DYNAMICS OF RETURNS IN EMERGING MARKETS: EVIDENCE FROM ASIAN AND INDIAN STOCK MARKETS

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by

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DECLARATION

I, Harip Khanapuri, hereby declare that this thesis for Ph.D. Degree in Commerce titled '**Dynamics of Returns in Emerging Markets: Evidence from Asian and Indian Stock Markets**' is a bonafide record of original research work done by me under the guidance and supervision of Dr.(Ms.) Guntur Anjana Raju, Reader, Department of Commerce, Goa University and that the same has not been previously formed the basis for the award of any degree, diploma or certificate or similar tile of this or any other University.

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CERTIFICATE

This is to certify that the thesis titled '**Dynamics of Returns in Emerging Markets: Evidence from Asian and Indian Stock Markets'** is a bonafide record of the original work done by Mr. Harip Khanapuri, under my guidance and supervision and the same has not been previously formed the basis for the award of any degree, diploma or certificate or similar tile of this or any other University.

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LIST OF ABBREVIATIONS

S&P	-	Standard and Poor
IFC	-	International Finance Corporation
MSCI	-	Morgan Stanley Capital International
MSCI AFE	-	MSCI Europe, Australasia and for East Index
RSP500	-	Log returns of SP500 Index
RKOSPI	-	Log returns of KOSPI index (South Korean Stock Market)
RSSEC	-	Log returns of Shanghai Composite Index (Chinese Stock Market)
RKLSE	-	Log returns of Kuala Lumpur Composite Index (Malaysian Stock Market)
RJKSE	-	Log returns of Jakarta Composite Index (Indonesian Stock Market)
RSET	-	Log returns of SET Index (Thailand Stock Market)
RNIFTY	-	Log returns of NIFTY Index (Indian Stock Market)
LNIFTY	-	Log values of NIFTY Index
LCOSPIMFG	-	Log values of CMIE COSPI Index for manufacturing sector
LCOSPITEX	-	Log values of CMIE COSPI index for fertile sector
LCOSPICHEM	-	Log values of CMIE COSPI Index for chemical sector
LCOSPITEL	-	Log values of CMIE COSPI Index for telecom sector
LCOSPIFB	-	Log values of CMIE COSPI Index for food & beverage sector
LCOSPIFINSERV	-	Log values of CMIE COSPI Index for financial services sector
LIIP	-	Log values of Index for Industrial Production

LM3	-	Log values of broad money supply
LCPI	-	Log values of consumer price index
LEX	-	Log values of exchange rate
LINTOIL	-	Log values of international oil prices
LFDI	-	Log values of foreign direct investments.

Chapter One

INTRODUCTION TO EMERGING MARKETS

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INTRODUCTION TO EMERGING MARKETS

1.1 Introduction and Classification of Emerging Markets:

Since the 1980s investments in emerging markets have become increasingly important in international portfolio management. This attention is justified on account of rapid growth of emerging economies which has surpassed that of developed economies. The enormous growth potential of these economies generates distinctively higher rates of return on their capital markets and this factor has resulted in inclusion of emerging market as significant asset in international portfolios.

The term emerging markets is used with reference to developing nations having potential to grow into developed nations. In fact initially, these countries were referred to as undeveloped nations. Since the term 'undeveloped' nations had negative connotation, these countries were subsequently referred to as LDNs - Less Developed Nations. Back in 1952, the sociologist, Alfred Sauvy, coined the term *Tires Monde* - 'Third World', to describe non-aligned nations that wanted to position themselves between Soviet and Western blocs. In due course of time, the concept 'Third World' gained popularity in economic as well as political sense. However, 'Third World' comprised of have-not nations. This resulted in negligible interest on the part of international investors in terms of resource allocation to these economies. It was during an investor conference in Thailand in 1981, with a desire to give an uplifting and positive image to these

economies, a Dutch banker Antoine W. Van Agtmael, (then working as Investment Officer with International Finance Corporation [IFC]), coined the term 'Emerging Markets' for these developing nations.

Up until now, however, no universally accepted definition of emerging market exists, nor does a consensus about which market merit the 'emerging' status. In general, the term emerging markets suggests a movement away from statistism and highly regulated markets and towards privatization and free markets. The term is basically used for markets of transitional economies that have already passed some initial developmental hurdles. The following definitions connote this meaning of the concept.

World Bank

The world Bank defines emerging markets as those that have not reached the minimum 2007 Gross National Product (GNP) per capita of $11,455 associated with high - income (developed) economies. According to World Bank, therefore, all countries classified as low or middle income countries are categorized as emerging market economies. According to this definition 144 economies fall in the category of emerging market economies.

S&P and IFC

On the other hand S&P and IFC define an emerging market as a market in transition, growing in size (market capitalization), activity (liquidity), or level of sophistication (modernizing and building market capacity). According to

S&P/IFC, emerging market is the one that meets one of at least two criteria: (i) it is located in a low or middle - income economy as defined by the World Bank, and (ii) its investible market capitalization is low relative to its most recent Gross Domestic Product (GDP). According to S&P/IFC, equity markets which impose restrictions such as foreign ownership limits, capital controls, extensive government interest in listed stocks and other legal and political restraints on trading activity, particularly for foreign investors, are generally considered as 'emerging markets'. S&P/IFC notes "pervasive restrictions on foreign portfolio investment should not exist in developed stock markets, and their presence is a sign that the market is not yet 'developed'." The IFC classification of emerging markets is shown in Table 1.1.

Morgan Stanley Capital International (MSCI)

MSCI builds a complete spectrum of market types from 'frontier' markets to 'emerging' markets and then to 'developed' markets. According to MSCI a market accessible to international investors essentially starts as 'frontier' market and evolve over time to 'emerging' market status first and then to 'developed' market status. In this process of evolution from one market type to another, the market would need to comply with increasingly stricter standards in terms of the following:

- Market accessibility, i.e. openness to foreign investment, investability, robustness and efficiency of the operational framework.

Table 1.1

Emerging Markets in the World Across Various Geographical Locations (According to IFC Classification)

Africa	Asia	Europe	Latin America	Middle East
Botswana	Bangladesh	Armenia	Argentina	Iran
Cote d'Ivoire	Bhutan	Bulgaria	Barbados	Israel
Cyprus	China	Croatia	Bermuda	Jordan
Egypt	Fiji	Czech	Bolivia	Kuwait
Ghana	India	Estonia	Brazil	Lebanon
Kenya	Indonesia	Greece	Cayman Island	Morocco
Mauritius	Korea	Hungary	Chile	Oman
Namibia	Kyrgyz	Latria	Colombia	Palestine
Nigeria	Malaysia	Lithuania	Costa Rica	Saudi Arabia
South Africa	Mongolia	Poland	Dominion Rep.	
Swaziland	Nepal	Portugal	Ecuador	
Tunisia	Pakistan	Roamnia	El Salvador	
Zambia	Philippines	Russia	Guatemala	
Zimbabwe	Sri Lanka	Slovakia	Honduras	
	Taiwan	Slovenia	Jamaica	
	Thailand	Turkey	Mexico	
	Uzbekistan	Ukraine	Panama	
		Yugoslavia	Paraguay	
			Peru	
			Trinidad and Tobago	
			Uruguay	
			Venezuela	

- Company and security minimum size and liquidity, as well as minimum number of companies and aggregate size of eligible securities.
- Sustainable characteristics of advanced economies and levels of geo-political risk comparable to other existing developed markets, for achieving 'developed' market status.

Currently, the MSCI classification of emerging markets as shown in Table 1.2 is popular in the fund management industry worldwide.

Table 1.2

Emerging Markets (According to MSCI Classification)
MSCI Index Constituents

MSCI Emerging Markets Index		MSCI Frontier Markets		MSCI Arabian Markets
Argentina	Malaysia	Bahrain	Romania	Bahrain
Brazil	Mexico	Bulgaria	Slovenia	Egypt
Chile	Morocco	Croatia	Sri Lanka	Jordan
China	Pakistan	Estonia	Tunisia	Kuwait
Colombia	Peru	Kazakhstan	Ukraine	Lebanon
Czech Republic	Philippines	Kenya	UAE	Morocco
Egypt	Poland	Kuwait	Vietnam	Oman
Hungary	Russia	Lebanon		Qatar
India	South Africa	Mauritius		Saudi Arabia
Indonesia	Taiwan	Nigeria		Tunisia
Israel	Thailand	Oman		UAE
Jordan	Turkey	Qatar		
Korea				

The markets of emerging economies are generally characterized by small market capitalization, low liquidity, high volatility of returns, limited number of premium-grade and investment-grade securities, inflation or hyper-inflation, high budget/trade deficits as percentage of GDP and large number of well developed domestic institutional investor base [Pradhan (2007)].

