Trade, Financial Flows and Stock Market Interdependence: Evidence from Asian Markets

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Abstract: Liberalization and globalization of Newly Industrialized Economies have contributed to increased integration of capital markets. This study tests whether convergence of macroeconomic variables, enhanced bilateral trade and financial flows cause greater interdependence of markets. Daily closing indices and quarterly differentials in interest, inflation, growth rates, exchange rates, trade of goods and services, direct and portfolio investment were used. Results revealed that markets of Asia are not immune to shocks originating in US although co-movements of macroeconomic variables do not help in explaining level of interdependence. Portfolio flows were found to be important than trade flows in explaining market interdependence.

Keywords: Dynamic Market Interdependence, US and Asian Newly Industrialized Economies (NIEs), Emerging Market Economies (EMEs), FEVD, Trade and Financial Flows

JEL Classification Number: F4, G1

1. Introduction

The newly industrialised economies (NIEs) of Hong Kong, Singapore, South Korea and Taiwan attracted considerable attention of researchers due to their high growth (average annual rate of around 9%) and rapid industrialization between 1960 and 1990. These economies moved to the elite club of high income economies by early 21st century and the GDP per capita rankings for Singapore, Hong Kong, Taiwan and South Korea stood at 4, 8, 24 and 30 respectively[1]. The rapid growth rates during this period are often associated with trade openness followed by financial liberalization measures adopted by these economies since the late 1980s. The gradual liberalization and globalization of their stock markets and advances in information technology have contributed to increased

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[1] World Economic Outlook Database, IMF, 2010.

integration/interdependence of these markets with other markets. The interrelationship of stock markets necessitates similarity in reactions toward external developments in macroeconomic policies and global financial environment. This in turn, has significant implications for asset pricing and international portfolio diversification.

The export-oriented growth strategies of Asian economies have led to an increase of their share in the world trade (Asia's share of world merchandise trade was 31% in 2009 and six east Asian economies accounted for 9.6 percent of world merchandise exports in 2013). Despite surging intra-regional trade, trade outcomes of Asian economies continue to depend heavily on the economic developments in the rest of the world, particularly US. The major trading partner still is US contributing to over 20% of the total merchandise trade of Asia-Pacific region in the year 2008, prior to the global economic crisis. Coupled with increasing trade flows, financial flows to Asia have also seen new highs. Net private capital flows to Asian economies from advanced economies stood an annual average of US $100 billion between 2003 and 2007. On an average, US alone accounted for more than 10% of Foreign Direct Investment (FDI) in Asian economies between 1991 and 2008. The net effect of these developments (linking of Asia to economic activity outside the region) along with forces of globalization has led to increased integration of the US and Asian stock markets. Stock market integration studies on Asian economies have proved the leadership role of US in information transmission among the Asian stock markets. Yang *et al*. (2003) and Awokuse *et al*. (2009) have empirically proved that US has the greatest influence on Asian stock markets. This has motivated the examination of the extent to which macroeconomic factors, trade and financial flows impact the stock market interdependence of US and six major Asian markets. This study attempts to test whether convergence of macroeconomic variables and enhanced bilateral trade and financial flows between countries cause greater interdependence of the stock markets between countries or not. We use data between two crisis periods, that is, between 1998 and 2008 to examine the possibility of interdependence of stock markets. In the next section, literature on market integration with specific reference to US and NIEs are discussed followed by sections on data and empirical framework. In the last two sections the methodology adopted for the study as well as the results are discussed. Finally, a conclusion is given.

2. Literature Review

2.1. Time-varying Stock Market Integration

Literature on stock price co-movements between the US and Asian equity markets are discussed to generate insights into the time varying degree of integration between these markets. Darrat and Zhong (2002) focused on the influence of established markets of Japan and US on eleven Asian emerging markets for the period 1987-1999. The study

