

A Study on the Linkages of Asian and the US Stock Markets

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Abstract

In the current unpredictable and volatile economic environment, the investment avenues have been changing rapidly. The stock market is one of them. There are multiple unpredictable factors which affect the performance of the global market time to time. In recent years, we have observed an unprecedented growth in the complexity of instruments for trading and risk management in international market and thus issues of international stock market linkages and the relationship between the Asian stock markets and others stock markets deserves to be investigated to justify the risk and return factor after the Asian Financial Crisis. This is the first exhaustive study of its kind on linkages and the interrelationship between the Asian stock markets and others stock markets namely, Malaysia (Kuala), Singapore (Strait), Philippines (Pse), Indonesia (Jakarta), China (Shanghai), Japan (Nikkie), Korea (Kospi), and the US (Dow) and reveal that stock markets of Thailand, Japan and China are exogenous before, during and after the crisis respectively. For the purpose of study composite sample consisting of all the stocks based on weekly stock indexes is been used to construct panels and for the same the total samples are separated into three sub periods — January 2005 to December 2007, January 2008 to December 2008, January 2009 to December 2009. The first part of paper gives an insight about the Asian and US stock markets and its various aspects. The second part consists of data and their analysis, collected from the various websites and manuals. The short-term linkage was tested through granger causality test based on

Vector Error Correction Model (VECM), and the co integration or long-term linkage was through Engle-Granger co integration test. The empirical results show that the number of significant cointegrating vector is higher during the crisis periods compared to other periods and concludes that the linkages between the Asian and the US stock markets are stronger in the post-crisis period

Keywords: VECM, Unit Root, DF test, ADF test, Shanghai, Nikkie, Kospi, Dow, Stock market

JEL Codes: COI, C22, C51, C53, G12, G14, G15, H83, F3

1. Introduction

Over the past decade, business has continued to grow with pace and became more globalised than ever and resulting demand for finance in many folds. With the growing global trade the needs to communicate across the borders has correspondingly multiplied, consequently there is globalization of capital markets which became integral part of economy and also custodian of socio-economic integrity and play instrumental role in global economic growth and have a deep impact on overall capital employment. Company in one country is borrowing in the capital market of another country. In an open economic competition and in the era of globalization performance

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of organization changes day by day, investment avenues became global and expanded gradually with continuous strength. With growing capital market and introduction of high breed financial instrument for common benefit it became important to understand the concept of global stock markets its investment, risk and return significance in economic development.

To achieve complete efficiency in stock market may not be possible because of difference in the economic, political, legal and cultural environment which cast there shadow on shareholders return. In general perception, investment is regarded as a sacrifice of certain present value of the uncertain future reward or allocation of funds to assets that are expected to yield some gain over a period of time which exclusively involves strategic decisions like, where to invest, when to invest and how to invest. Since every investor have different behavior with common appetite to invest in those investment policies which may generate maximum return with minimum risk. To have return with safe growth and investment in unpredictable global capital / financial market, investors have to establish some diversified policies and procedures to shed the risk and equate the invested expectations through global portfolio which is an appropriate selection and collection of investments held by institutions or a private individual.

In order to attract the investors globally, market reforms are inevitable which may fuel competition in financial market with safe return to investors and produce positive financial vibration which explores capital market efficiency and zenith the growth. Balance financial employment and motivating returns on investment need healthy and vibrant capital market. Positive stock markets encourage common investors to invest in security market and maximize the wealth. In order to cater the global economic competition and varied requirements of savers and investors wide spectrum of financial intermediaries with high breed investments offerings both in money market and capital market with nations central banks as the apex body have come into existence across the globe. Further in efforts to manage unexplored challenges and capitalize the global investment opportunities to the fullest, pursuance of nation's policy of liberalization, privatization, and globalization has fueled overall competitiveness in global economies and respective stock markets. Global economies offering tremendous opportunities to stock market and other financial organizations to explore expand and diversify their product range and operators besides improving their operational efficiency. Effective

execution of strategy is contingent upon adoption of new high breed global financial instrument, technology better possess of credit and risk appraisal, fund management, product diversification, responsive structure, internal control and availability of talented man power.

2. Causes of Recession and Its Impact

The financial crisis which in respect recognized as great recession was sponsored by greedy uncontrolled fall of world trade currency the US dollars by 40% which chopped investor's interest earning on their assets by more than 80% during 2001-2008. It happens due to Federal Reserve Banks secret mission with no accountability. The over emphasis upon debt instead of income through hyper inflating the money supply US dollar began to fall in value and touched historic low against the major competitive currencies. The Federal Reserve Bank printed too many dollars to cover mounting budget deficit which was \$164.7 billion in the third quarter as to avoid a recession which has created an imbalance between income and assets and caused drastic inflation a hidden tax which was 4.3% in 2007 and was 1% higher than its GDP. It has been noted that inflation sabotaged US growth and swallowed 15% of its economy and its Infection spread and created insecurity globally. The IMF sees inflation rate nearly doubling by almost 12 % in emerging and developing world due to recession impact.

To control inflation you need to control money supply but in USA money supply exploded astonishingly 3,000% from \$302 billion in 1959 to \$11.5 trillion in 2006 and thus dollars purchasing power collapsed almost by 85% during the period resulting America becoming largest debtor on earth which mounted to & 53 trillion. Once largest creditor nation in the world US became largest debtor nation and its overall debt observation was considered in between 70 to 100 trillion dollars with increasing trend of more than \$7.4 billion per day. In the previous year of recession, its total debt grown almost by & 4.3 trillion, comparatively 5.5 times larger than US, GDP. Interest on foreign debt rose almost by \$2.2 trillion, Business and financial sector debt grown by 7-11%, Almost 80% of American debts which stood to around \$42 trillion were created since 1990. Highest debt ratio in world history, that's \$175,154 per man, woman and child or \$700,616 per family of four.

In May 2007 trade surplus of US recorded historic negative trade deficit of \$827 billion. Since 1985, its

international deficit is approximately 35% larger than social security spending, almost 50% larger than all defense spending, and 2.5 times higher than Medicare. Its merchandise ratio to national income has grown to 18%. Its overall merchandise trade deficit of \$815 billion in 2007 was due to its trade performance and created history by establishing second largest negative trade balance. Its cumulative deficit mounted to 6.6 trillion dollars which caused negative international net worth of \$5 trillion and its core manufacturing base reduced by 60%,

America's 27% of the economy depends on international trade in goods; foreign interests have more control over the US economy than Americans and interest on foreign debt rose almost by \$2.2 trillion. They own about \$9 trillion of US financial assets, including 13% of all stock, 13 % of agencies, and 27 % of corporate bonds. Its foreign reserve and universal reserve fell from 50% of the worlds total to 2.4% ratio, a 95% drop. As 2006 SDR data revealed that USA has \$69 billion as compared to China \$1.04 trillion, Japan \$882 billion reserves. During the period China and Japan together own 40% of the total world international reserve (\$5 Trillion) and US share is just 1% with tremendously growing international debts in comparison to it mere \$69 billion international reserve. It is also revealed that 80% of world's official foreign exchange reserves which is about \$2.2 trillion dollars are held by Asian central banks.