As Beim and Calomaris (2001) note, emerging market is a curious term. It suggests that the financial markets of the developing countries were underground, underwater or otherwise hidden from the world although they existed from long time.

In the words of Agtmael et. al., over the next 25 years, emerging markets have the potential of making developed countries dependent on them. Emerging markets today own 75% of world's foreign exchange reserves. They currently account for 20% of world's economy[1]. Adjusted for purchasing power parity they actually represent more than 40% of global economic output[2]. Many emerging market countries are projected to become among the world's largest economies in the decades ahead, with China and India being the most prominent.

1.2 The Growing Significance of Emerging Markets

It was in the early 1990's that investors began to perceive emerging markets as an asset class. Eastern Europe opened up with the fall of Berlin Wall,

[1] Zhang Yuwei (2007),'Emerging Markets to Lead in World Economy – The World is Not Flat But Tilting Toward Emerging Markets', UN Chronicle Online Edition.
[2] Principal Global Investors Report (2007) on 'Trends in Global Emerging Markets Equities'.

economic reforms began in China under the leadership of Deng Xioping, similarly in other countries such as India and Korea, and monetary stability regimes began to unfold in the major economies of Latin America. Along with decline in developed world inflation and interest rates from the late 1980s onwards, these developments prompted increased equity flows into the emerging market asset class. Since then, total emerging market inflows as a share of the global economy (from which they are sourced) have averaged roughly 0.5%. Of those inflows, roughly 20% (i.e. $1 out of every $5) have come in the form of portfolio equity.[3] The increasing interest in emerging markets is on account of several fundamental changes in emerging market economies.

1.2.1 Superior Economic Growth Rate

Emerging market economies have shown tremendous economic growth. Henry and Kannan (2006) observe that from 1975 to 2005 the emerging economies have grown at an average rate of 5.1 per cent per year, roughly twice the average growth rate of the US. The strength of economic fundamentals of emerging markets is also visible from the fact that in the year 2000, the difference between average output growth of advanced economies and the developing economies was about 2 per cent whereas in 2004 it rose to about 4 per cent. In terms of projected growth rate, Table 1.3 project a higher growth rate (5.3 per cent) in the decade 1996-06 for developing economies as compared to the earlier decade (3.9 per cent), in contrast to the decline of growth that was evident in

[3] Insights and Outlooks from JP Morgan Asset Management, 2006.

respect of advanced economies (from 3 per cent in 1987-96 to 2.7 per cent in 1997-2006). Barring a modest slowdown in Asia (which has been consistently showing higher growth rates), all regions in the emerging world show higher growth in the current decade (1997-2006) than the earlier decade.

Table 1.3

Output Growth in Emerging Markets: Ten Year Average (%)

Emerging Market Region	1987-96	1997-2006
Africa	2.2	4.0
Central and Eastern Europe	0.9	3.6
CIS	-	5.2
Developing Asia	7.8	6.6
Middle East	3.4	4.5
Western Hemisphere	2.8	2.8

Source: 'Developing Economies – A Profile of Growth', www.bseindia.com

Table 1.4 gives the details of countrywise real GDP growth rate in respect of selective emerging markets. It is evident that emerging markets have shown real GDP growth rates which is superior to that of major advanced economies (G7 countries). However, some of the emerging economies such as Zimbabwe have consistently shown negative real GDP growth rate on account of persistence of high inflation and moreover hyper inflation in recent times. The median inflation rates in emerging economies has generally been higher than

that in advanced economies (Fig 1.1). If emerging economies are able to control their high inflation, the projected real GDP growth rate would still be higher.

Table 1.4

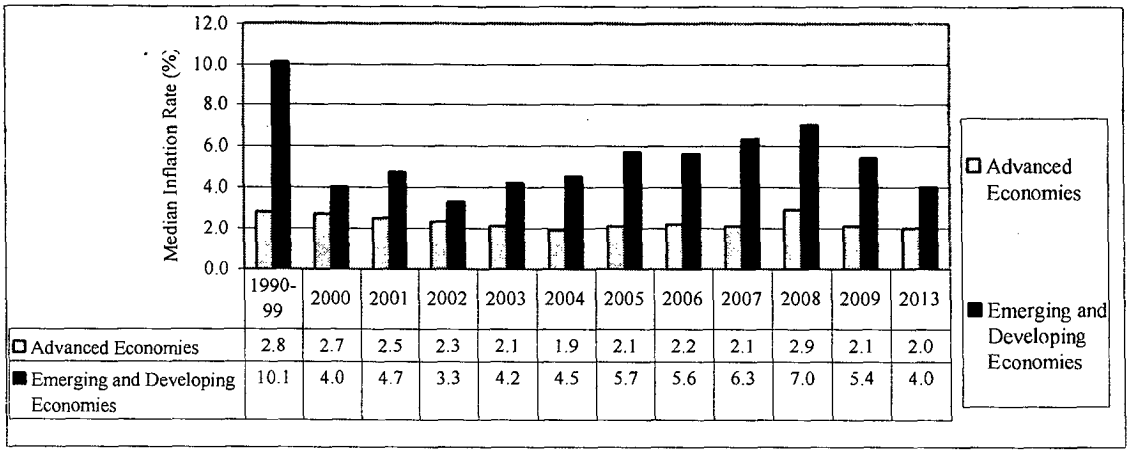
Real GDP of Selected Emerging Markets and Major Advanced Economies
(Annual Percentage Change)

	1990-99	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2013
Argentina	4.2	-0.8	-4.4	-10.9	8.8	9.0	9.2	8.5	8.7	7.0	4.5	3.0
Brazil	1.7	4.3	1.3	2.7	1.1	5.7	3.2	3.8	5.4	4.8	3.7	4.0
Chile	6.4	4.5	3.5	2.2	4.0	6.0	5.7	4.0	5.0	4.5	4.5	5.0
China	9.9	8.4	8.3	9.1	10.0	10.1	10.4	11.1	11.4	9.3	9.5	10.0
Colombia	2.9	2.9	1.5	1.9	3.9	4.9	4.7	6.8	7.0	4.6	4.5	5.0
Czech	-0.3	3.6	2.5	1.9	3.6	4.5	6.4	6.4	6.5	4.2	4.6	4.0
Egypt	4.1	5.4	3.5	3.2	3.2	4.1	4.5	6.8	7.1	7.0	7.1	7.8
Hungary	0.1	5.2	4.1	4.4	4.2	4.8	4.1	3.9	1.3	1.8	2.5	4.3
India	5.6	5.4	3.9	4.6	6.9	7.9	9.1	9.7	9.2	7.9	8.0	8.0
Indonesia	4.1	5.4	3.6	4.5	4.8	5.0	5.7	5.5	6.3	6.1	6.3	6.7
Israel	5.2	8.9	-0.4	-0.6	2.3	5.2	5.3	5.2	5.3	3.0	3.4	3.7
Jordan	4.2	4.3	5.3	5.8	4.2	8.6	7.1	6.3	5.7	5.5	5.8	6.0
Korea	6.1	8.5	3.8	7.0	3.1	4.7	4.2	5.1	5.0	4.2	4.4	4.6
Malaysia	7.1	8.7	0.5	5.4	5.8	6.8	5.0	5.9	6.3	5.0	5.3	6.0
Mexico	3.3	6.6	-	0.8	1.4	4.2	2.8	4.8	3.3	2.0	2.3	3.8
Morocco	2.6	1.8	7.6	3.3	6.1	5.2	2.4	8.0	2.2	6.5	5.7	5.9
Nigeria	2.6	5.3	8.2	21.2	10.3	10.6	5.4	6.2	6.4	9.1	8.3	6.5
Pakistan	4.0	4.3	2.0	3.2	4.8	7.4	7.7	6.9	6.4	6.0	6.7	7.2
Peru	3.1	3.0	0.2	5.0	4.0	5.1	6.7	7.6	9.0	7.0	6.0	5.5
Phillipines	2.8	6.0	1.8	4.4	4.9	6.4	4.9	5.4	7.3	5.8	5.8	6.2
Poland	2.6	4.3	1.2	1.4	3.9	5.3	3.6	6.2	6.5	4.9	4.5	4.9
Russia	...	10.0	5.1	4.7	7.3	7.2	6.4	7.4	8.1	6.8	6.3	5.6
S. Africa	1.4	4.2	2.7	3.7	3.1	4.9	5.0	5.4	5.1	3.8	3.9	4.8
Saudi Arabia	3.1	4.9	0.5	0.1	7.7	5.3	6.1	4.3	4.1	4.8	5.6	5.8
Sri Lanka	5.2	6.0	-1.5	4.0	6.0	5.4	6.0	7.4	6.3	6.4	5.6	5.5
Taiwan	6.5	5.8	-2.2	4.6	3.5	6.2	4.2	4.9	5.7	3.4	4.1	5.0
Thailand	5.1	4.8	2.2	5.3	7.1	6.3	4.5	5.1	4.8	5.3	5.6	6.0
Turkey	3.9	6.8	-5.7	6.2	5.3	9.4	8.4	6.9	5.0	4.0	4.3	5.0
Venezuela	2.4	3.7	3.4	-8.9	-7.8	18.3	10.3	10.3	8.4	5.8	3.5	2.2
Zimbabwe	2.0	-7.3	-2.7	-4.4	-10.4	-3.6	-4.0	-5.4	-6.1	-6.6	-6.8	...
Major Advanced Economies	*2.5*	*3.6*	*1.0*	*1.2*	*1.8*	*3.0*	*2.3*	*2.7*	*2.2*	*0.9*	*0.9*	*2.6*

Source: Compiled from World Economic Outlook, April 2008.
Notes: (i) Major advanced economies include G7 countries.