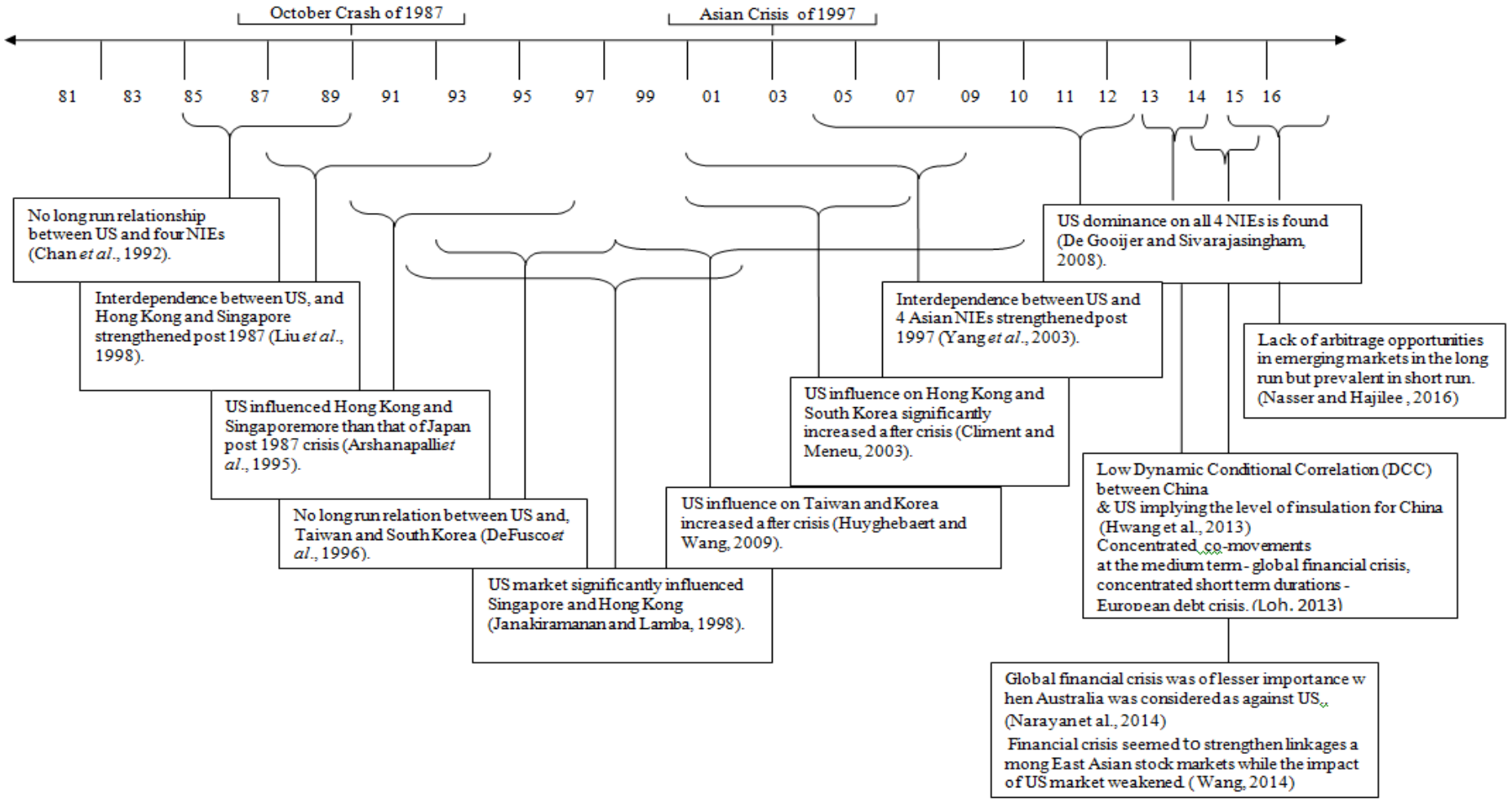
concluded that US market was the permanent driving force of Asian emerging markets while Japan has only temporary effects. Studies by Arshanapalli *et al*. (1995) and Baharumshah *et al*. (2003) were also in line with Darrat and Zhong's (2002) study concluding that Asian markets were more integrated with US than Japan.

Masih and Masih (1999) argued that the price leadership of US may be attributed to two factors: firstly, the US market, with its dominance in the global market, is also the most influential producer of information; secondly, international investors often overreact to news from the US and place less weight on information from other markets. Hence, innovations in US market influence Asian markets significantly while the reciprocal relationships have been minimal.

Figure 1 presents literature on interdependence/co-movements between stock markets of US and Asian NIEs during the past three decades. Based on the time period used in these empirical studies, it was observed that the degree of integration has been increasing between US and Asian NIEs. Following the stock market crash of October 1987, US market began to have a significant impact on Hong Kong and Singapore markets, though its influence on Taiwan and South Korea remain unchanged. The impact of US market on Taiwan and South Korea dramatically increased since the Asian financial crisis of 1997, while the impact of Japan on the four Asian NIEs was relatively low. Thus, the literature reinforces the popular perception that stock market of US best predicts the Asian markets, despite the presence of the regional leader, Japan.

Despite a plethora of empirical studies on the stock market linkages between US and Asian markets confirming the price leadership of US, the effects of their bilateral economic relationships on such linkages have not been analyzed. Understanding the factors affecting stock market integration is of importance as it provides a better view of the functioning of the global stock markets. Prior research suggests that performance of economic fundamentals, development of market, global economic climate, cultural and geographical distance and extent of trade and investment links, *among others*, affect stock market interdependence between two countries. A description of factors, examined by researchers, that drive stock market integration, is presented in the following sub-section.