Since 1990s with declining US manufacturing base, its per capita energy consumption have increased heavily. Each day the world oil market consumes 76 million barrels, America, with 5% of the total world population consumes three times more oil than its total productivity, and it has consumption of 20 million barrels per day (26 % of world total oil production). The difference between Americans production and consumption during the period was almost 75% which produced deficit gap of 15.5 million per day and collectively 5.7 billion per year. Further, its population increased 70 million and in its comparison in last 30 years its oil reserves declined by 42% and it produces only 20 billion barrels oil.

In comparison to economic growth its spending ratios and its employee number increases faster than its population. Federal government spending ratios reached almost 25% of its total national income which was 10 times more growth in government spending than its economy growth since 1930 and consumed 15% of its economy. During the period education productivity dropped by

71% and unemployment rate increases to it all time high. There was very unusual situation. The economy grew at a 0.6% annual rate over the last two quarters, the slowest pace since 2001 recession. In 2007, US housing market worsened and were one of the major causes for the subprime crises that were witnessed and resulted in collapse of large financial institutions, the bailout of banks by national government and downturns in stock markets around the world. Years of easy liquidity and relatively low interest rate regime fuelled an economic boom across the globe, driven largely by credit expansion and magnificent rise in asset prices. Default and losses on other loan types also increased significantly as the crises expanded from the housing market to other parts of the economy. However, the obscure problem of plenty began to surface in the US mortgage economy, with disastrous parameter. Mortgage prices in US declined 40% in less than a year and impacted the economy of US in large.

Policymakers did not recognize the increasingly important role played by financial institutions such as investment banks and hedge funds, also known as the shadow banking system which resulted number of established and leading banks collapsed as some of them were not commercial banks but was connected with commercial banks through derivatives transactions. Large number of the banks was heavily dependent for short term funds on money market mutual fund that provided wholesale fund, fled the market. In fact banks were not felled losses on their subprime loans. They were felled by losses on mortgage backed securities caused by drying up of liquidity and by the loss of nerve of market participant, confidence. Questions regarding banks solvency, declines in credit availability, and damaged investor's confidence had an impact on global stock markets, where securities suffered large losses during late 2008 and early 2009.

The US tried to maintain and expands consumption rather than producing real goods and savings thus facing uncontrollable debt in relation to size of its economy. In order to develop stability in overall market it provided funds to encourage lending and restore faith in commercial paper markets in addition it also bailout integral financial institutions and implemented economic stimulus programs to promote and protect market confidence. The (FED) chairmen acknowledged that the central bank faced increasingly contradictory pressure of slowing growth and rising consumer prices. In past 1 % decline in US growth impacted growth in emerging economies by 0.5% to 1 % depending on trade and financial links to US and

Week dollars impacted Asian exports in particular.

Since 1997, Asia attracted almost 50% of the total capital inflow. It is due to large population which make Asia darling of investor. The economies of Southeast Asia handsomely maintained a high interest rate which attracted investors who are found of high return. With the support of World Bank, IMF, regional economies of Asia experienced high growth rates but the recession of US impacted global market to a large extent and market with close interrelation suffered in multiple way. In addition to recession, Asian countries weak domestic financial system, free international capitals flows, fluctuating market and investor's sentiment and hype hazard economic policies also played supportive role.

3. Literature Review

Literature review is an organized and scientific approach of study which require collection and systematic analysis of literatures in the selected area of the researchers in which they have limited or no exposure. A deep survey of literature exposed the truth that large number of researchers, independent and professional research institutions and academicians has carried out extensive research in the field of international stock market linkages and many are concerned about the relationship between the Asian stock markets and others after the Asian Financial Crisis, *Sharpe and Cooper, Basu, Irala, Brown, S.V. Ramana Rao, Zafar S.M, Tariq, Naliniprava Tripathy, M. Kabir Hassan, Neal C. Maroney Hassan Monir El-Sadyand Ahmad Telfah, Barman and Smanta, Myong Jae Lezand SooCheong (Shawn) Jang*, and they produced important findings which pave multiple dimensions and set ultimate standard. It has been noted that large number of the studies has been carried out in developed economy or developed countries stock market, few studies in this context is been carried out in developing economy or countries stock market. Further outcome of these studies reflects that studies which are carried out in developing nations are not scientific and lack authenticity and validity thus keeping developing nations in mind this paper initiate humble beginning in this, respects.

Ayshanapalli et al. (1995) in his study he examine the existence of a common stochastic trend between the US and the Asian stock market movements during pre- and post-October 1987 periods. For the study he took data for the time period January 1, 1986 to May 12, 1992 from Singapore, Thailand, Malaysia, Philippines, Hong

Kong Japan and United States. He used cointegration and error-correction model for his study and found that influence of the US stock market innovations were in excess during the post-October 1987 period. The study concluded with the fact that Asian stock markets are less integrated with Japan's stock market than they are with the US stock market, *Masih and Masih (1999)* in his study examined the long-term and short-term dynamic linkages between the international and Asian emerging stock markets, and tried to quantify the extent of the Asian stock market fluctuations which are explained by intra-regional contagion effect. The finding of study at the global level, confirm the widely flouting doctrine of united State leadership in short and long term stock market and its existing relationship between OECD stock markets along with the emerging Asian stock markets. At Southeast Asia, the results of the study confirm the dominating role of Hong Kong stock market which was even expected too, *Malliaropulos and Priestly (1999)* in their study investigated the predictable component of Southeast Asia Stock market. For the purpose data from January 1988 to December 1995 at weakly frequency basis was taken as sample and the study findings were assessed by adjusting stocks returns for potential time varying expected returns and partial integration of this emerging market into world capital market. The study clearly indicated the danger of testing market efficiency without sufficiently adjusting the stock returns with care, especially time variation in the expected return and partial integration of local markets into world class, *Sheng and Tu (2000)* in their study they investigated linkages among national stock markets before and during the period of their Asian Financial crisis through co-integration and variance decomposition analysis. For the study they took data from July 1, 1996 to June 30, 1998 on daily closing prices basis of the New York S&P 500 and the 11 major Asia-Pacific equity market indexes. The outcomes of the study reveals that Southeast Asian countries have strong relationship in comparison to the Northeast Asian countries and the findings also indicate that there were no cointegrational relationship prior to Asian financial crises. Further the forecast error variance decomposition finds that the degree of exogeneity for the stock markets has been reduced to an extent, *Manning (2002)* in his study tried to investigate the co- movement of stock markets in South Asia, concurrently taking the United States to be an external stock market. For the study they took the data compromised weekly and quarterly information on stock indexes and US dollars series for the US, Hong Kong,