Fig 1.1

Median Inflation Rates in Advanced and Emerging Economies (in percentage)



	1990-99	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2013
Advanced Economies	2.8	2.7	2.5	2.3	2.1	1.9	2.1	2.2	2.1	2.9	2.1	2.0
Emerging and Developing Economies	10.1	4.0	4.7	3.3	4.2	4.5	5.7	5.6	6.3	7.0	5.4	4.0

Source: World Economic Outlook, 2007

1.2.2 Positive Changes and Fundamental Improvements in Emerging Markets:

Emerging markets have experienced some fundamental improvements and policy changes that are responsible for their improved economic performance in recent years. Some of these include:

Rising productivity levels

Several emerging markets have introduced and continued the economic reforms of liberalization, privatization and globalization that has brought about a high degree of labour productivity. There is a marked improvement in industrial capabilities in these countries and coupled with availability of low-cost labour pool, emerging economies have shown increased productivity levels. Several global companies have also established themselves in emerging

economy countries on account of low-cost labour advantage. Average wages in emerging economies is seven times lower than wages in developed markets. The entry of foreign players in these economies has further increased the level of competition in domestic markets thereby forcing the domestic players to improve their performance.

Population demographics:

Approximately 85% of world's population resides in emerging market nations. Therefore, there is no shortage of labour in these economies. For instance, India and China are the two big emerging economies that are currently reaping the advantage of skilled labour force in fueling their economic growth. Besides, the high population coupled with rising income levels constitute substantial current and future demand for goods and services produced in these economies giving boost to their economic growth.

Trade surplus and falling interest rates

During 1997-98 (Asian financial crisis), many emerging market economies witnessed high levels of indebtedness and the trade balance had swung to nearly $80 billion deficit. Today these economies have experienced a trend reversal with similar amount of trade surplus. The improved trade surplus has further reduced the short-term interest rates in emerging economies.

Improved accounting standard and greater transparencies

Many emerging Asian and eastern European companies have already moved to or are moving towards adopting international accounting standards. This has attracted greater attention of global investors on account of improved transparencies.

1.3 The Growing Size of Emerging Markets

Over the years, the emerging market economies have grown substantially in size in terms their share in global output and market capitalization, the two significant parameters from viewpoint of international investors.

Size of the Economy

Table 1.5 indicates that with around 85% of world population residing in emerging and developing economies, they account for approximately 44% of world GDP as at 2007. The share of Asian emerging market region in the world GDP is 20.1% which in fact is higher than the share of advanced Euro region (16.1%). Further, single emerging economy like China accounts for 10.8% of world GDP which is much more than that of developed economies like Japan (6.6%), and United Kingdom (3.3%).

Market Capitalization

In 1982 the thirty-two developing-country stock markets surveyed by the International Finance Corporation (IFC) had a market capitalization of $67

billion, for about 7,300 listed companies and representing about 2.5 percent of world market capitalization. At $13.9 billion, Malaysia had the single largest stock market in this group in terms of market capitalization followed by Brazil at

Table 1.5

Share of Advanced and Emerging and Developing Economies in Aggregate GDP and Population, 2007 (*Percentage*)

Economy	GDP		Population	
	Advanced Economies	World	Advanced Economies	World
Advanced Economies	**100.0**	**56.4**	**100.0**	**15.3**
United States	37.9	21.4	30.7	4.7
Euro Area	28.6	16.1	32.3	4.9
Japan	11.7	6.6	13.0	2.0
United Kingdom	5.9	3.3	6.2	0.9
Emerging and Developing Economies	**100.0**	**43.6**	**100.0**	**84.7**
Africa	6.9	3.0	15.1	12.8
Central and Eastern Europe	9.3	4.1	3.3	2.8
CIS	10.2	4.5	5.1	4.3
Developing Asia	46.0	20.1	62.0	52.6
China	24.8	10.8	24.2	20.5
India	10.5	4.6	20.6	17.5
Middle East	8.7	3.8	4.4	3.7
Western Hemisphere	19.0	8.3	10.1	8.6

Source: World Economic Outlook, 2007

$10.2 billion. Ten year later, by the end of 1992, as a group, the market capitalization increased to $770 billion for about 12000 listed companies, and nearly tripled their share of world equity market capitalization, from 2.5% to 7.0%. Trading volume increased 25 times from the 1980 level. By that time, the Mexican, Korean and Taiwanese stock markets were among the 15 largest markets in the world. Further, by the end of 1999, the IFC had identified eighty-one emerging stock markets with total market capitalization exceeding $3 trillion, or 8.5 percent of world equity market capitalization. In 1999 the value of outstanding domestic debt securities trading in emerging markets exceeded $1.4 trillion, representing 4.7 percent of the global bond market and a several-fold increase over the total twenty years earlier.

Over a period from 1990 to 2006, the market capitalization of emerging markets has grown by 2091.21% and accounts for 18.83% of world market capitalization as at 2006 (Table 1.6). The increase in emerging markets capitalization is substantially higher than the corresponding increase observed in developed markets (331.75%) during the same period. Extraordinary growth in market capitalization is observed in emerging markets of China (119423.45%), Poland (103409.72%) and Russia (541634.84%). A further insight on growing size of market capitalization can be obtained from changing ratio of market capitalization to GDP which shows the portion of the stock market on the total national product of an economy and indicates the development stage of a financial market sector.

Table 1.6

Growth in Market Capitalization of Selected Emerging Markets

	1990		2000		2006		% Change
	$ Millions	%GDP	$ Millions	%GDP	$ Millions	%GDP[a]	(1990-2006)
Argentina	3270	2.3	166068	58.4	79730	33.6	2338.23
Brazil	16400	3.6	226152	37.6	711100	59.6	4235.98
Chile	13600	44.9	60401	80.3	174556	118.4	1183.50
China	2030	0.5	580991	48.5	2426326	34.9	119423.45
Colombia	1420	3.5	9560	11.4	56204	37.6	3858.03
Czech	..	..	11002	19.4	48604	30.8	..
Egypt	1760	4.1	28741	28.8	93477	89.1	5211.19
Hungary	505	1.5	12021	25.6	41935	29.8	8203.96
India	38600	12.2	148064	32.2	818879	68.6	2021.45
Indonesia	8080	7.1	26834	16.3	138886	28.4	1618.89
Israel	3320	6.3	64081	55.5	173306	97.3	5120.06
Jordan	2000	49.7	4943	58.4	29729	296.1	1386.45
Korea	111000	42.1	171587	33.5	835188	91.2	652.42
Malaysia	48600	110.4	116935	129.5	235356	139.1	384.27
Mexico	32700	12.4	125204	21.5	348345	31.1	965.28
Morocco	966	3.7	10899	32.7	49360	52.7	5009.73
Nigeria	1370	4.8	4237	9.2	32819	19.6	2295.55
Pakistan	2850	7.1	6581	9	45518	41.5	1497.12
Peru	812	3.1	10562	19.8	59658	45.3	7247.04
Phillipines	5930	13.4	25957	34.4	68382	40.5	1053.15
Poland	144	0.2	31279	18.3	149054	31	103409.72
Russia	244	0	38922	15	1321833	71.8	541634.84
S. Africa	138000	123.2	204952	154.2	715025	236	418.13
Saudi Arabia	48200	36.7	67171	35.6	326869	208.6	578.15
Sri Lanka	917	11.4	1074	6.6	7769	24.4	747.22
Thailand	23900	28	29489	24	139564	69.9	483.95
Turkey	19100	12.7	69659	35	162399	44.6	750.26
Venezuela	8360	17.2	8128	6.9	8251	3.6	-1.30
Zimbabwe	2400	27.3	2432	32.9	26557	71.2	1006.54
World	**9403525**	**48**	**32187882**	**103**	**43642048**	**99.6**	**364.10**
All Emerging	**375065**	**18.8**	**2019125**	**35.8**	**8218463**	**50.1**	**2091.21**
Developed Markets	**9028460**	**51.6**	**30168757**	**117.9**	**38980586**	**112.9**	**331.75**

Source: World Development Indicators, 2005 and 2007.