Figure 1: Interdependence between US and Asian NIEs



2.2. Factors Influencing Stock Market Integration

One of the seminal papers that studied the factors affecting stock market integration is that of Bracker et al. (1999). The authors made use of Geweke measures to capture the evolution of comovement between eight developed stock markets and the U.S. market from 1972 through 1993. Their results indicated that macroeconomic factors such as bilateral import dependence, the size differential of two markets are significantly associated with the extent of stock market comovement over time. Pretorius (2002) modeled the bilateral correlation between 10 emerging stock markets into cross-section and panel regressions respectively and found that in both settings, the correlation between two countries was positively related to the importance of trade relationship between them, and negatively related to the difference between their industrial production growth rates.

Colthup and Zhong (2005) postulated the influence of a set of macroeconomic variables in the evolution of equity market linkages among 12 Pacific basin markets. The eigen value and trace statistics obtained by cointegration on pair of market indices are regressed against cointegrating relation of industrial production indices, interest rate differentials, market size differential, market volatility and exchange rate volatility. Except for industrial production index, all the other factors helped explain equity market linkages. Liu *et al*. (2006) measured stock market interdependence between U.S. market and its trading partners using generalized variance decomposition (VDC) analysis. The authors tested if trade relations can explain interdependence of stock markets and did not find sufficient evidence for all countries.

Nasser and Hajilee (2016) used monthly stock market data for the period from January 2001 to December 2014 to examine integration among five emerging markets namely Brazil, China, Mexico, Russia and Turkey along with the developed markets of US, UK and Germany. The study used bounds testing approach to cointegration and error-correction models and showed evidence of short run integration between the chosen emerging and developed economies. On the other hand, long run relationship was prevalent only between the emerging markets and Germany. The results of this study implied lack of arbitrage opportunities in emerging markets in the long run while the opportunities was indicative to be prevalent in the short run.

It is observed that the empirical results obtained on economic fundamentals are mixed and inconclusive. Bracker *et al*. (1999) and Tavares (2009) reported negative impact of higher exchange rate volatility on stock market interdependence while Colthup and Zhong (2005) found a positive impact. While some studies concluded significant negative effects of interest rate and inflation rate differentials, Kizys and Pierdzioch (2009) found them to be insignificant factors.

Similarly, studies like Chen and Zhang (1997), Chambet and Gibson (2008), have found strong evidence for the *trade relation hypothesis*- more the bilateral trade flows, greater is the integration between their markets. However, this is not a unanimous view, with Liu *et al*. (2006) indicating that the hypothesis is hardly a general rule across countries.

2.3. Market Integration and Crisis

Loh (2013) studied the co-movements between 13 Asia-Pacific stock market returns with European stock market returns and the US stock market returns using weekly data for the period Jan 2001 to Mar 2012. The study used wavelet coherence method to test co-movements and the results indicated presence of strong integration between Asian markets with Europe and the US markets in the long run. However, the study reported that the co-movements were concentrated at the medium term during the global financial crisis whereas it was concentrated at the short term durations during the European debt crisis.

Narayan et al. (2014) identified patterns and causes of stock market integration among emerging Asian economies and developed markets. The study examined market integration of US, Australia, China, India, Korea, Malaysia, Singapore and Thailand for the period 2001-2012 using EGARCH-dynamic conditional correlations (DCC). The study found that the correlations were strongest during the global financial crisis period (2007-2009) in addition to reporting that the bilateral correlations were highly volatile. The study reasoned that price differentials, exchange rate risk, global financial crisis, bilateral trade relations, openness variable and domestic market characteristics as determinants of stock market integration. When compared with the US market, results indicated that global financial crisis was the most significant factor, though other factors were also found to be significant. In addition, the correlation results indicated that Asian markets were more integrated with Australian market than the US market (global financial crisis was of lesser importance when Australia was considered as against US). In the case of Asian markets and the Indian market, it was found that global financial crisis and market factors of the six economies influence the pairwise correlations.

Hwang et al. (2013) studied the determinants of stock market comovements among US and emerging markets during the US financial crisis. The study used dynamic multivariate EGARCH model to estimate dynamic conditional correlations (DCC) of daily stock returns of 10 emerging economies along with the US market during the period 2006-2010. Using the estimates of DCC, the study analyzed three different types of dynamic behavior of stock returns using the global financial crisis as a reference period. The results indicated presence of 3 breaks for Korea, Taiwan and Thailand, 2 breaks for India, Malaysia, Russia and Philippines and 1 break for China and Brazil. In particular, China was reported with lowest DCC with the US while Brazil market had high correlations with

the US market essentially implying the level of insulation that China had on the US market.