Indonesia, Korea, Japan, Malaysia, the Philippines, Taiwan, Singapore and Thailand for the period from January 1988 to February 1999. His study produced that generally two common trends are present in the East Asian stock market indexes and similarly two trends prevails when the US stock market additionally included in Johansen VAR, *Azman, Saini et al. (2002)* in their study tried to investigate presence of causality among the ASEAN-5 equity market in the long run. For the study they have used weekly Morgan Stanley Composite Index (MSCI) along with indexes obtained from the Kuala Lumpur Stock Exchange (KLSE) covering the period from January 1988 to August 1999 and implemented unit root tests involved both Augmented Dickey- Fuller (ADF) and Phillips and Person (PP) test for the purpose. The study indicated that market have erratic causality presence with weak form, *Johansen and Juselius (JJ)* in their study tried to investigate the impact of Asian financial crises and Gulf war 1990 on relative stock market by using maximum likelihood procedure for co integration testing and for long run causality test the Toda- Yamamoto causality is been viewed. The study finding reflects that stock market of Singapore in long run was affected by Philippines, otherwise it was constant and not been affected by other stock markets of ASEAN-5. Further results also indicate that opportunities exists there for positive international portfolio diversification within the context of the ASEAN-5 stock markets, *Click and Plummer (2005)* in their study examined whether the ASEAN-5 stock markets are integrated or segmented by using the time series technique of co integration to produce the possibility of long run relationship. Data on the basis of weekly stock index quotes from July 1, 1998 to December 31, 2002 are used in local currencies. The study suggests that there is only one significant co integrating vector, leaving four common trends among five variables and conclude with indication that the ASEAN-5 stock markets are co integrated in economic sense, but the integration cannot be considered as a absolute co-integration, *Choudhry et al. (2007)* tried to examine empirically the changes in the long run relationships between the stock prices of eight Far east countries during the Asian financial crises, 1997-98. For the purpose daily stock prices indexes ranging from January 1, 1998 to January 1, 2003 were taken. The empirical outcome of the study indicates that there was significant long run relationship and linkages between the Far east stock markets before, during and after the crisis. The core finding suggests that during the crises period

there were deep linkages and sound relationships among the stock markets. Further the study indicate significant influence of US stock market in all the period along with growing influence of Japanese stock market, *Jang and Sul (2002)* in their study tried to analyze the changes in the co-movement among the stock markets of the Asian countries like “Thailand, Korea and Indonesia” which have undergone the crises directly and the other neighboring countries like “Singapore, Taiwan, Japan, and Hong Kong being influenced indirectly by the crises. For the study purpose, sample have been taken from October 1, 1996 to September 30, 1998 and have been divided into eight months sub period. By using Granger-causality test and co-integration analysis, they found that there was no co-movement in the stock markets of seven Asian countries before the crisis. Study witnessed that during the period of Asian financial crises (June, 1997) unidirectional and bidirectional linkages among the Asian stock markets was increased significantly. The study also witnessed strong co- movement in some cases and the linkage among the Asian stock markets became stronger during the eight months of post crises. *Korczak and Lasfer (2005, 2008)* revealed that in the post-event period the cumulative abnormal returns are positive and significant for both domestic and cross- listed firms, but they are statically higher for the domestically- listed companies.

Going thorough literature of different academicians and financial scientist it can be deemed that these studies are helpful for future financial planning but can't be considered as an ultimate remedy to volcano “recession”. It is hard truth that ends of one recession is beginning of another. It is one side of economic growth and its causes are more political and lesser socio- economical. Chauvinistic attitude of developed economies, constipated attitude of developing economies and blind attitude of under developing economies are the core motivator of recessions. More global studies time to time are inevitable in this context and effective suggestions are to be made in order to control the recession.

4. Objective of the Study

Objective of the study is to examine the interrelationship between the Asian stock markets and US stock markets and to analyze the pre and post crisis strength of linkages between them and their impact on stock market as a whole.

4.1 Methodology

The study is done with special reference to relationship between the Asian stock markets and others after the Asian Financial Crisis. For the purpose, data from January 2005 to December 2009 from Malaysia (Kuala), Singapore (Strait), Philippines (Pse), Indonesia (Jakarta), China (Shanghai), Japan (Nikkie), Korea (Kospi), and the US (Dow) stock markets were mainly extracted. Three panels namely Panel A, Panel B and panel C containing different equity prices and their variances listed on the selected stock exchanges have been drawn. Simple random technique has been used, analytical and descriptive research design is been adopted which based on the secondary data collected from the websites, annual reports and journals, published periodicals, stock exchange and various other related sites. A composite sample, consisting of all the stocks is been used to construct panels and for the same the total samples are separated into three sub periods. First period is pre-crises period spanning from January 2005 to December 2007 denoted as panel A. Second period is during – crises period spanning from January 2008 to December denoted by panel B and third period is post-crises period spanning from January 2009 to December 2009 denoted by Panel C. To interpreting the results Dickey-Fuller (ADF) unit root test, Phillips- Perron (PP) test and Granger- causality based on Vector Error Correction Model (VECM) are used.

4.2 Tools Used for Analysis

In this study, for interpreting the results and to determine stationarity of the data series the statistical and econometric tools are been used. The very first step is to examine the stationary of the variables. Further unit root test is applied to check the stationary of the series by using the Dickey-Fuller (DF) test, Augmented Dickey-Fuller (ADF) test. For robustness of unit root test results the series is also tested by using the Phillip- Perron (PP) test. Then the cointegration test (Engle-Granger cointegration test) is used to estimate the long run equilibrium relationship among the variables. Finally, Granger causality test is applied to test the short-run relationship between the stationary series which deals with financial time series data.

4.3 Unit Root

Unit Root test is applied to check the stationary of the series (Gujarati, 2003; and Enders, 2005). The stationary

condition here has been tested using the Dickey Fuller, Augmented Dickey Fuller and Philip-Peron unit root tests.

4.4 Dickey–Fuller Unit Root Test (DF Test)

In statistics, the Dickey–Fuller test tests whether a unit root is present in an autoregressive model. It is named after the statisticians D. A. Dickey and W. A. Fuller, who developed the test in 1979.)

A simple AR (1) model is

$$y_t = \rho y_{t-1} + u_t$$

Where y_t is the variable of interest, t is the time index, ρ is a coefficient, and u_t is the error term. A unit root is present if $|\rho| = 1$. The model would be non-stationary in this case.

The regression model can be written as

$$\nabla y_t = (\rho - 1)y_{t-1} + u_t = \delta y_{t-1} + u_t$$

Where ∇ is the first difference operator

4.5 Augmented Dickey Fuller Test (ADF Test)

In statistics and econometrics, an Augmented Dickey–Fuller test (ADF) is a test for a unit root in a time series sample. It constructs a parameter correction for higher order correlation, by adding lag difference of the time series. It is consists of a regression of the first difference of the series against the series lagged once, lagged difference terms, and optionally, a constant and tie trend.

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_p \Delta y_{t-p} + \varepsilon_t$$

Consequently, there are three main versions of the test which are as commonly used in Dickey –Fuller unit root test (DF test) and in Augmented Dickey Fuller test (ADF test). Each version of the test has its own critical value which depends on the size of the sample. They are as:

1. Test for a unit root:

$$\nabla y_t = \delta y_{t-1} + u_t$$

2. Test for a unit root with drift:

$$\nabla y_t = a_0 + \delta y_{t-1} + u_t$$

3. Test for a unit root with drift and deterministic time trend:

$$\nabla y_t = a_0 + a_1 t + \delta y_{t-1} + u_t$$

4.6 Philip-Peron Test

In statistics, the Phillips- Perron test is a unit root test. It is used in time series analysis to test the null hypothesis that a time series is $I(1)$. It builds on the Dickey- Fuller test of the null hypothesis $\delta = 0$ in $\nabla y_t = \delta y_{t-1} + u_t$, where ∇ is the first difference operator.