[a]Market Capitalization as percentage of GDP for 2005 for respective country and country group.

This ratio for emerging markets has grown from 18.8% of aggregate GDP in the year 1990 to 50.1% of aggregate emerging economies GDP in the year 2006. This growth of market capitalization as percentage of aggregate GDP is more than the growth in market capitalization of developed economies during the same period, although in absolute terms developed economies still command sizeable share in world market capitalization. However, it is worth noting that even the most restrictive emerging market like China has increased its market capitalization phenomenally from mere 0.5% of GDP in 1990 to 34.9% of GDP in 2006. Further, countries like Czech Republic where stock market did not even exist in 1990, today has market capitalization representing 30.8% of its GDP. For some emerging markets like Chile, Jordan, Malaysia and Saudi Arabia, the market capitalization of their stock markets is well above their economic output.

The number of listed domestic companies on stock markets of emerging economies increased remarkably during the decade of 1990 from just 7691 in the year 1990 to 23462 in the year 2000 (Table 1.7). However, subsequently, there has been decline in the number of listed companies to 17263 in the year 2006. Overall, the entire period of 1990 to 2006 represents an increase in number of listed domestic companies in emerging markets by 124.46%. Similarly, the average size of listed stocks in emerging markets has shown a ten fold increase from $48.77 Mn in 1990 to $476.07 Mn in the year 2006.

Table 1.7

Growth of Listed Domestic Companies in Emerging Markets

	1990	2000	2006	% Change (1990-2006)	Avg. Size of Listed Stock ($Mn) (1990)	Avg. Size of Listed Stock ($Mn) (2006)
Argentina	179	127	103	-42.46	18.27	774.08
Brazil	581	459	392	-32.53	28.23	1814.03
Chile	215	258	244	13.49	63.26	715.39
China	14	1086	1440	10185.71	145.00	1684.95
Colombia	80	126	114	42.50	17.75	493.02
Czech	..	131	29	..	..	1676.00
Egypt	573	1076	603	5.24	3.07	155.02
Hungary	21	60	41	95.24	24.05	1022.80
India	2435	5937	4796	96.96	15.85	170.74
Indonesia	125	290	344	175.20	64.64	403.74
Israel	216	654	612	183.33	15.37	283.18
Jordan	105	163	227	116.19	19.05	130.96
Korea	669	1308	1694	153.21	165.92	493.03
Malaysia	282	795	1027	264.18	172.34	229.17
Mexico	199	179	131	-34.17	164.32	2659.12
Morocco	71	53	65	-8.45	13.61	759.38
Nigeria	131	195	202	54.20	10.46	162.47
Pakistan	487	762	652	33.88	5.85	69.81
Peru	294	230	193	-34.35	2.76	309.11
Phillipines	153	228	238	55.56	38.76	287.32
Poland	9	225	267	2866.67	16.00	558.25
Russia	13	249	309	2276.92	18.77	4277.78
S. Africa	732	616	401	-45.22	188.52	1783.10
Saudi Arabia	59	75	86	45.76	816.95	3800.80
Sri Lanka	175	239	237	35.43	5.24	32.78
Thailand	214	381	476	122.43	111.68	293.20
Turkey	110	315	314	185.45	173.64	517.19
Venezuela	76	85	53	-30.26	110.00	155.68
Zimbabwe	57	69	80	40.35	42.11	331.96
World	**25424**	**47884**	**49946**	**96.45**	**369.87**	**873.78**
All Emerging	**7691**	**23462**	**17263**	**124.46**	**48.77**	**476.07**
Developed Markets	**17733**	**24422**	**28733**	**62.03**	**509.13**	**1356.65**

Source: Compiled from World Development Indicators, 2005 and 2007.

1.4 Emerging Markets in the Context of International Investments

Emerging market economies have achieved an important position in the context of international investments. The volumes of direct investment flows as well as portfolio flows signify that emerging market are being considered by global investors as vital channels for wealth creation.

Direct Investments in Emerging Markets

Table 1.8 indicates that, The total FDI inflows to emerging markets have increased from $24580 Mn in 1990 to $280795 Mn in 2005 representing an increase of 1042.37% during the period. The net FDI inflows to emerging markets has increased from 0.8% of GDP in 1990 to 2.9% of GDP in 2005. The growing economy and availability of low-cost labour have made emerging economies a very attractive centre for direct investments. China (2169.20%), India (2683.97%), Israel (3598.68%), Jordan (3931.58%), Peru (6043.90%), Poland (10688.76%) have seen significant increase in the flow of FDI investments during the period from 1990 to 2005.

Emerging Markets and International Portfolio Diversification

Ever since the Nobel Laureate, Dr. Harry Markowitz gave the mean-variance theory of portfolio diversification (1959), the international fund managers and investors have always been in search of an asset class that has distinct but negative correlation with their existing domestic asset portfolios. This will help them in effectively diversifying their portfolio to earn suitable

Table 1.8

FDI and Net Portfolio Investments in Emerging Markets
(A comparison of net flows in 1990 and 2005)

	FDI			Net Portfolio Investments			
				Bonds		Equity	
	$ Million		%	$ Million			
Emerging Markets	**1990**	**2005**	**Change**	**1990**	**2005**	**1990**	**2005**
Argentina	1836	4730	157.63	-857	1872	0	-48
Brazil	989	15193	1436.20	129	3580	103	6451
Chile	661	6667	908.62	-7	584	367	1635
China	3487	79127	2169.20	-48	2702	0	20346
Colombia	500	10375	1975.00	-4	496	0	86
Czech	0	..	..	..	-201	0	..
Egypt	734	5376	632.43	-1	1554	0	729
Hungary	623	6436	933.07	921	2987	0	-16
India	237	6598	2683.97	147	-3959	0	11968
Indonesia	1093	5260	381.24	26	3791	0	-165
Israel	151	5585	3598.68	..	..	..	..
Jordan	38	1532	3931.58	0	134	0	60
Korea	789	4339	449.94	..	..	..	..
Malaysia	2332	3966	70.07	-1239	492	0	-1200
Mexico	2549	18772	636.45	661	-839	1995	3353
Morocco	162	1552	858.02	0	-41	0	64
Nigeria	588	2013	242.35	0	0	0	..
Pakistan	245	2183	791.02	0	1092	0	451
Peru	41	2519	6043.90	0	2640	0	766
Phillipines	530	1132	113.58	395	1081	0	1461
Poland	89	9602	10688.76	0	11384	0	1341
Russia	..	15151	..	..	10033	..	-215
S. Africa	-76	6257	..	..	406	389	7230
Sri Lanka	43	272	532.56	0	0	0	-216
Thailand	2444	4527	85.23	-87	1156	440	5665
Turkey	684	9805	1333.48	597	3212	89	5669
Venezuela	451	2957	555.65	345	5365	0	91
Zimbabwe	-12	103	..	-30	0	0	..
World	203236	974283	379.39	..	..	..	..
All Emerging & Developing Economies	**24580**	**280795**	**1042.37**	**1082**	**55110**	**3390**	**66680**

Source: Compiled from World Development Indicators, 2007

risk-adjusted return. In this context emerging markets have been found to be an ideal asset class. Emerging markets occupy centre place in the context of international portfolio investments on account of two important reasons. The first, high rates of economic growth in emerging markets provide great absolute investment opportunities. Because the rate of economic growth in most developing countries is expected to exceed the rate of growth in the developed world for many years to come, the typical discussion presumes that long-run stock returns in emerging markets will also exceed those of developed markets [Malkiel and Mei (1998); Mobius (1994)]. Secondly, the low correlation of emerging market stock returns with those of developed markets and their relative isolation provides diversification opportunities that enable investors in developed countries to increase the expected return on their portfolio while reducing the risk [Harvey (1994), Cha, Yan-Leung, Cheung (1998), Shashikant, Uma (1998), Gunduz, Omran (2001), Neaime, S. (2002), Lin, J., Wu, C. (2006)]. However, in so far as inclusion of emerging markets in international portfolios is concerned, a mere generalisation of benefits of investing in emerging markets may not suffice for commitment of billions of dollars into these economies. One needs to understand the dynamics of returns in such markets where change is a driving force for returns.

