00		
KOSPI	0.87	-0.16	0.92	0.62	0.94	0.83	0.97	0.92	0.95	1.00	
TSEC	0.45	0.48	0.61	0.42	0.57	0.40	0.53	0.51	0.51	0.48	1.00

Direction of variations is determined by signs of correlation coefficient. Value from Table no 2 shows that Karachi Stock market only has negative correlation with Nikkei stock market but this association is weak in nature. Weak positive correlation present between Karachi/Shanghai stock markets and Karachi/Taiwan stock markets. Karachi stock market has strong positive relationship with Hong Kong, Shanghai, Straight Time, Australian, Bombay, Jakarta, Malaysian and KOSPI (Korean) stock market. Correlation analysis gives us idea about short term relationship between Asian Pacific markets which changes over the period of time. In light of Modern portfolio theory it can be said that low correlation between assets is key to reduce the risk.

Correlation is a short term and time varying approach. Any portfolio and policy formulation on the basis of correlation analysis is not effective for longer period of time. For this reason need arises to move on toward cointegration which tells about long term relationship. It measures the price co-movement of assets. This provides a reliable base for portfolio and policy making. It helps to provide the long run equilibrium with short term fluctuations and readjustments through speed of adjustments.

Unit Root Test

Augmented Dickey Fuller unit root test is performed on the data to check stationary data. In order to satisfy conditions for cointegration data must be non-stationary on level but stationary at on 1st difference.

Table 3 Unit Root

Markets	ADF	Probability	ADF* 1st Difference	Probability
ASX	-1.393146	0.5868	-29.98265	0.0000
BSE	0.438781	0.9845	-18.36140	0.0000
HS	-1.600103	0.4821	-29.53142	0.0000
JKSE	1.009095	0.9968	-32.18845	0.0000
KOSPI	-0.972348	0.7646	-30.84066	0.0000
KSE	2.413659	1.0000	-25.58414	0.0000
Mal	0.208233	0.9731	-28.64951	0.0000
Nik	-2.039377	0.2700	-30.19695	0.0000
SSE	-2.046054	0.2671	-13.74397	0.0000
ST	-1.184429	0.6830	-28.20852	0.0000
TSEC	-2.284901	0.1772	-29.84893	0.0000

Johnson Cointegration Analysis

Table no 4 show results of Johansen co-integration analysis which confirm figure 1 graphic display. Both trace statistics and maximum eigen statistics confirms very weak long term association among markets of Asian pacific region. Lag length is two on the basis of Akaike information criteria. It means that when one market face stimulus then associated market faces ripples effect after two weeks. Lag time rational can be understood that investor adjust their portfolios by adopting different techniques. This portfolio management develops contagion effect by major correlational changes specially after crisis. It also confirms correlation short term time varying nature. To understand direction of change between two markets effect of change direct Pairwise Granger Causality Test is required.

Table 4 Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.108357	389.2665	285.1425	0.0000
At most 1 *	0.086052	289.9454	239.2354	0.0000
At most 2 *	0.061076	212.0214	197.3709	0.0075
At most 3	0.049593	157.445	159.5297	0.0645
At most 4	0.039275	113.3958	125.6154	0.2176
At most 5	0.029072	78.69781	95.75366	0.4091
At most 6	0.020534	53.14819	69.81889	0.4987
At most 7	0.017348	35.18055	47.85613	0.4385
At most 8	0.013357	20.02552	29.79707	0.4211
At most 9	0.00798	8.380389	15.49471	0.4256
At most 10	0.001664	1.442339	3.841466	0.2298
Trace test indicates 3 cointegration eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.108357	99.32109	70.53513	0.0000
At most 1 *	0.086052	77.92403	64.50472	0.0016
At most 2	0.061076	54.57633	58.43354	0.1144
At most 3	0.049593	44.04919	52.36261	0.2735
At most 4	0.039275	34.69803	46.23142	0.4793
At most 5	0.029072	25.54961	40.07757	0.7323
At most 6	0.020534	17.96765	33.87687	0.8793
At most 7	0.017348	15.15502	27.58434	0.7359
At most 8	0.013357	11.64513	21.13162	0.5829
At most 9	0.00798	6.93805	14.2646	0.4965
At most 10	0.001664	1.442339	3.841466	0.2298

Max-eigenvalue test indicates 2 cointegration eqn(s) at the 0.05 level

****MacKinnon-Haug-Michelis (1999) p-values**

Pairwise Granger Causality Test

Karachi stock market has a causal relationship with Singapore (Straight Times), Indian (Sensex), Japan (Nikki), Kuala Lumpur Composite stock market (Malaysia), Jakarta Stock Exchange (Indonesia) and Taiwan Stock exchange. In this short term, causal relationship the between Pakistan and rest Asian pacific markets, a bidirectional causal relationship is present only between Indian and Pakistan stock market. It is not a good option due to high correlation as well as bidirectional relationship.