It have certain advantages over other tests as PP test are robust to general forms of heterokdasticity in the error term u_t , and also the user does not have to specify a lag length for the test regression. The Phillips-Perron's test allows the error disturbances to be weakly dependent and heterogeously distributed.

4.7 Granger Causality Test

Granger Causality test is a stastical hypothesis test based on prediction and widely applied to test the short-run relationship between the stationary series. It is a technique for analyzing whether one time series is useful in forecasting another. This concept has been widely recognized and used in econometrics literature. Its mathematical formulation generally based on linear regression theory to study of feedbook relationship between inputs and outputs variables. In this study causality is to be tested between weekly stock indexes values to determine the short-run relationship between

the time series of Asian stock markets and US stock Markets namely, Malaysia (Kuala), Singapore (Strait), Philippines (Pse), Indonesia (Jakarta), China (Shanghai), Japan (Nikkie), Korea (Kospi), and the US (Dow) stock markets.

$$X_t = \alpha_0 + \sum \gamma_j x_{t-j} + \sum \beta_j y_{t-j} + \mu_{xt} \quad (1)$$

$$Y_t = \alpha_0 + \sum \gamma_j x_{t-j} + \sum \beta_j y_{t-j} + \mu_{yt} \quad (2)$$

5.1 Engle-Granger Cointegration Test

Cointegration is an econometric property of time series variables. The basic purpose of the cointegration test is to determine whether a group of nonstationary series is cointegrated or not.

$$X_t = \beta_0 + \beta_1 y_t + \mu_t \quad (3)$$

$$\Delta v_t = a_1 v_{t-1} + \varepsilon_t \quad (4)$$

5.2 Correlation Test

The Pearson Correlation test was used to find the correlation between Asian stock markets and US stock Markets. It can indicate a predictive relationship that can be exploited in practice and can also suggest possible causal, or mechanistic relationships.

5. Analysis and Interpretation

Table 1 ADF, DF and PP Test

Country	ADF		DF		PP	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
	Calculated Value	Calculated Value	Calculated Value	Calculated Value	Calculated Value	Calculated Value
Panel A(Before)						
Dow	-1.027404	-14.57762	-0.387791	-0.838949	-0.862709	-14.92429
Jakarta	-2.222998	-13.92682	1.138484	-3.05017	-2.286181	-13.93364
Kospi	-0.747378	-12.99211	0.872597	-4.193257	-0.670755	-13.04489
Kuala	-2.078993	-12.85207	0.576451	-6.073075	-2.088927	-12.85207
Nikkie	-0.374132	-12.63108	-0.515304	-2.078116	-0.382975	-12.62898
Pse	-1.155426	-11.62814	0.517692	-4.260154	-1.155426	-11.6297
Shanghai	-2.533486	-12.09338	0.303522	-3.261392	-2.26441	-12.42346
Strait	-0.747139	-12.47291	0.571519	-3.432298	-0.746913	-12.47269
CV@1%	-3.472534	-3.472813	-2.57987	-2.580164	-3.472534	-3.472813
CV@5%	-2.879966	-2.880088	-1.942883	-1.942924	-2.879966	-2.880088
CV@10%	-2.576674	-2.576739	-1.615351	-1.615325	-2.576674	-2.576739

Table 2

Country	ADF		DF		PP	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
	Calculated Value	Calculated Value	Calculated Value	Calculated Value	Calculated Value	Calculated Value
Panel B(While)						
Dow	-1.28099	-8.15746	-0.58136	-3.16877	-1.22023	-8.177211
Jakarta	-0.86908	-7.40415	0.131332	-7.05935	-0.83076	-7.439294
Kospi	-1.16135	-3.09856	-0.43003	-2.28432	-1.16135	-7.696092
Kuala	0.350513	-6.22377	1.327735	-5.32033	0.350513	-6.199255
Nikkie	-1.22367	-7.70961	-0.40936	-7.55863	-1.22367	-7.703232
Pse	-0.69546	-8.14495	0.384167	-8.21862	-0.69546	-8.150697
Shanghai	1.314002	-6.90421	2.099381	-6.97451	1.434756	-6.904455
Strait	-0.79057	-6.86278	0.275370	-2.90193	-0.79057	-6.872518
CV@1%	-3.56543	-3.56831	-2.61109	-2.61301	-3.56543	-3.568308
CV@5%	-2.91995	-2.92118	-1.94738	-1.94767	-2.91995	-2.921175
CV@10%	-2.59791	-2.59855	-1.61273	-1.61257	-2.59791	-2.598551

Table 3

Country	ADF		DF		PP	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
	Calculated Value	Calculated Value	Calculated Value	Calculated Value	Calculated Value	Calculated Value
Panel C(After)						
Dow	-1.41318	-6.6701	-0.44708	-6.60936	-1.43387	-6.638382
Jakarta	-0.39213	-8.74777	0.950120	-6.92034	-0.39213	-8.741791
Kospi	-0.47084	-6.98509	0.229769	-6.69725	-0.54783	-6.956151
Kuala	-0.34681	-6.58524	0.924271	-6.57948	-0.39183	-6.581682
Nikkie	-1.59489	-6.87475	-0.77058	-6.93542	-1.59489	-6.82913
Pse	-0.49853	-9.07274	0.508096	-8.26793	-0.36992	-9.229796
Shanghai	0.209205	-7.68107	0.516339	-7.28103	0.290112	-7.681147
Strait	-0.4383	-8.29664	0.370410	-7.55686	-0.41	-8.296637
CV@1%	-3.53659	-3.53836	-2.6016	-2.60219	-3.53659	-3.538362
CV@5%	-2.90766	-2.90842	-1.94599	-1.94607	-2.90766	-2.90842
CV@10%	-2.5914	-2.5918	-1.6135	-1.61345	-2.5914	-2.591799

5.3 Interpretation

After applying all the tests of unit root, viz, DF, ADF and PP tests it was found that the data series of GDP at FC, WPI and IIP are non-stationary at level. This conclusion is justified by the fact that the critical values at 5% level of significance are greater than the calculated values of the data series which leads us to accept the null hypothesis i.e. all stock markets time series data have a unit root.

But all the series of data are found to be stationary at their first difference where the calculated value is greater than the critical value which leads us to reject the null hypothesis and accept the alternative i.e. all stock markets time series data do not have a unit root. The non-stationary of the data indicates that the statistical properties do not like mean, variance etc. of the time series data of all GDP at FC, WPI and IIP are not constant. So the null hypothesis in

all the units root tests DF, ADF and PP has been accepted at level as the critical value at 5% level of significance is greater than the computed value in all the respective tests. Contrary to this, the null hypothesis in all the above unit root tests has been rejected at first difference as the critical value is found to be smaller than the computed value in all the respective test. The stationary and the non-

stationary data help us in determining the short and long term relationship between the variables.

The null hypothesis in all the stationary tests is that all GDP at FC, WPI and IIP have a unit root. The presence of unit root in the data series indicates its non-stationarity and its absence indicates stationarity.