1.5 Emerging Markets and Expectation of Superior Returns

One of the most important argument with which the emerging markets are sold to international investors today is their ability to generate superior

returns. Harvey (1995) for instance reports a 20.36 percent dollar return on the emerging market composite index as compared to 13.63 percent return on the US market. In terms of consistency in superior returns, Erb, Harvey and Viskanta (1997) suggest that growth is likely to be highest in relatively poor but stable countries and therefore these markets must generate high returns. Mobius (1994), Malkiel and Mei (1998) also propound that because the rate of economic growth in most developing countries is expected to exceed the rate of growth in the developed world for many years to come, the long-run stock returns in emerging markets will also exceed those of developed markets. Using the earnings yield and the dividend-price-ratio based measures, Henry and Kannan (2006) found that average expected returns over the period 1985-2005 were higher in Latin American and Asian emerging markets than in US. Emerging markets have consistently shown superior performance at short and long horizons in comparison to the developed markets (Table 1.9).

1.6 Heterogeneity Characteristic of Emerging Markets

The main objective of selection of emerging markets as asset class in a global portfolio is to diversify the risk and earn superior returns. However, an important question that would arise is whether a global investor can simply select any of the emerging market to achieve this objective. An answer to this would be positive if all the emerging markets exhibit same characteristics in terms of market structures, growth patterns and returns. Research however, indicates that important disparities exist among emerging markets at the

Table 1.9

Emerging Markets vs. Developed Markets (Comparative Results in USD % Returns - Periods Ending June 30, 2007)

Stock Market Index	Three Months	One Year	Three Years	Five Years	Ten Years
MSCI Emerging Market Free Index[4]	15.0	45.4	38.7	30.6	9.4
MSCI EAFE Index[5]	6.4	27.0	22.2	17.7	7.7
S&P 500 Index	6.3	20.5	11.7	10.7	7.1

Source: Principal Global Investors Report (2007)- 'Trends in Global Emerging Markets Equities'.

microstructure level as well as the activity volume level [Bekaert and Harvey (2003)]. In fact Derrabi (2000) while examining evolution of emerging markets attribute such disparities to the four distinct stages of evolution: *the embryonic phase* characterised by primitive quotation system, lack of automation, low volumes and rudimentary regulations; *low activity phase* indicating the beginning of privatisation programme within the structural adjustment policy framework (usually suggested by IMF) which encourage economic activity from private sector and increases the number of market participants; *active phase* following continuous genuine reforms and typified by computerised processing of quotations, increased openness of market and greater participation from foreign

[4] MSCI Emerging Market Free Index is a group of securities from emerging markets tracked by Morgan Stanley Capital International. A 'Free' index represents investible opportunities for global investors, taking into account the local market restrictions on share ownership by foreign investors.

[5] MSCI Europe, Australasia and the Far East Index is group of securities tracked by Morgan Stanley Capital International

investors; *maturity phase* marking the end of stream of regulatory reforms and transforming the emerging market into developed market which may be even integrated with the other developed markets. Different emerging markets or their groups will thus be in a different phase at a time which will obviously create a distinct risk-return matrix. Therefore it is clear that emerging markets cannot be considered as homogeneous asset class. And an investor focusing on these markets need to ascertain the profitability of investing in particular emerging market after examining all the relevant risk factors impacting that market.

1.7 Stability of Emerging Market Returns

Research and forecasts both have proved that emerging markets offer high returns and also have potential to offer such returns in future; mainly on account of shift in focus of economic policies from regulation to deregulation. However, this transition phase has brought about substantial volatility in emerging market returns. Table 1.10 for instance reports that though MSCI Emerging Markets index has given returns well above that of developed markets indices, the standard deviation of these returns is very high at 34.40 per cent which is well above that of Russell 3000 (17.13 per cent) and MSCI EAFE (18.91 per cent). Harvey (1994) reports the annualised standard deviations of over 75 per cent for Argentinean and Turkish markets and found that though emerging markets average returns are roughly 50 per cent higher than the Morgan Stanley Capital Index (MSCI) world composite index, the standard deviation too is about

80 per cent higher than the MSCI world index. Cha, B. and Cheung, Y. (1998) reports that higher mean returns in Hong-Kong, Korea, Singapore and Taiwan are accompanied with high level of risk with standard deviation ranging from 28.79 per cent (for Korea) to 46.96 per cent (for Taiwan) for the whole sample period of March 1975 to September 1992. During the longest US bull market

Table 1.10

Annual Average Returns and Standard Deviations of Russell 3000, MSCI EAFE and MSCI Emerging Markets, 1988-2005

	Russell 3000	MSCI EAFE	MSCI Emerging Markets
Compound Return	12.02%	06.61%	14.33%
Standard Deviation	17.13%	18.91%	34.40%
Arithmetic Return	13.33%	7.92%	18.99%

Source: Jacobo, R. (2007) 'Searching for Eldorado in Emerging Markets', Pension and Investments,

history, emerging markets returns declined 43 per cent from December 1994 to October 2001 when the S&P index gained 130 per cent [Frashure, R. and Wang, C. (2002)]. In fact the whole episode of Asian crisis in 1997 had put the entire emerging market asset class in question. The fragile market microstructures in these economies and weak risk management systems can wipe out entire or substantial amount of expected returns. The kind of policies and policy formulation process also inflicts volatility in emerging market returns. Ranciere,

Tornell and Westermann (2003) for instance argue that in attempting to force transitions, countries may adopt policies that raise the rate of progress but, at the same time, increase the risk of crisis. The frequent occurrence of economic crisis in emerging market regions (Mexican crisis, 1994, Asian crisis, 1997, Russian crisis, 1998, Brazilian crisis, 1999, Argentinean Peso crisis, 2002) is evidence of such policy related issues. Another major reason for high degree of volatility in emerging markets is the amount of international capital invested in them. Negative developments in an emerging market region can make investors wary about their investments in other emerging markets. For example, during the Asian crisis of 1997, international investors withdrew their investments even from Latin American and Easter European emerging markets, depressing those economies even when they did not share any economic ties with Asia. An interesting observation of Harvey (1994) however cannot be ignored that the main benefit to emerging market investment is not the increasing of returns but the lowering of portfolio volatility for minimum variance strategies. Harvey et. al. reports that when the 18 emerging market returns are added to the portfolio of 18 developed markets, the standard deviation of minimum variance portfolio is reduced from 14.5 per cent (including only developed markets) to 7.5 per cent (including both developed and emerging markets). Given the observed volatility in emerging market returns and research evidence it can be concluded that the merits of including this asset class need to be appropriately weighed with its limitations.

1.8 Integration of Emerging Markets With Global Economy

An important measure to evaluate the benefits of portfolio diversification with inclusion of emerging market assets is by understanding the integration of emerging economies with the global economy. The following facts provide an insight into growing integration of emerging market economies with the global economy[6]:

- The growth in global activity in the past five years is dominated by the emerging and developing economies - China itself has accounted for about one-quarter of global growth; Brazil, Russia, China and India almost one-half; and all emerging and developing economies together for about two-thirds, compared with about one-half in the 1970s.[7]
- The ratio of merchandise trade to GDP of an economy is a useful measure in evaluating integration of that economy with the global economy since it directly reflects participation of an economy in global trade. The merchandise trade of emerging market economies has grown from 32.5% in 1990 to 59.2% in 2005. Within the emerging market set, East Asia and Pacific economies have increased their percentage share of merchandise trade to GDP from 47.1% to 74.6%, emerging Europe and Central Asia from 49.7% to 68.6%, Latin American and Carribean region from 23.2% to 44.2%, Middle East and North Africa from 43.5% to 57.6% and South Asia from mere 16.5% to 31.2%, during the period from 1990 to 2005. Emerging