Table 5 Pairwise Granger Causality Tests

Null Hypothesis:	Observations	F-Statistic	Probabilities
NIK does not Granger Cause KSE	867	5.96318	0.0027
KSE does not Granger Cause NIK		1.48261	0.2276
HS does not Granger Cause KSE	867	2.23263	0.1079
KSE does not Granger Cause HS		2.21504	0.1098
SSE does not Granger Cause KSE	867	1.5969	0.2031
KSE does not Granger Cause SSE		0.06675	0.9354
ST does not Granger Cause KSE	867	3.22164	0.0404
KSE does not Granger Cause ST		0.85259	0.4267
ASX does not Granger Cause KSE	867	0.11882	0.888
KSE does not Granger Cause ASX		1.2574	0.2849
BSE does not Granger Cause KSE	867	5.5179	0.0042
KSE does not Granger Cause BSE		3.03038	0.0488
JKSE does not Granger Cause KSE	867	3.57143	0.0285
KSE does not Granger Cause JKSE		0.58206	0.559
MAL does not Granger Cause KSE	867	6.66712	0.0013
KSE does not Granger Cause MAL		0.6888	0.5025
KOSPI does not Granger Cause KSE	867	2.08306	0.1252
KSE does not Granger Cause KOSPI		0.59037	0.5543
TSEC does not Granger Cause KSE	867	0.55318	0.5753
KSE does not Granger Cause TSEC		3.58281	0.0282
Lags: 2			

A single unidirectional causal relationship exists between Pakistan to Taiwan Stock exchange only because of increasing portfolio investment of Pakistani Investors in the Taiwan stock market. Extent of correlation is positive but still less than 0.5 and direction of stimulus is from Pakistan stock market to Taiwan stock market which gives venue for portfolio diversification. Other unidirectional causal relationship exists from Japan, Malaysia, Indonesia and Singapore

Stock exchange to Pakistan. Singapore market is very risky for Pakistani investor. As direction of impact is from Singapore market to Pakistani market. High positive correlation means high short term integration which increasing over the period of time. If Singapore market faces crunch it will cause huge ripples effect in the same way on the Pakistani market as well. From investor who invested in Pakistan Stock market, investment in Singapore Straight Time stock market is not a worthy option.

A similar situation is with Malaysia and Indonesia stock market. Both options are not recommended for investor who holds stock in Karachi stock market. Japan (Nikki) is one of the most important markets. Shanghai stock market is second best option for short term only due to small correlation.

There are three co-integration vectors according to trace statistics and two cointegration vectors according to maximum eigen statistics out of 11 stock markets which clearly show that integration among the markets is weak over the period of time. As integration is also time variant in nature. After US subprime crisis, contagion effect reduces market associations clearly visible in graph.

Bi-Variate Co-integration Analysis

Bi-variate analysis tells us that Karachi stock market has long term association with Shanghai, Australian, Bombay and Taiwan stock markets. Long term association with China is due to high level of trade between both countries. There are huge stakes of Chinese investor in Pakistan's power sector confirm this long term association. Long term association with Australia is due to large investment of Australia in Pakistan to develop dairy and horticulture industries. Educational scholarship for Pakistani students also facilitates this relationship. Pakistan's long term trade association with India confirms co-integration between both countries' markets. Bilateral trade between both countries from past two decades is very stream line. Informal trade is also very high which one of main reason for this association. Relationship between Pakistan and Taiwan is flourishing in all domains so both countries want to develop trade agreement. Taiwan's investors are interested in Pakistan market for that delegation visits to discuss matters related trade office formation in Pakistan.

Conclusion

This study provides a strong base for answering a major question regarding where to invest? which market shall be selected for establishing trade ties and investment portfolios among Asian Pacific markets. It clearly highlighted to policy developers as well as investors that for short term investments Japan (Nikki), and Taiwan are best available options where China is second best venue for portfolio diversification. Pakistan market has long term association with Shanghai, Australian, Bombay and Taiwan stock markets. Investors who need to diversify their portfolio must invest in other Asian pacific markets like Nikki, Hang Shang, Kospi, Kuala Lumpur, Jakarta and Straight Times with long term horizon.

Table 5 Bi-Variate Cointegration Test

No. of CE(s)	Eigenvalue	(Trace) Statistic	Critical Value	Prob.**
KSE & Nikki				
None	0.007934	10.27822	15.49471	0.2599
At most 1	0.003895	3.379655	3.841466	0.066
KSE & HangShang				
None	0.009065	11.23304	15.49471	0.1976
At most 1	0.003858	3.347318	3.841466	0.0673
KSE & Shanghai				
None*	0.007115	6.183397	3.841466	0.0129
At most 1	0.008272	13.37662	15.49471	0.1017
KSE & Straight Times				
None	0.009833	11.22984	15.49471	0.1978
At most 1	0.003081	2.672454	3.841466	0.1021
KSE & Australian S.M				
None*	0.005034	4.370746	3.841466	0.0366
At most 1	0.007473	10.86653	15.49471	0.2198
KSE & Sensex				
None*	0.006038	5.244804	3.841466	0.022
At most 1	0.008586	12.71217	15.49471	0.1258
KSE & Jakarta				
None	0.010553	10.09572	15.49471	0.2734
At most 1	0.001048	0.908216	3.841466	0.3406
KSE & Malaysia				
None	0.01354	12.63852	15.49471	0.1288
At most 1	0.000961	0.832913	3.841466	0.3614
KSE & Kospi				
None	0.009057	9.287567	15.49471	0.3395
At most 1	0.001625	1.408691	3.841466	0.2353
KSE & Taiwan				
None *	0.01799	18.76667	15.49471	0.0155
At most 1	0.003511	3.045845	3.841466	0.0809

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