5.4 Cointegration Test

Table 4 Panel A: Pre-Crisis Results of Asian Stock Markets

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value
None *	0.239950	137.2585	125.6154	0.0080	42.25320	46.23142
At most 1	0.174208	95.00527	95.75366	0.0562	29.47752	40.07757
At most 2	0.123725	65.52775	69.81889	0.1048	20.33965	33.87687
At most 3	0.113952	45.18810	47.85613	0.0872	18.63160	27.58434
At most 4	0.088763	26.55650	29.79707	0.1129	14.31473	21.13162
At most 5	0.050145	12.24177	15.49471	0.1457	7.922596	14.26460
At most 6 *	0.027657	4.319170	3.841466	0.0377	4.319170	3.841466

Table 5 Panel A: Pre-Crisis Results of Asian & US Stock Markets

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value
None *	0.283391	191.4291	159.5297	0.0003	51.31663	52.36261
At most 1 *	0.223203	140.1125	125.6154	0.0048	38.89671	46.23142
At most 2 *	0.197319	101.2158	95.75366	0.0199	33.84895	40.07757
At most 3	0.130210	67.36682	69.81889	0.0772	21.48347	33.87687
At most 4	0.113110	45.88335	47.85613	0.0757	18.48536	27.58434
At most 5	0.093070	27.39799	29.79707	0.0923	15.04419	21.13162
At most 6	0.051358	12.35380	15.49471	0.1407	8.119507	14.26460
At most 7 *	0.027121	4.234294	3.841466	0.0396	4.234294	3.841466

Table 6 Panel B: During Crisis Results of Asian Stock Markets

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value
None *	0.659298	148.0339	125.6154	0.0010	51.68388	46.23142
At most 1 *	0.568984	96.35000	95.75366	0.0455	40.39731	40.07757
At most 2	0.350878	55.95269	69.81889	0.3799	20.74243	33.87687
At most 3	0.298428	35.21026	47.85613	0.4369	17.01274	27.58434
At most 4	0.175844	18.19751	29.79707	0.5515	9.282993	21.13162
At most 5	0.146289	8.914522	15.49471	0.3733	7.591799	14.26460
At most 6	0.027181	1.322723	3.841466	0.2501	1.322723	3.841466

Table 7 Panel B: During Crisis Results of Asian & US Stock Markets

<i>Hypothesized</i>		<i>Trace</i>	<i>0.05</i>		<i>Max-Eigen</i>	<i>0.05</i>
<i>No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Statistic</i>	<i>Critical Value</i>	<i>Prob.**</i>	<i>Statistic</i>	<i>Critical Value</i>
None *	0.785704	209.8354	159.5297	0.0000	73.93895	52.36261
At most 1 *	0.609206	135.8964	125.6154	0.0101	45.09959	46.23142
At most 2	0.518620	90.79683	95.75366	0.1045	35.09271	40.07757
At most 3	0.365177	55.70412	69.81889	0.3900	21.81164	33.87687
At most 4	0.329223	33.89248	47.85613	0.5077	19.16726	27.58434
At most 5	0.178363	14.72522	29.79707	0.7976	9.429908	21.13162
At most 6	0.102289	5.295312	15.49471	0.7767	5.179566	14.26460
At most 7	0.002408	0.115746	3.841466	0.7337	0.115746	3.841466

Table 8 Panel C: Post-Crisis Results of Asian Stock Markets

<i>Hypothesized</i>		<i>Trace</i>	<i>0.05</i>		<i>Max-Eigen</i>	<i>0.05</i>
<i>No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Statistic</i>	<i>Critical Value</i>	<i>Prob.**</i>	<i>Statistic</i>	<i>Critical Value</i>
None *	0.634107	153.5469	125.6154	0.0003	59.31949	46.23142
At most 1	0.434889	94.22740	95.75366	0.0634	33.67321	40.07757
At most 2	0.339467	60.55419	69.81889	0.2187	24.46776	33.87687
At most 3	0.316446	36.08643	47.85613	0.3920	22.44655	27.58434
At most 4	0.145219	13.63988	29.79707	0.8602	9.257716	21.13162
At most 5	0.068611	4.382168	15.49471	0.8704	4.193621	14.26460
At most 6	0.003191	0.188547	3.841466	0.6641	0.188547	3.841466

Table 9 Panel C: Post-Crisis Results of Asian & US Stock Markets

<i>Hypothesized</i>		<i>Trace</i>	<i>0.05</i>		<i>Max-Eigen</i>	<i>0.05</i>
<i>No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Statistic</i>	<i>Critical Value</i>	<i>Prob.**</i>	<i>Statistic</i>	<i>Critical Value</i>
None *	0.634342	190.1012	159.5297	0.0004	59.35729	52.36261
At most 1 *	0.559546	130.7439	125.6154	0.0235	48.37702	46.23142
At most 2	0.378450	82.36687	95.75366	0.2899	28.05680	40.07757
At most 3	0.332643	54.31007	69.81889	0.4482	23.86141	33.87687
At most 4	0.220598	30.44866	47.85613	0.6958	14.70447	27.58434
At most 5	0.151572	15.74420	29.79707	0.7301	9.697824	21.13162
At most 6	0.072655	6.046371	15.49471	0.6901	4.450362	14.26460
At most 7	0.026688	1.596009	3.841466	0.2065	1.596009	3.841466

5.5 Interpretation

- There exist long-term relationship between Asian stock markets and US stock markets.
- As all the Eigen values are below 1 so the stock markets are stable and have effects on each other markets.
- There is strong long term relationship between stock markets of Asia and US after the crisis period.

6. Granger Results

Table 10 Panel A (Pre Crisis Period)