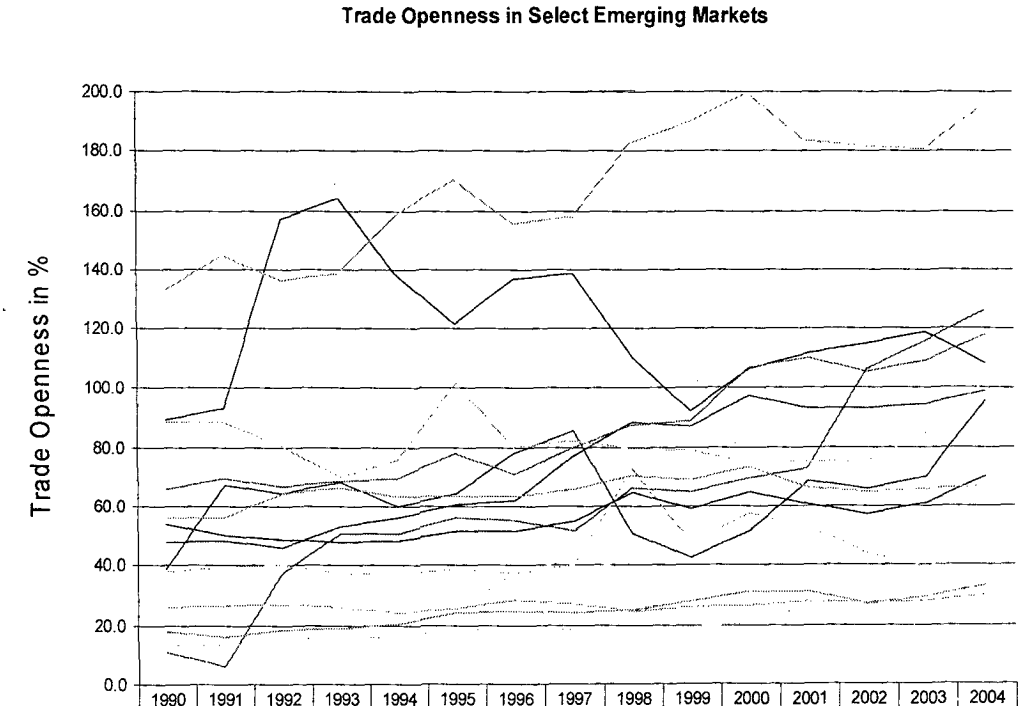
[6] Statistics and computations based on World Development Indicators, 2007.
[7] World Development Indicators Report on Global Prospects and Policies (2007).

and developing economies now account for about one-third of global trade and more than one-half of the total increase in import volumes since 2000.

- The increasing trade openness across emerging markets is providing platform for integration of emerging markets with global economy (Fig. 1.2). The aggregate exports of emerging and developing economies has increased significantly from $714951 mn in 1990 to $3596835 mn in 2005. Similarly, aggregate imports have increased from $689821 mn in 1990 to $3263799 mn in 2005.
- The aggregate private capital inflows to emerging markets have increased from 1997-99 average of $252.4 billion to $1633.8 billion in 2007, representing an increase of 547.31% during the period. Likewise, the outflows of private capital have also increased from $88.8 billion (average of 1997-99) to $1027 billion in 2007 representing an increase of 1056.53% at CAGR of 45%.
- There is also increasing evidence of growing regionalism [UNCTAD (2007)] and increasing economic linkages between emerging markets regions and emerging economies of the same region. Almost one-half of exports from emerging and developing economies is now directed towards other such economies, with rising intra-regional trade within Asia most notable.

Fig 1.2

Trade Openness in Select Emerging Markets (1990 - 2004)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Brunei	89.4	93.3	157.1	164.1	138.2	121.7	136.8	138.7	110.5	92.0	106.3	111.4	115.0	118.5	108.1
Cambodia	10.9	5.9	37.6	50.5	50.5	56.5	55.3	51.4	66.4	64.9	69.7	72.7	106.3	115.8	125.6
Indonesia	37.9	39.1	40.1	37.5	37.1	38.7	37.2	40.1	72.6	47.2	57.8	53.1	44.2	39.2	45.8
Malaysia	133.1	144.8	136.3	138.6	158.8	170.4	155.3	157.7	182.6	189.6	199.7	183.6	181.5	180.6	195.1
Myanmar	38.6	67.1	64.4	68.3	60.1	64.5	77.9	85.8	50.4	42.4	51.4	68.5	65.8	70.1	95.3
Philippines	48.0	48.1	46.0	53.2	56.1	60.4	62.0	76.9	88.6	87.0	97.2	92.9	93.3	94.5	98.7
Thailand	65.9	69.4	66.9	68.3	69.3	77.9	70.9	79.8	87.2	88.8	106.6	110.1	105.4	109.2	117.9
Korea	53.9	50.0	48.6	47.6	48.1	51.5	51.5	54.7	64.9	59.1	64.9	60.4	57.2	61.1	70.2
Bangladesh	18.1	16.3	18.3	19.1	20.2	24.3	24.6	24.2	25.0	27.7	31.0	31.2	26.8	29.4	32.9
India	13.4	13.5	15.2	15.5	16.0	18.4	18.3	18.6	18.5	19.2	20.3	22.1	22.1	23.5	26.3
Maldives	88.4	88.3	80.3	70.2	75.7	101.9	79.9	82.5	79.4	79.1	74.5	75.1	75.1	84.4	102.0
Nepal	22.5	26.9	26.5	26.4	24.4	24.8	38.0	41.4	38.7	35.4	31.4	26.1	27.3	32.9	36.5
Pakistan	26.2	26.4	27.2	26.0	23.9	25.7	28.3	27.1	24.5	26.0	26.5	27.9	27.2	27.8	30.0
Sri Lanka	56.4	56.1	64.3	66.3	63.4	63.6	63.5	65.7	70.3	69.2	73.2	66.4	64.8	65.6	66.4

Source : Compiled from IMF Direction of Trade Statistics and IMF World Economic Outlook Database

Emerging market economies have thus evolved significantly since they were discovered. With strong internal growth dynamics and suitable macroeconomic policies, these economies will continue to create an enabling investment climate and attract sustainable capital flows both direct as well as portfolio flows.

One major reason why emerging markets have gained significance in international portfolios is their segmentation from the other markets particularly developed markets in the world. Grubel (1968) was the first to point out that the unique characteristics operating in countries around the world meant that investments in assets denominated outside the domestic market was likely to provide an attractive source of risk reduction opportunities. The major factors contributing to this property of international assets were lesser degree of international trade, greater restrictions on foreign currency movements and less advanced communication systems which discouraged information transmission across markets. Emerging markets have formed part of global portfolios on account of their relative isolation from developed markets which in turn is attributed to reasons stated above. Traditionally, there have been excessive regulations in emerging markets that restricted larger volumes of economic activities to domestic territories. However, since the very concept of emerging markets connotes potential for transformation into mature markets, the properties of emerging market are bound to change significantly over the years due to reform process. In current business environment the policy restrictions do not sustain for long and even emerging markets tend to expand their economic

activities across the borders. The above facts on integration of emerging markets with global economy highlights two significant evolving properties of emerging markets - firstly, the increasing trade ties between emerging economies and developed and other emerging economies; and secondly gradual movement towards freer financial markets that encourage foreign investor participation. As these emerging economies establish stronger trade ties with other emerging or developed economies, international factors become more, and more influential in determining their stock market returns [Dekker, A., Sen, K., Young, M. (2000), Forbes, K., Chinn, M. [2003], Worthington, A., Higgs, H., Katsuura, M. (2003)]. For emerging markets such freer stock markets provides several benefits. It represents an opportunity to attract foreign capital to finance economic growth. It also helps in development of equity markets which in turn is positively related to long-run economic growth [Boyd and Smith (1996), Levine and Zervos (1996, 1998)]. However, one negative aspect of stock market opening is the influx of so-called hot money which is highly sensitive to the future expectation of economic growth in emerging markets and expectation of returns from holding securities. Given the sensitivity of these investments, even a small shock to the economy can lead to volatile change in flow of funds which may instill considerable volatility in domestic markets.

Emerging markets are increasingly integrating with global financial markets even informationally. The continuing reforms by emerging market economies in the areas of market microstructure by introducing transparent electronic trading mechanisms, corporate disclosure practices and corporate

governance, improved accounting standards and movement towards international disclosure practices is increasing the foreign influences in emerging stock markets. The developments in communication technology, spread of internet service, etc. is enabling the market participants to trade with global information in hand.

Under these circumstances, the study of impact of this transformation of emerging markets on correlations between emerging markets and developed and other high risk emerging markets therefore becomes vital for asset allocation decisions. In other words it remains to be examined whether emerging markets still provides portfolio diversification benefits.

Chapter Two

LITERATURE REVIEW AND RESEARCH METHODOLOGY

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LITERATURE REVIEW AND RESEARCH METHODOLOGY

The interesting behaviour of emerging market returns has given birth to a great amount of empirical work in the context of these markets trying to characterise their return and diagnose their behaviour considering macro dynamics in these markets and other extraneous influences. The focus of this research is on integration of emerging markets with other emerging markets and developed markets as well; in other words, the dynamic comovement of emerging market returns and evaluating the impact of macroeconomic factors on stock prices of emerging Indian stock market. We thus examine the existing literature on these aspects.