Wang (2014) studied the integration and causality among six East Asian stock markets (China, Hong Kong, Taiwan, Singapore, South Korea and Japan) while considering the interactions with the US market before and during the global financial crisis using cointegration, Granger causality and impulse response analysis. The results of the study suggested that before the financial crisis, East Asian markets tended to respond to global shocks. However, the financial crisis seemed to strengthen linkages among East Asian stock markets while the impact of US market weakened during the crisis period. In addition, the study reported an increasing integration of Chinese market with other East Asian markets in recent years.

The role of direct flows and portfolio flows in influencing stock market integration has received little attention especially in the event of a crisis. Foreign capital flows to Asian economies have grown rapidly since the 1980s following liberalization of equity markets worldwide. Investing in a foreign stock market is a form of capital outflow, giving rise to linkage between the capital exporting country and the capital importing country whose nature has not yet been clearly understood. Recent studies have observed that capital flows lead to higher domestic returns by exerting pressure on local prices and are linked to host country as well as market performances abroad (Richards, 2005).

Studies investigating the effect of capital flows on stock market integration are fewer and inconclusive. Johnson and Soenen (2002) concluded that greater FDI contributes to greater comovement of stock markets while Forbes and Chinn (2004) found no significant influence of capital flows (FDI and bank lending) on stock market integration. The role of portfolio flows in influencing stock market linkages has received less empirical attention. In a recent study, Poshakwale and Thapa (2010) concluded that rapid growth in flow of portfolio investments is leading to greater integration of Indian equity market with global markets.

In addition, stock market interdependence has not been examined for any pair of countries separately since almost all the studies conduct panel and pooled regressions for a group of countries. Analyzing stock market integration between a pair of countries separately will highlight the importance of their bilateral economic relationships that vary across country pairs and aid in policy-making decisions for individual countries.

Thus, this study attempts to determine what factors drive the stock market interactions between US and Asian NIEs. The empirical framework is based on two hypotheses identified from the literature: 1) Convergence of macroeconomic variables between two countries causes greater interdependence between their stock markets and 2) Higher the

bilateral trade flows and financial flows between countries, greater is the interdependence of their stock markets. In order to test these hypotheses, time-series regression analysis was carried out for each pair of US-Asian markets.

3. Data

To capture the interdependence among the stock markets of US and the four Asian NIEs, data on daily closing stock indices from January 1, 1999 to December 31, 2009 in local currencies were used. The period coincides with the intervening years between two crises, the Asian crisis and global financial crisis. The indices chosen to represent the stock markets of each economy were as follows: Hang Seng Index (Hong Kong), Straits Times Index (Singapore), Korean SE Composite Index (South Korea) and Taiwan SE Corp. Weighted Index (Taiwan) and Dow Jones Industrial Average (US). All daily indices were transformed into daily rates of return in the empirical estimations, and were calculated as difference in natural logarithms as follows: $R_{it} = \ln P_{it} - \ln P_{it-1}$, where R_{it} denotes the rate of return of the i^{th} market on day t, and P_{it} (P_{it-1}) denotes the stock index on day t (t-1).

Differentials in interest rates, inflation rates and growth rates, and changes in exchange rates, trade of goods and services, direct investment and portfolio investment by US in Asian economies were used as explanatory variables of stock market interdependence. Quarterly data on most of the macroeconomic variables were obtained from IMF-IFS database, US Treasury International Capital, Bureau of Economic Analysis of US. Data for quarterly series of Industrial Production Index, Consumer Price Index, three-month Treasury-bill rates, average and end of the quarter exchange rates (national currency per US Dollar), GDP at current prices and expenditure based (national currency), US exports and imports, US portfolio outflows and inflows for each Asian economy were used.

4. Empirical Framework

4.1. Hypothesis 1

According to the discounted cash flow valuation model, the value of a firm's stock will equal the expected present value of the firm's future payouts (dividends). Future payouts of firms ultimately reflect real economic activity as measured by industrial production or other variables while interest and inflation rates are reflected on the discount rates used in the cash flow model. Consequently, stock prices and thereby the returns, are built on expectations of these macroeconomic fundamentals. Since stock prices reflect economic conditions, it is posited that comovement of economic fundamentals determines the common fluctuations in international stock markets. For instance, industrial production index and GDP growth rates which are indicators of real activity reflect the aggregate corporate earnings of a country and influence the stock prices significantly. Hence, high

differentials in these growth rates between countries may lead to divergent behavior of their stock markets. Similarly, frequent and large changes in inflation differential between two countries can reduce the correlations between a pair of national equity market returns. In addition, higher exchange rate uncertainty is expected to dampen the equity markets' correlation. On the other hand, stock market linkages significantly increase in the presence of money market integration. If money markets have a higher linkage, then the interest rates move in the same direction, in turn, causing stock market integration. Thus, following the general argument that comovement of macroeconomic factors lead to comovement of stock returns, the econometric model was built as follows:

$$FEVD_t = f\{|r_{US} - r_j|_t,\ |\pi_{US} - \pi_j|_t,\ |g_{US} - g_j|_t,\ (\Delta e_j)_t\} \quad (1)$$

where, $FEVD_t$ is the percentage of variance of Asian stock market j explained by that of US market in quarter t, r_{US} is the short term interest of US and r_j is that of Asian economy j, π_{US} is the inflation rate of *US* and π_j is that of Asian economy j, g_{US} is industrial production growth rate of *US* and g_j is that of Asian economy j, and Δe_j is the change in exchange rate between *US* and Asian economy j.

4.2. Hypothesis 2

Chen and Zhang (1997) observed that stock market comovements are driven more by economic links rather than geographic proximities *per se*. There are two channels that contribute to increase in economic integration between countries- trade flows and capital flows. Higher the bilateral trade and capital flows between two countries, higher the interdependence between their stock markets. The underlying economic foundation is that trading activities link the cash flows of trading partners, thereby making their stock markets highly correlated (Chen and Zhang, 1997 and Bracker *et al*., 1999; Pretorius, 2002). If two countries have tight trade relations, their stock markets should be more interdependent, and stock price response patterns should be more predictable (Soydemir, 2000). Forbes and Chinn (2004) argued that bilateral financial flows may be important compared to trade flows in explaining stock market interdependence. Studies that include only trade flows are likely to overstate the importance of trade linkages. Increase in cross-border capital flows followed by financial liberalization leads to a decrease in asymmetric information across markets and thereby, greater interdependence between them. These capital flows take two major forms: Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI).

Johnson and Soenen (2002) were the first to include FDI as one the important factors affecting stock market integration between Japan and Asian countries. The study argued that an increase in FDI from Japan to the rest of Asia signals a growing

internationalization of the economy and closer ties to Japan. Similarly, Poshakwale and Thapa (2010) postulated that trading activities of foreign portfolio investors contain significant information in explaining short-run and long run comovements of Indian equity markets and global markets. Thus, a positive relationship between capital flows and the level of interdependence in the stock markets was posited. Based on this, the following model was constructed:

$$FEVD_t = f\{(Trade_j)_t, (FDI_j)_t, (FPI_j)_t\} \quad (2)$$

where $Trade_j$ is the sum the exports and imports between US and Asian economy j scaled by GDP of j, FDI_j is the foreign direct investment of US in Asian economy j scaled by GDP of j, FPI_j is the foreign portfolio investment by US in Asian economy j scaled by GDP of j.

5. Methodology

5.1. Forecast Error Variance Decomposition (FEVD)

In this study, the forecast error variance decomposition analysis obtained by vector autoregressive (VAR) modeling of stock returns was used to investigate the degree of stock market interdependence between US and Asian markets. The FEVD technique uses simulations on an estimated VAR model and thereby measures the responses of a given market to innovations in other markets. This provides a quantitative measure of short-run dynamic interdependencies between US and Asian markets. Particularly, this variance decomposition of the forecast errors captures the percentage of unexpected variation in a stock market's return accounted for by shocks of other markets in the system. This method has been extensively used by researchers investigating the extent of stock market interdependence (Dekker *et al.* 2001) and determinants of market integration (Liu *et al.*, 2006 and Lin and Cheng, 2008). However, the shortcoming of the traditional approach of FEVD analysis is that the results vary according to the ordering of variables in VAR model. This is overcome by employing the recently developed generalized FEVD analysis of Pesaran and Shin (1998).

5.2. Time Series Regression

Time series regression was used to empirically investigate the economic determinants of stock market interdependence. The dependent variable is the percentage of FEVD of Asian market explained by the US market and independent variables are the macroeconomic variables. The variables used were in quarterly frequency covering a period of 11 years (1999-2009) and consisted of 44 data points. Prior studies have used panel regression analysis by pooling the data of all country-pairs considered for the empirical work. In this study, individual time series regression analysis was carried out for each US-Asian pair

instead of pooling the data to understand the effects of bilateral relationships between US and Asian economies on stock market interdependence.

6. Results

6.1. Unit Root Tests

VAR modeling cannot be applied if the variables used are non-stationary as it may lead to spurious regression results. Thus, each series was checked for a unit root using the ADF and PP tests with and without trend. The selection of optimal lag length was determined by minimizing AIC and the critical values of MacKinnon (1996) were used. The results of *t*-statistics for the unit root tests of log levels and first differences of daily stock indices of the four Asian stock markets and US market are presented in Table 1. The results indicated that for every stock price index the unit root hypothesis was not rejected at 1%, 5% and 10% significance levels; whereas, tests performed on the first differences of log stock prices strongly indicated that each of the first-differenced series was stationary. The evidence supports that all stock price index series contain a single unit root, i.e., they are integrated of order one.