<i>Null Hypothesis</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Probability</i>
1. JAKARTA does not Granger Cause DOW	155	14.0953	2.5E-06
DOW does not Granger Cause JAKARTA		0.11208	0.89405
2. KOSPI does not Granger Cause DOW	155	3.30748	0.03930
DOW does not Granger Cause KOSPI		3.49449	0.03286
3. KUALA does not Granger Cause DOW	155	6.80793	0.00148
DOW does not Granger Cause KUALA		1.76044	0.17550
4. NIKKIE does not Granger Cause DOW	155	32.5656	1.8E-12
DOW does not Granger Cause NIKKIE		2.07966	0.12856
5. PSE does not Granger Cause DOW	155	42.6531	2.2E-15
DOW does not Granger Cause PSE		1.11186	0.33164
6. SHANGHAI does not Granger Cause DOW	155	8.15762	0.00043
DOW does not Granger Cause SHANGHAI		8.99034	0.00021
7. STRAIT does not Granger Cause DOW	155	36.1628	1.5E-13
DOW does not Granger Cause STRAIT		0.30796	0.73541
8. KOSPI does not Granger Cause JAKARTA	155	1.36519	0.25848
JAKARTA does not Granger Cause KOSPI		27.3615	7.4E-11
9. KUALA does not Granger Cause JAKARTA	155	0.28308	0.75386
JAKARTA does not Granger Cause KUALA		38.6251	2.9E-14
10. NIKKIE does not Granger Cause JAKARTA	155	0.81177	0.44601
JAKARTA does not Granger Cause NIKKIE		3.85139	0.02338
11. PSE does not Granger Cause JAKARTA	155	0.61936	0.53966
JAKARTA does not Granger Cause PSE		5.93406	0.00331
12. SHANGHAI does not Granger Cause JAKARTA	156	2.90498	0.05782
JAKARTA does not Granger Cause SHANGHAI		8.19581	0.00042
13. STRAIT does not Granger Cause JAKARTA	155	33.1207	1.2E-12
JAKARTA does not Granger Cause STRAIT		4.49795	0.01267
14. KUALA does not Granger Cause KOSPI	155	0.22864	0.79589
KOSPI does not Granger Cause KUALA		0.33463	0.71613
15. NIKKIE does not Granger Cause KOSPI	155	64.8663	5.0E-21
KOSPI does not Granger Cause NIKKIE		2.56708	0.08013
16. PSE does not Granger Cause KOSPI	155	52.3644	5.6E-18
KOSPI does not Granger Cause PSE		0.67288	0.51177
17. SHANGHAI does not Granger Cause KOSPI	155	1.19294	0.30619
KOSPI does not Granger Cause SHANGHAI		3.65989	0.02806
18. STRAIT does not Granger Cause KOSPI	155	2.42488	0.09195
KOSPI does not Granger Cause STRAIT		1.36927	0.25745
19. NIKKIE does not Granger Cause KUALA	155	21.1980	7.8E-09
KUALA does not Granger Cause NIKKIE		1.69835	0.18648
20. PSE does not Granger Cause KUALA	155	64.5927	5.8E-21
KUALA does not Granger Cause PSE		3.27910	0.04038
21. SHANGHAI does not Granger Cause KUALA	155	2.30669	0.10311
KUALA does not Granger Cause SHANGHAI		0.47153	0.62497
22. STRAIT does not Granger Cause KUALA	155	10.4385	5.7E-05
KUALA does not Granger Cause STRAIT		1.55146	0.21532
23. PSE does not Granger Cause NIKKIE	155	2.87002	0.05982

Null Hypothesis	Obs	F-Statistic	Probability
NIKKIE does not Granger Cause PSE		0.82547	0.44001
24. SHANGHAI does not Granger Cause NIKKIE	155	2.78515	0.06491
NIKKIE does not Granger Cause SHANGHAI		7.05117	0.00118
25. STRAIT does not Granger Cause NIKKIE	155	68.1080	9.0E-22
NIKKIE does not Granger Cause STRAIT		0.66653	0.51500
26. SHANGHAI does not Granger Cause PSE	155	3.59127	0.02996
PSE does not Granger Cause SHANGHAI		6.36311	0.00223
27. STRAIT does not Granger Cause PSE	155	86.5297	1.0E-25
PSE does not Granger Cause STRAIT		0.16434	0.84860
28. STRAIT does not Granger Cause SHANGHAI	155	0.83299	0.43675

6.1 Interpretation

- After applying the grangler causality test between Jakarta and Dow. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 14.0953 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is excepted because the calculated value is less than the tabulated value i.e. calculated value is 0.11208 and tabulated value is 2.5. So it is concluded that the grangler causality test between Jakarta and Dow is unidirectional and runs from Jakarta to Dow.
- After applying the grangler causality test between Kospi and Dow. It was found that there is a bilateral causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 3.30748 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is also rejected because the calculated value is greater than the tabulated value i.e. calculated value is 3.49449 and tabulated value is 2.5. So it is concluded that the grangler causality test between Kospi and Dow is bilateral and runs from Kospi to Dow and vice versa.
- After applying the grangler causality test between Kuala and Dow. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 6.80793 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is excepted because the calculated value is less than the tabulated value i.e. calculated value is 1.76044 and tabulated value is 2.5. So it is concluded that the grangler causality test between Kuala and Dow is unidirectional and runs from Kuala to Dow.
- After applying the grangler causality test between Nikkie and Dow. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 32.5656 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is excepted because the calculated value is less than the tabulated value i.e. calculated value is 2.07966 and tabulated value is 2.5. So it is concluded that the grangler causality test between Nikkie and Dow is unidirectional and runs from Nikkie to Dow.
- After applying the grangler causality test between Pse and Dow. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 42.6531 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is excepted because the calculated value is less than the tabulated value i.e. calculated value is 1.11186 and tabulated value is 2.5. So it is concluded that the grangler causality test between Pse and Dow is unidirectional and runs from Pse to Dow.
- After applying the grangler causality test between Shanghai and Dow. It was found that there is a bilateral causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 8.15762 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative.

The second null hypothesis is also rejected because the calculated value is greater than the tabulated value i.e. calculated value is 8.99034 and tabulated value is 2.5. So it is concluded that the grangler causality test between Shanghai and Dow is bilateral and runs from Shanghai to Dow and vice versa.

- After applying the grangler causality test between Strait and Dow. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 36.1628 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is excepted because the calculated value is less than the tabulated value i.e. calculated value is 0.30796 and tabulated value is 2.5. So it is concluded that the grangler causality test between Strait and Dow is unidirectional and runs from Starit to Dow.
- After applying the grangler causality test between Kospi and Jakarta. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was less than the tabulated value i.e. calculated value is 1.36519 and tabulated value is 2.5, which leads us to accept this null hypothesis and reject its alternative. The second null hypothesis is rejected because the calculated value is greater than the tabulated value i.e. calculated value is 27.3615 and tabulated value is 2.5. So it is concluded that the grangler causality test between Kospi and Jakarta is unidirectional and runs from Jakarta to Kospi.
- After applying the grangler causality test between Kuala and Jakarta. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was less than the tabulated value i.e. calculated value is 0.28308 and tabulated value is 2.5, which leads us to accept this null hypothesis and reject its alternative. The second null hypothesis is rejected because the calculated value is greater than the tabulated value i.e. calculated value is 38.6251 and tabulated value is 2.5. So it is concluded that the grangler causality test between Kuala and Jakarta is unidirectional and runs from Jakarta to Kuala.
- After applying the grangler causality test between Nikkie and Jakarta. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was less than the tabulated value i.e. calculated value is 0.81177 and tabulated value is 2.5, which leads us to accept this null hypothesis and reject its alternative. The second null hypothesis is rejected because the calculated value is greater than the tabulated value i.e. calculated value is 3.85139 and tabulated value is 2.5. So it is concluded that the grangler causality test between Nikkie and Jakarta is unidirectional and runs from Jakarta to Nikkie.
- After applying the grangler causality test between Pse and Jakarta. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was less than the tabulated value i.e. calculated value is 0.61936 and tabulated value is 2.5, which leads us to accept this null hypothesis and reject its alternative. The second null hypothesis is rejected because the calculated value is greater than the tabulated value i.e. calculated value is 5.93406 and tabulated value is 2.5. So it is concluded that the grangler causality test between Pse and Jakarta is unidirectional and runs from Jakarta to Pse.
- After applying the grangler causality test between Shanghai and Jakarta. It was found that there is a bilateral causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 2.90498 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is also rejected because the calculated value is greater than the tabulated value i.e. calculated value is 8.19581 and tabulated value is 2.5. So it is concluded that the grangler causality test between Shanghai and Jakarta is bilateral and runs from Shanghai to Jakarta and vice versa.
- After applying the grangler causality test between Strait and Jakarta. It was found that there is a bilateral causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 33.1207 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is also rejected because the calculated value is greater than the tabulated value i.e. calculated value is 4.49795 and tabulated value is 2.5. So it is concluded that

the granger causality test between Strait and Jakarta is bilateral and runs from Strait to Jakarta and vice versa.