2.1 Segmentation and Integration Dynamics of Stock Markets

Marketplaces are said to be segmented when their returns are not affected by factors other than domestic factors. Therefore, events occurring in international markets do not impact the returns in segmented markets because of which they offer different return for the same unit of risk borne. The risk of such portfolio is therefore only its variance. Emerging markets are perceived to offer higher rate of return compared to developed markets for the same unit of risk borne by investors in the two markets. On the other hand markets are said to be integrated if events occurring in other markets impact the returns in domestic markets. The focus of attention here therefore is contribution of

integrated market to the risk of global portfolio; in other words its covariance. In such case international diversification of portfolio may not yield suitable risk adjusted returns to investors because of foreign influences. In fact in integrated market setting assets of identical risk command same expected returns irrespective of their domicile.

The studies on stock market integration are numerous and available for developed as well as emerging stock markets.

2.1.1 Dynamic Comovement among Developed Country Stock Markets

Eun, S. and Shim, S. (1989) formally present significant evidence on the linkages among nine large industrialized markets viz., Australia, Japan, Hong Kong, UK, Switzerland, France, Germany, Canada and US. Using daily stock market index returns and Vector Autoregression (VAR) methodology, they studied the long-term linkages between the markets and the efficiency with which the innovations are transmitted between the markets. The study finds substantial degree of interdependence among national markets. At 20 day horizon, for instance, the innovations in foreign markets collectively account for 26% of the forecast error variance of a national stock market on the average. The forecast error variance analysis in VAR helps to understand the contribution unexpected developments in a particular stock market in explaining the variations in other stock markets. They also conclude that US stock market is the most, by far, is the most influential market in the world reflecting the dominant position of US in the world economy. The authors use impulse response functions (that explains

how long a shock in a particular national stock market lasts in other stock markets) to examine the dynamic pattern of innovation and conclude that most of the response by national stock markets to a shock in other markets are completed within two days.

Arshanapalli, B. and Doukas, J. (1993) use bivariate cointegration to examine the changes of dynamic interactions among international stock market indices. They showed that there was no interdependence between US and international stock markets prior to October 1987 crash. However, except for the Nikkei, the co-movements of stock prices increased significantly after the crash period. At the same time evidence of unidirectional causality from the US to French, German and the UK stock markets was documented. They attributed these findings to the loosening of financial deregulation after the crisis.

Cheung, Y. and Lai, K. (1998) explores the potential existence and sources of long-term comovements of stock markets among three major member countries of the European Monetary System (EMS), namely, France, Germany and Italy. The empirical study employs Gonzalo and Granger's (1995) analysis of common permanent components, which permits a decomposition of the dynamics of a multivariate system into permanent and transitory components and allows for long-term comovement analysis between subsystems under a cointegration framework. For a system or subsystem of variables, its long-run behavior is governed by a relatively small set of common permanent components. These

permanent components represent the underlying forces driving long-term comovements among the variables. By obtaining common permanent components in different subsystems of variables, researchers can analyze whether there are long-term comovements within individual variable groups and whether the comovements of a specific group of variables can in turn be linked to those of others. In this study, the authors investigate the potential linkage between the common permanent components in four groups of variables, those of stock prices, the money supply, dividends, and industrial production of three EMS countries. Using monthly Morgan Stanley Capital International (MSCI) market indexes, covering the period from April 1979 through June 1992, and macroeconomic factor data Cheung and Lai provide empirical results that show that the stock markets in these countries display long-term comovements. The results also suggest the presence of two common permanent components driving the long-run dynamics of these stock markets. It is found that although part of the long-term comovements of stock prices can be attributed to those comovements of several macroeconomic variables (especially for the post-1987 period), the explanatory power of the latter is far from strong. Nonetheless, the results confirm at least a limited role of these macroeconomic variables in accounting for the relative stock market movements among the three EMS countries.

Wang, C. (1999) provides empirical evidence on the systematic biases in international equity market correlations based on different holding periods and

establishes an analytical framework to correct those biases. Wang et. al. shows that average 18-country correlations tend to increase with holding periods on the short end and decrease with holding periods over multiple years. Correlations are usually the highest for three-month holding periods and much lower for 1-day and 1-week holding periods on the short end and two- and three-year holding periods on the long end. Correlations of long holding periods are low due to the long-term mean-reversion of security prices. This term structure of correlations is observed in the 18 developed equity markets, the G4 and G7 equity markets, and the U.S. large cap and small cap indices.

Bala, L and Premaratne, G. (2003) ascertained the degree and nature of volatility comovement between Singapore's stock market with those of US, UK, Japan and Hong-Kong between 1992 and 2002 using time variant unconditional correlation coefficients. The outcome of the study was that all the displayed significant correlation coefficients showed that the effect of shocks took a longer time to dissipate. Besides that, the impact of bad news did tend to have a larger effect on Singapore stock market compared to couther markets. Singapore and Hong-Kong were shown to have stronger linkages. Also, Singapore market responded to shock from Hong-Kong constantly and the effect lasted for approximately 3 days. In contrast, the Singapore market's response to other markets was only for a day and became insignificant thereafter. Hong-Kong and the US market influenced the Singapore stock market very strongly and UK did not show any influence. Lastly it was shown that there were small but significant volatility

spillovers from Singapore to Hong-Kong, Japan and the US markets. These findings are significant as they differ from the usual belief that the spillover effects are significant from the dominant market to the smaller market.

Engsted, T. and Tanggaard, C. (2004) extend the study of Shiller (1993) and analyse the comovement of US and UK stock markets. The authors decompose stock return innovations in the two countries into various 'news' components (dividend news, real interest rate news, and stock return news), and then analyse how these components move together across countries. Using VAR methodology the study concludes that that news about future excess returns (risk-premia) is the main determinant of stock market volatility in both the USA and the UK, and that this news component is highly cross-country correlated which helps explain the high degree of comovement of US and UK stock markets. This indicates that equity risk premia in the two countries are hit by common real shocks. US and UK excess stock returns are highly positively correlated. Over the whole period 1918–99 the correlation is 0.542, and the correlation coefficient remains highly positive across various sub-periods (in the three sub-periods 1918–45, 1943–70, and 1973–99, the correlations are 0.604, 0.474, and 0.638, respectively). Thus, there is a high degree of comovement of the two national markets. The results of variance decomposition indicate that the USA and the UK news about future excess returns accounts for most of the variation in stock returns.

Connolly, R. and Wang, F. (1999) examines the cross-market equity return and volatility linkages for the U.S., U.K., and Japan. They investigate the extent to which these linkages can be explained by macroeconomic news announcements in the three countries, including money supply, industrial production, price inflation, unemployment rate, and trade deficit during the 1985-1996 period. Specifically, using daily data for the sample period January 1, 1985 through December 31, 1996 and generalized standard GARCH conditional volatility model the study models the impact of macroeconomic news announcements on daily close-to-open and open-to-close mean returns, volatility, and covariances among the U.S., Japan, and the U.K. The U.S. economic news variables include money supply, industrial production, consumer price inflation, wholesale price inflation, and the merchandise trade balance. For U.K. Macroeconomic news announcements for the U.K. are money supply, retail price inflation, industrial production, and the unemployment rate while for Japan the variables include monthly announced value of Japanese industrial production, money supply, consumer price inflation, and wholesale price inflation. The results show that each domestic market's open-to-close and close-to-open returns are significantly linked to the open-to-close returns of the two previous foreign markets, even after controlling for the effect of economic news announcements. Furthermore, the asymmetric return spillover patterns among the three national stock markets persist in the study. Specifically, in the open-to-close return series, the impact of the S&P500 on the Nikkei225 returns is five times the impact of the Nikkei225 on the S&P500. Likewise, the impact of the FTSE100 on the Nikkei225 is about three

times the impact of the Nikkei225 on the FTSE100. Finally, the impact of the FTSE100 on the S&P500 is ten times the size of the S&P500's effect on the FTSE100 index return. In addition, they find little evidence that economic news announcements in the three countries have systematic, independent effects on the return process in any of the three national stock markets. The results also indicate that some individual, and mostly domestic, economic news announcements significantly affect the size of return spillovers between markets. For example, U.S. money supply news announcements significantly increase the size of the return spillover from the Nikkei225 into S&P500, while significantly reduces the size of the return spillover from the FTSE100. Thus, they conclude that while economic news announcements by themselves do not directly affect the return process in each national stock market, they play an important role in explaining the variation in the return spillovers between markets.

Chiang, K. and Leonhard, C. (2002) use Volatility Decomposition Method [Campbell, Lettau, Malkiel, and Xu (2001)] to study the variance composition of 18 major national indices of developed markets of Asia, Europe, US, UK and Canada over the period 1974-2001. They find that over the sample period country-specific volatility has increased and, accordingly, the benefits of international diversification have remained substantial. They also find evidence in second moments of returns suggesting that international equity markets, as a whole, have not been more financially integrated over the sample. However, promoting economic integration is not without financial implications. By

focusing on 10 European Union country indices, the study concludes that the benefits of regional diversification within the EU have shrunk and the financial links among EU member states have been considerably strengthen over the sample period.