Table 1: Unit root tests

Stock index	Without trend				With trend			
	ADF		PP		ADF		PP	
	Levels	Returns	Levels	Returns	Levels	Returns	Levels	Returns
ln HIS	-1.528	-53.95***	-1.469	-53.98***	-1.959	-53.94***	-1.895	-53.97***
ln STI	-1.487	-51.40***	-1.556	-51.46***	-1.487	-51.39***	-1.786	-51.45***
lnKOSPI	-1.325	-52.21***	-1.298	-52.21***	-2.255	-52.20***	-2.230	-52.20***
ln TSEC	-1.776	-51.97***	-1.874	-52.03***	-1.863	-51.97***	-1.958	-52.02***
ln DJIA	-2.246	-32.69***	-2.377	-133.4***	-2.234	-32.69***	-2.352	-133.4***

Note: ***, ** and *denote rejection of null hypothesis at 1%, 5% and 10% levels respectively. The critical values of the ADF test without trend and with trend were -3.43 and -3.96 respectively at 1% significance level. The critical values of the PP test without trend and with trend were -3.43 and -3.96 respectively at 1% significance level. MacKinnon (1996) critical values were used for the rejection of unit root hypothesis.

6.2. FEVD Analysis

Since both the ADF and PP test proved that the first differences of stock prices (log returns) were stationary, the returns series were used in the VAR framework. The percentage of FEVD of Asian markets explained by the US market was estimated for every quarter of the period 1999-2009. This captures the fluctuations in interdependence between these markets. The results of 10-day ahead FEVD analysis for the stock markets

of Asian NIEs are presented in Table 2. Several major findings emerged from the analysis. First, a substantial number of interactions were found to exist among the US and Asian markets. A single market's own innovations did not fully account for its own variance, i.e. no market was absolutely exogenous. Among the Asian markets considered for the study, Hong Kong and Singapore markets had significant interactions with the US market followed by South Korea and Taiwan. On an average, the US market accounted for around 20% of variance in Hong Kong and Singapore markets, while explaining more than 15% in the case of Korean and Taiwanese markets. Prior studies indicated significant increase in stock market interdependence during crisis periods. Along similar lines, the percentage of variance of Asian markets explained by the US market indicated a marked increase during the sub-prime crisis period. During the period 2007-2009, the average variance explained by US market jumped to around 25% for Hong Kong and Singapore markets. This was also true for other Asian markets as the US market accounted for more than 20% of variance in Korean and Taiwanese markets during the same period. The empirical results from FEVD analysis revealed that stock markets of Asia are not immune to the shocks originating in US although the effects of shocks vary considerably across markets.

Table 2: Percentage of variance of Asian markets explained by US market

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Qtr I	41.45	23.33	25.78	26.23	22.5	19.03	13.87	32.25	32.51	13.22	30.76
Qtr II	15.3	23.52	40.98	15.4	14.94	17.79	14.18	36.81	27.28	33.57	13.66
Qtr III	19.98	13.96	16.61	37.16	10.65	4.33	8.7	18.98	36.24	18.29	28.88
Qtr IV	20.41	26.58	17.78	25.49	26.81	25.87	25.26	32.19	35.34	23.25	19.18
Qtr I	18.38	20.28	20.9	15.28	14.92	15.37	22.34	3.92	44.53	13.87	20.14
Qtr II	12.39	34.49	36.14	6.06	19.5	9.58	19.89	45.14	22.47	50.25	7.44
Qtr III	16.86	7.64	16.61	21.29	5.101	6.62	15.09	57.26	24.55	27.27	21.59
Qtr IV	21.5	15.72	22.95	9.15	19.12	13.65	8.84	23.39	36.54	12	30.87
Qtr I	20.51	16.37	7.07	5.88	23.28	16.63	12.66	13.59	33.55	17.05	19.56
Qtr II	8.89	21.75	32.61	18.78	14.76	3.62	27.95	22.84	22.69	39.98	18.88
Qtr III	13.73	3.9	4.54	19.77	8.65	1.59	8	32.54	27.93	22.47	19.8
Qtr IV	11.87	18.67	13.12	20.56	26.23	11.1	12.84	6.071	28.61	17.23	7.05
Qtr I	2.21	8.78	9.49	12.86	22.18	18.94	10.91	10.23	25.76	23.02	12.75
Qtr II	17.82	14.06	6.4	9.83	16.2	6.71	24.08	11.87	16.01	23.87	11.91
Qtr III	3.99	8.96	4.98	19.35	13.05	10.47	25.33	18.32	27.53	31.75	16.57
Qtr IV	6.56	3.9	16.55	24.27	15.06	19.33	8.75	7.41	30.75	34.4	12.2