- After applying the granger causality test between Kuala and Kospi. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was less than the tabulated value i.e. calculated value is 0.22864 and tabulated value is 2.5, which leads us to accept this null hypothesis and reject its alternative. The second null hypothesis is also accepted because the calculated value is less than the tabulated value i.e. calculated value is 0.33463 and tabulated value is 2.5. So it is concluded that the granger causality test between Kuala and Kospi has no effect on each other.
- After applying the granger causality test between Nikkie and Kospi. It was found that there is a bilateral causality between the two stock indices. The calculated value in the first null hypothesis was greater than the tabulated value i.e. calculated value is 64.8663 and tabulated value is 2.5, which leads us to reject this null hypothesis and except its alternative. The second null hypothesis is also rejected because the calculated value is greater than the tabulated value i.e. calculated value is 2.56708 and tabulated value is 2.5. So it is concluded that the granger causality test between Nikkie and Kospi

is bilateral and runs from Nikkie to Kospi and vice versa.

- After applying the granger causality test between Pse and Kospi. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis is greater than the tabulated value i.e. calculated value is 52.3644 and tabulated value is 2.5, which leads us to reject this null hypothesis and accept its alternative. The second null hypothesis is accepted because the calculated value is less than the tabulated value i.e. calculated value is 0.67288 and tabulated value is 2.5. So it is concluded that the granger causality test between Pse and Kospi is unidirectional and runs from Pse to Kospi.
- After applying the granger causality test between Shanghai and Kospi. It was found that there is a unidirectional causality between the two stock indices. The calculated value in the first null hypothesis was less than the tabulated value i.e. calculated value is 1.19294 and tabulated value is 2.5, which leads us to accept this null hypothesis and reject its alternative. The second null hypothesis is rejected because the calculated value is greater than the tabulated value i.e. calculated value is 3.65989 and tabulated value is 2.5. So it is concluded that the granger causality test between Shanghai and Kospi is unidirectional and runs from Kospi to Shanghai.

Table 11 Panel B (While the Crisis Period)

<i>Null Hypothesis</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Probability</i>
JAKARTA does not Granger Cause DOW	50	3.16118	0.05193
DOW does not Granger Cause JAKARTA	1.41980	0.25238	
KOSPI does not Granger Cause DOW	50	8.75606	0.00061
DOW does not Granger Cause KOSPI	1.58777	0.21562	
KUALA does not Granger Cause DOW	50	4.52379	0.01621
DOW does not Granger Cause KUALA	0.52002	0.59804	
NIKKIE does not Granger Cause DOW	50	2.82400	0.06992
DOW does not Granger Cause NIKKIE	1.12299	0.33425	
PSE does not Granger Cause DOW	50	8.52103	0.00073
SHANGHAI does not Granger Cause DOW	49	0.23733	0.78973
DOW does not Granger Cause SHANGHAI	0.55536	0.57783	
STRAIT does not Granger Cause DOW	50	5.21103	0.00921
DOW does not Granger Cause STRAIT	1.21275	0.30691	
KOSPI does not Granger Cause JAKARTA	50	0.02128	0.97896
JAKARTA does not Granger Cause KOSPI	2.25666	0.11642	
KUALA does not Granger Cause JAKARTA	50	0.27620	0.75994

Null Hypothesis	Obs	F-Statistic	Probability
JAKARTA does not Granger Cause KUALA	7.67502	0.00136	
NIKKIE does not Granger Cause JAKARTA	50	0.37635	0.68850
JAKARTA does not Granger Cause NIKKIE	3.98740	0.02545	
PSE does not Granger Cause JAKARTA	50	8.15137	0.00095
JAKARTA does not Granger Cause PSE	0.19223	0.82579	
SHANGHAI does not Granger Cause JAKARTA	49	1.11722	0.33629
JAKARTA does not Granger Cause SHANGHAI	0.19029	0.82739	
STRAIT does not Granger Cause JAKARTA	50	0.15583	0.85617
JAKARTA does not Granger Cause STRAIT	2.85233	0.06819	
KUALA does not Granger Cause KOSPI	50	1.95190	0.15384
KOSPI does not Granger Cause KUALA	0.53479	0.58947	
NIKKIE does not Granger Cause KOSPI	50	0.63303	0.53564
KOSPI does not Granger Cause NIKKIE	0.02342	0.97687	
PSE does not Granger Cause KOSPI	50	7.76588	0.00127
KOSPI does not Granger Cause PSE	2.39305	0.10288	
SHANGHAI does not Granger Cause KOSPI	49	3.95107	0.02642
KOSPI does not Granger Cause SHANGHAI	0.09410	0.91038	
STRAIT does not Granger Cause KOSPI	50	1.11910	0.33549
KOSPI does not Granger Cause STRAIT	0.09250	0.91183	
NIKKIE does not Granger Cause KUALA	50	0.18832	0.82900
KUALA does not Granger Cause NIKKIE	2.71536	0.07703	
PSE does not Granger Cause KUALA	50	12.2504	5.7E-05
KUALA does not Granger Cause PSE	0.49247	0.61437	
SHANGHAI does not Granger Cause KUALA	49	4.47894	0.01696
KUALA does not Granger Cause SHANGHAI	1.04235	0.36117	
STRAIT does not Granger Cause KUALA	50	0.41807	0.66085
KUALA does not Granger Cause STRAIT	0.96416	0.38904	
PSE does not Granger Cause NIKKIE	50	13.3379	2.8E-05
NIKKIE does not Granger Cause PSE	0.49676	0.61180	
SHANGHAI does not Granger Cause NIKKIE	49	1.51260	0.23157
NIKKIE does not Granger Cause SHANGHAI	0.76225	0.47268	
STRAIT does not Granger Cause NIKKIE	50	0.43426	0.65043
NIKKIE does not Granger Cause STRAIT	0.42431	0.65681	
SHANGHAI does not Granger Cause PSE	49	1.00017	0.37602
PSE does not Granger Cause SHANGHAI	1.19141	0.31340	
STRAIT does not Granger Cause PSE	50	0.99600	0.37735
PSE does not Granger Cause STRAIT	5.64387	0.00650	
STRAIT does not Granger Cause SHANGHAI	49	0.85009	0.43428
SHANGHAI does not Granger Cause STRAIT	3.45293	0.04046	

6.2 Interpretation

- There is not seen any significant relationship between various stock markets during the post crisis period.
- There has not been seen any bilateral causality be-

tween any of the pair of stock markets of Asia and US Stock markets.

- There is strong causality from Pse to Kuala and Pse to Nikkie during the crisis period through the results as both the Null Hypothesis is rejected of the same stock markets.

Table 12 Panel C (Post Crisis Period)

<i>Null Hypothesis:</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Probability</i>
JAKARTA does not Granger Cause DOW	62	7.64928	0.00114
DOW does not Granger Cause JAKARTA	0.13697	0.87228	
KOSPI does not Granger Cause DOW	63	4.00860	0.02341
DOW does not Granger Cause KOSPI	1.32283	0.27430	
KUALA does not Granger Cause DOW	63	5.28417	0.00780
DOW does not Granger Cause KUALA	0.21703	0.80556	
NIKKIE does not Granger Cause DOW	63	3.75694	0.02922
DOW does not Granger Cause NIKKIE	1.62935	0.20490	
PSE does not Granger Cause DOW	63	2.41268	0.09851
DOW does not Granger Cause PSE	1.63801	0.20323	
SHANGHAI does not Granger Cause DOW	60	2.50325	0.09110
DOW does not Granger Cause SHANGHAI	3.31666	0.04366	
STRAIT does not Granger Cause DOW	63	1.39668	0.25561
DOW does not Granger Cause STRAIT	1.79242	0.17566	
KOSPI does not Granger Cause JAKARTA	62	1.66318	0.19860
JAKARTA does not Granger Cause KOSPI	8.35504	0.00066	
KUALA does not Granger Cause JAKARTA	62	1.58799	0.21324
JAKARTA does not Granger Cause KUALA	10.8350	0.00010	
NIKKIE does not Granger Cause JAKARTA	62	3.89583	0.02595
JAKARTA does not Granger Cause NIKKIE	11.5086	6.3E-05	
PSE does not Granger Cause JAKARTA	62	0.26847	0.76551
JAKARTA does not Granger Cause PSE	13.6850	1.4E-05	
SHANGHAI does not Granger Cause JAKARTA	60	3.87392	0.02667
JAKARTA does not Granger Cause SHANGHAI	4.32242	0.01805	
STRAIT does not Granger Cause JAKARTA	62	0.05988	0.94194
JAKARTA does not Granger Cause STRAIT	32.1890	4.4E-10	
KUALA does not Granger Cause KOSPI	63	7.84250	0.00097
KOSPI does not Granger Cause KUALA	2.28645	0.11072	
NIKKIE does not Granger Cause KOSPI	63	0.85991	0.42853
KOSPI does not Granger Cause NIKKIE	2.84945	0.06601	
PSE does not Granger Cause KOSPI	63	4.13729	0.02091
KOSPI does not Granger Cause PSE	0.45069	0.63940	
SHANGHAI does not Granger Cause KOSPI	60	8.15909	0.00079
KOSPI does not Granger Cause SHANGHAI	4.62226	0.01395	
STRAIT does not Granger Cause KOSPI	63	3.94727	0.02470
KOSPI does not Granger Cause STRAIT	1.92235	0.15547	
NIKKIE does not Granger Cause KUALA	63	2.28416	0.11095
KUALA does not Granger Cause NIKKIE	3.82748	0.02746	
PSE does not Granger Cause KUALA	63	0.20092	0.81855
KUALA does not Granger Cause PSE	5.90585	0.00463	
SHANGHAI does not Granger Cause KUALA	60	4.36020	0.01747
KUALA does not Granger Cause SHANGHAI	2.68377	0.07725	
STRAIT does not Granger Cause KUALA	63	0.63642	0.53284
KUALA does not Granger Cause STRAIT	6.09301	0.00396	
PSE does not Granger Cause NIKKIE	63	2.63180	0.08053
NIKKIE does not Granger Cause PSE	0.36478	0.69593	
SHANGHAI does not Granger Cause NIKKIE	60	7.68046	0.00114

<i>Null Hypothesis:</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Probability</i>
NIKKIE does not Granger Cause SHANGHAI	2.61384	0.08233	
STRAIT does not Granger Cause NIKKIE	63	3.56160	0.03476
NIKKIE does not Granger Cause STRAIT	1.61503	0.20770	
SHANGHAI does not Granger Cause PSE	60	2.90646	0.06311
PSE does not Granger Cause SHANGHAI	5.22861	0.00834	
STRAIT does not Granger Cause PSE	63	0.00112	0.99888
PSE does not Granger Cause STRAIT	4.59997	0.01399	
STRAIT does not Granger Cause SHANGHAI	60	4.24827	0.01925
SHANGHAI does not Granger Cause STRAIT	2.04317	0.13934	

6.3 Interpretation

- There is bilateral relationship between Shanghai and Kuala. They both have long term relationship among themselves during the post crisis period.
- There is also relationship between Shanghai and Pse as their Bothe null hypothesis are rejected.
- It has also been seen through the results that Strait stock market has impact on almost all the other Asian stock markets.

7. Findings

- It has been seen that Asian stock markets has impact on each other strongly but US stock market does not have impact on all the Asian markets.
- There is strong relationship between various stock markets.
- Some of the stock markets have strong impact than other markets.
- There exists strong impact of Strait on Pse which is in short term and in before crisis.
- The Shanghai and Nikkie has impact during the post crisis period.
- It is been seen that Jakarta has strong impact on various other stock markets during the post crisis period.
- It is also been seen that the one stock market has effect on other stock markets.
- There is effect between various stock markets in long term and short term during, while and after the crisis.

8. Recommendations

- To study the movements, one has to be confident and never get influenced by sentiments as present stock market work on confuse and corrupt market hypothesis and is unpredictable. All the available information are outcome of statically and

arithmetical calculation which base on window dressed presentation of books of accounts. Thus investors have to develop their sense and have to judge the market movement minutely before they make a choice from available alternatives.

- They (investors) have to become market movement, governing rules and regulation literate and have to develop knowledge about the tests and tools and their purpose of implementation to analyze the result if want to protect their investment from market gambling. Only information of stock market is not enough for the purpose.
- Before investing in any alternative one should know their objective and risk appetite. They must have ability to study fundamental analysis like ratio and balance sheet if they want to avail advantage and must invest for long run.
- Before making any investment one must go through the published reports of the industry/ company and also check the date of publishing the reports, for which the report is been published. Weather it is for FIIs, or common investors.
- Companies and stock market presentation and interpretation should be simple so that it can be understood to everyone easily.
- While making any investment decision one should not rely on fund manager but give time to understand him and then discuss about the future plans from making any investment. Plan should be flexible and can be adjusted according to unforeseen future.

9. Conclusions

This study attempts to examine the linkages between the Asian and the US stock markets. The empirical analysis of this study begins with the ADF and PP stationarity tests in order to determine at which level the data exhibit stationarity; this is done for the purpose of co integration analysis.

Empirical results show that the long-run relationships between Asian stock markets occur only for during- and post-crisis period.

For the pre-crisis period, there are no significant cointegrating vectors among the Asian stock markets. This result shows that the Asian stock markets are more independent before the crisis. The number of co-integrating vectors increased after the US stock market was included in pre-crisis and during-crisis periods. This implies that the system is more interdependent during these two periods. Therefore, adding the US stock market does not help the investors to reduce the portfolio risk.

The results of short-run Granger-causality based on VECM showed that Thailand, Japan and China stock markets are the most exogenous markets before, during and after the crisis respectively.

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