6.3. Stationarity Test

As a preliminary analysis, all variables used in the regression analysis were tested for stationarity. Kwiatkowski-Phillips-Schmidt-Shin tests (KPSS) test was used to check the stationarity of variables used in the regression. This is because traditional ADF and PP tests on time series have low power to reject the null hypothesis for presence of unit root when the series is near the unit root and the sample size is small. The results of stationarity test of all the macroeconomic variables are presented in Table 3. It is observed that all the variables used are stationary as the test statistics obtained are less than the critical values and the null hypothesis of stationarity cannot be rejected at 1% level for the entire series. Thus, the variables are used in the time-series regression analysis

Table 3: Stationarity test

Variables	Hong Kong	Singapore	South Korea	Taiwan
% FEVD	0.110***	0.056***	0.087***	0.057***
Inflation differential	0.062***	0.047***	0.113***	0.061***
Interest rate differential	0.078***	0.133**	0.091***	0.099***
Growth rate differential	0.050***	0.087***	0.092***	0.152***
Exchange ratechange	0.126***	0.109***	0.164*	0.104***
Trade / GDP	0.093***	0.063***	0.105***	0.083***
FDI / GDP	0.056***	0.040***	0.072***	0.117***
FPI / GDP	0.131**	0.083***	0.108***	0.080***

Note: *, ** and *** denote that the null hypothesis cannot be rejected at 1%, 5% and 10% levels as the critical values at these levels are 0.216, 0.146 and 0.119 respectively (Kwiatkowski-Phillips-Schmidt-Shin, 1992 - Table 1).

6.4. Macroeconomic Fundamentals

The results of regression analysis of influence of macroeconomic variables on stock market interdependence between US and Asian NIEs are presented in Table 4. It was observed that none of the variables were significant for all US-Asian NIE pairs except Taiwan for which the inflation rate differential was found to be negative and significant at 5% level. Thus, it can be concluded that comovements of macroeconomic variables of US and Asian NIEs do not help in explaining the level of interdependence between their stock markets in the past decade.

In addition, the sign of the coefficients on the macroeconomic variables vary across US-Asian NIE pairs. Only exchange rate change was found to have positive coefficients for all the Asian economies. The variables were not jointly significant and the model has extremely low explanatory power (R-squared values were around 5% for all NIEs except

for Taiwan whose R-squared was around 15%). The results are in line with the conclusions of Kizys and Pierdzioch (2009) that international equity correlations are not systematically linked to comovement or asymmetric shocks of macroeconomic fundamentals.

6.5. Trade and Financial Flows

The regression model in equation (2) was tested for each US-Asian NIE pair and the results are presented in Table 5. FPI significantly explained the stock market interdependence of all US-Asian NIE pairs while FDI was significant in the case of US-Korea and US-Singapore pairs only. Trade flows were significant in explaining the stock market interdependence of US-Korean markets only.

Table 4: Macroeconomics Determinants of US-NIE Stock Market Interdependence

Variables / Countries		Constant	Growth differential	Inflation differential	Interest rate differential	Exchange rate change
Hong Kong	Coefficient	23.754***	0.260	-0.782	1.652	8.284
Singapore	Coefficient	20.389***	-0.451	1.170	1.405	0.208
Korea	Coefficient	19.585***	-0.227	0.0175	-0.365	0.294
Taiwan	Coefficient	18.278***	0.155	-2.989***	1.080	0.011

Note: *, ** and *** denote that null hypothesis is rejected at 10%, 5% and 1% levels respectively.

Table 5: Influence of Trade and Capital Flows on US-NIE Stock Market Interdependence

Variables / Countries		Constant	Bilateral trade	Foreign Direct Investment	Foreign Portfolio Investment	Adjusted R-squared	F-statistic
Hong Kong	Coefficient	39.15**	-1.07	0.21	0.056**	10.7%	1.82
Singapore	Coefficient	0.72	-0.18	0.51**	0.68***	26.6%	4.05***
Korea	Coefficient	36.44***	-1.27**	-7.68	-2.18*	24.8%	5.61***
Taiwan	Coefficient	11.25	-2.85	2.84	1.82**	20.6%	4.03**

Note: *, ** and *** denote that null hypothesis is rejected at 10%, 5% and 1% levels respectively.

The coefficients on trade flows were negative for all US-Asian NIE pairs. This was because the percentage of trade flows (with US) to GDP of all Asian NIEs indicated a decreasing trend for the period 1999-2009 while the stock market interdependence between the economies indicated an increasing trend. This implied that the decreasing trade flows between economies affect their stock market interdependence negatively. Similarly, decreasing trend of direct investment flows from US has negative influence on stock market interdependence between US and Asian NIEs. During the same period, the

portfolio flows (from US) to GDP ratio greatly increased and had a positive impact on the stock market interdependence.

Thus, it was found that financial flows, in particular portfolio flows were more important than trade flows in explaining stock market interdependence of US-Asian NIEs except Korea. This is because, on an average, the ratio of portfolio flows to GDP was much higher than that of bilateral trade flows to GDP for Hong Kong, Singapore and Taiwan and vice-versa in case of Korea. The results are in line with the conclusions of Liu *et al.*'s (2006) study where it was reported that the difference in trade relations could not explain the difference in the level of stock market integration between US and Asian NIEs. Overall the regression models were significant for all NIEs except Hong Kong. The diagnostic tests proved that no serial correlation and no ARCH effects were found for all US-Asian NIE models except for Singapore. In the case of US-Singapore regression model, an ARCH term was added to remove the heteroskedasticity effects in the residuals.

7. Summary and Conclusion

Increased stock market interdependence points to progressing integration of stock markets. This is expected to lead to reduction in cost of capital and increase in the average price of financial assets but also weakens the attractiveness of international portfolio diversification (Kearney and Lucey, 2004). Studies by Yang (2002) and Yang *et al*. (2003) found significant increase in stock market linkages between US and Asian economies after Asian crisis of 1997. The dramatic increase in the influence of US stock market on the Asian economies during the sub-prime crisis is similar to the results obtained by other studies that examined the impact of 1987 and 1997 crisis. This implies that diversification is least efficient when it is most needed. It can be concluded from our analysis that comovement of macroeconomic variables did not contribute to changes in the influence of US stock market on that of Asian NIEs. In addition, the expected signs of the coefficients of the variables varied across countries, thus indicating that the variables did not follow similar trends across the US and Asian economies. The growing importance of portfolio flows in the recent decade had fuelled the interdependence between the US and Asian economies while trade flows and direct flows to and from US contributed much less to the increasing stock market interdependence. Another major finding is that the effects of bilateral economic relationships on stock market interdependence vary across the Asian region, thereby stressing the importance of country-wise analysis of stock market interdependence.

Our results assume relevance as effective policy formulation requires an understanding of the determinants of international financial integration especially in the context of financial and monetary policy reforms. An obvious result of this study is that the Asian markets

cannot be treated as homogeneous entities. Any benefits for policymakers must depend on individual country analysis. Similarly, benefits for investors must be derived in a corresponding manner. The limited and inconclusive evidence on macroeconomic fundamentals as explanatory factors can be due to several reasons. First, as pointed out by some researchers stock price movements may not be fully driven by public information on macroeconomic fundamentals and no clear relationship exists between them. Second, national stock market interdependence may be due to contagious market shocks, unrelated to economic fundamentals. Such results have been reported by Von Furstenberg and Jeon (1989) for developed markets of US, Japan, Germany and UK, Karolyi and Stulz (1996) for the US and Japanese markets, and Serra (2000) for 26 emerging markets. This is because non-fundamental factors that are related to behavioral patterns like herding, over-reaction etc may significantly influence the stock market interdependence. Stiglitz (2000) argued that owing to the non-existence or large asymmetries of information, financial agents rely to a large extent on the "information" provided by the actions of other market agents, leading to interdependence in their behavior, i.e., contagion effects.

The results obtained on the role of trade flows and financial flows confirm the view that international capital mobility is the most important factor in determining the interrelationships of national stock markets with other markets. Trade flows have relatively lesser impact on stock market interdependence during the past decade. Capital flows through the portfolio route were significant for all the four Asian economies considered in the study while direct investment was significant for only two economies. The findings are in line with that Richards (2005). The study found that at least for Asian markets, foreign portfolio flows had much stronger influence on the stock prices. The benefits of financial integration depend on the quality, size and composition of capital flows into an economy. Stiglitz (2000) argued that capital flows are subject to asymmetric information, agency problems, adverse selection and moral hazard. Although such problems may also occur in trade in goods and services, they are intrinsic to financial flows and are far more significant. Studies have found that when portfolio capital leaves, it leaves faster than it came in. Thus the short-term nature of portfolio flows lead to financial instability and adversely affect economic growth. The ambiguous economic outcomes of equity market integration are highlighted by Segot and Lucey (2008). Increased integration affects corporate financing decisions, dynamics of portfolio allocation and volatility of domestic financial systems. They argued that optimal degree of stock market integration depends on a trade-off between cheaper capital and financial stability. Thus, the process of equity market integration has to be monitored carefully and policymakers should consider institutional development and corporate governance reforms before further liberalizing their financial system.

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