Hardouvelis, G., Malliaropulos, D. and Priestley, R. (2002) examine whether or not the convergence of European economies towards Economic and Monetary Union (EMU) and the launch of the single currency leads to an increase in stock market integration through a reduction in investment barriers. Besides they investigate whether or not the influence of country-specific risk factors on required returns has decreased in favor of EU-wide factors. The data set include weekly, Deutschemark-denominated, dividend adjusted and continuously compounded stock returns based on Friday closing prices on the eleven EU countries and excess currency returns calculated as the continuously compounded difference in the one-month Eurocurrency interest rates between a given country and Germany, adjusted for the rate of depreciation vis-à-vis the Deutschemark. The study using estimated Conditional Asset Pricing Model concludes that in the context of models of partial integration, the reduction in investment barriers leads to an increase in cross-border equity holdings, thus, decreasing home equity bias. The authors find that for a given country, stock market integration is expected to be higher, the higher the probability of the country joining EMU and the closer the calendar date to the time of launch of the single currency, as restrictions on holding foreign assets become less binding.

This in turn leads to an increase in cross-border equity holdings, increasing the relative weight of EU-wide risk in required returns. The authors discovered that in the 1990s the degree of integration of local markets with the EU market is negatively associated over time with the forward interest rate differential vis-à-vis Germany. When this interest rate differential shrinks in 1997 and 1998, the markets converge towards full integration, that is, expected returns are increasingly determined by EU-wide market risk and less by local risk.

Yang, J., Min, I. and Li, Q. (2003) examines the possible impact of the Economic and Monetary Union (EMU) on stock market linkages. Their study allows for inference on international market integration from three different perspectives: contemporaneous (based on return innovations), the short-run (using Generalized VAR and impulse response analysis) and the long-run (by comparing cointegration relations among the eleven European stock markets and the US in two different periods: before and after EMU) and further explores the possible different market behaviors between large and small stock markets. The data used in this study consist of the daily stock index closing price of ten EMU countries, the UK and US. Specifically, they include Germany, France, Italy, Netherlands, Austria, Belgium, Finland, Ireland, Portugal, Spain, the UK and the US. They conclude that most EMU stock markets are more integrated with large EMU countries after the EMU was implemented. The impulse response analysis further confirms that each of the large EMU stock markets (Germany, France, Italy and the Netherlands) became more integrated with

other large EMU markets in the short run after the EMU launched. For example, the German stock market explains the error variance of the French stock market much more significantly in post EMU period (6.1% in pre EMU period vs. 12.2% in post EMU period at day 20). On the other hand the three smallest EMU markets (Austria, Belgium and Ireland) became more isolated from other EMU markets after the EMU launched. In respect of such small markets the findings further suggests that after controlling for macroeconomic environments, only too small a market size may give rise to the concern of market liquidity and become an obstacle for active participation of international investors. By following Pesaran and Shin (1996) methodology of cointegrating vector analysis, the study concludes that European stock markets as a whole are more integrated in the long run in period after EMU as deviations from equilibrium are shorter lived. Interestingly, it is also found that the EMU markets seem to be less integrated with the UK after establishment of the EMU, which provides indirect positive evidence for significant impact of the EMU on European stock market integration.

Murinde, V. and Poshakwale, S. (2004) also find higher positive correlations among the stock markets in Hungary, Czech and Poland during the Euro period than is the case in the pre-Euro period. Similar results are obtained with respect to even the foreign exchange markets.

Brooks, R., Forbes, K. and Mody, A. (2003) in their study on G7 countries conclude that though evidence for "globalization" in the form of more trade and capital flows across borders is clear, the evidence on comovements of markets is more mixed. Financial comovements clearly increased during the 1990s as capital flows increased. But there is some question whether the high level of comovements was due to real underlying changes or the manifestation of a "bubble."

Bessler, D. and Yang, J. (2003) investigated the dynamic structure of nine major stock markets using an error correction model and directed acyclic graphs (DAG). The DAG representation provides a structure of causality among these markets in contemporaneous time. The data set includes daily stock index closing prices of the world's nine major stock markets that include indices on markets in Australia, Japan, Hong Kong, United Kingdom, Germany, France, Switzerland, United States, and Canada. They find that stock index prices from nine countries (with exchange rate adjustments to U.S. dollars) are cointegrated with one cointegrating vector. Further, they show that it is only the U.S. and Canadian markets that respond to perturbations in this long-run relation. The dynamic structure shows that the Japanese market is the most highly exogenous in the sense that price information from other major stock markets explains a modest proportion of the stock price movement in this country. Also, innovations from the Japanese market explain relatively little of the stock price movement in other markets. Markets in Canada and France are among the least

exogenous of nine markets in the sense that information from other national stock markets is most prevalent in explaining the stock price movement in these countries compared to other countries under study. Innovation accounting results in their study show that, though the U.S. market is highly influenced by its own historical innovations, it is also influenced by market innovations from the U.K., Switzerland, Hong Kong, France, and Germany. More importantly, it is found that the U.S. market is probably the only market that has a consistently strong impact on price movements in other major stock markets in the longer-run (30 days). Finally, the study shows that international stock markets are neither fully integrated nor completely segmented, which immediately suggests the potential for international diversification.

Walti, S. (2004) use monthly data on MSCI stock market indices to study the macroeconomic variables underlying comovements between stock market returns for fifteen industrialized countries over the period 1973 to 1997. Synchronization is measured by a correlation coefficient, possibly adjusted for changes in volatility following Forbes and Rigobon (2002). Explanatory variables include the intensity of trade relations, the degree of financial integration, and the nature of the exchange rate regime. The study concludes that trade and financial integration contribute positively to synchronization, while a fixed exchange rate regime increases comovements, in particular when the institutional mechanism underlying the regime is mutual. Other factors such as

the similarity of economic structure across countries, informational asymmetries and a common language also contribute to stock market synchronization.

Westermann, F. (2004) using VAR and Johansen's Cointegration and Granger Causality methodology, studied the interaction between stock markets in the U.S., the U.K. and Switzerland. Westermann et. al. did not find evidence of any common permanent stochastic shocks that drive the long-run fluctuations of stock market price indices in these countries. The author however found that in the short run, the U.K. and Switzerland are Granger-caused by the U.S. S&P500 index. The forecast error variance analysis, on the other hand, indicate that the effects of the S&P500 index tend to be short-lived and the U.K. and Swiss price indexes uncertainty is largely attributable to shocks to their own stock market.

Beine, M., Capelle-Blancard, G. and Raymond, H. (2005) test for linear and nonlinear Granger causality between the French, German, Japanese, UK and US daily stock index returns from 1973 to 2003. The authors find that lagged dependence from the US market towards the other four markets is always significant, whereas the reverse is not always true. The results indicate of a potential leadership of the US market. The study concludes that Japanese stock market displays a relatively low linear dependence with the other four markets. On the reverse, linear dependence is high between the three European countries (France, Germany and UK) on the period 1987-2003, higher than between each of these countries and the United States. The interdependence between European

stock markets is found to be increased after 1987. The results of the nonlinear dependence test, document evidence of a bi-directional nonlinear dependence between the five stock returns, after 1987.

Kim, S. (2005) examined the nature of stock market linkages in the advanced Asia-Pacific stock markets of Autralia, Japan, Hong-Kong and Singapore with the US stock markets and the information leadership of the US and Japan in the region. Using Granger Causality test, it was examined whether US and Japanese market returns and trading volume Granger caused the market returns of the other markets and also whether the US and Japan volatilities and trading volume Granger caused volatilities in other markets. It is found that the correlation of daily market returns was significantly higher in the post crisis period, implying that the market linkages appeared to be enhanced after the crisis period. The US returns Granger caused returns of each of the stock markets in the region in both pre- and post-crisis period. The Japanese returns, on the other hand, appeared to have less significant effect on certain stock markets. Volatility of US market Granger caused volatilities in all the stock markets under investigation for both periods, with the exception of Hong-Kong in the post-crisis. As for Japan, its volatility did not exert a high amount of influence in most of the markets.

2.1.2 Dynamic Comovement among Emerging Country Stock Markets

Emerging markets are being considered as segmented markets for a long time now and thus have gained substantial importance in global portfolios. In fact, in several developed countries fund managers have evolved specific country funds (focusing on emerging market economies) and special emerging markets funds. Evaluation of success of such strategies however demand testing of collinearity of emerging market returns with developed or other high risk emerging markets. In case such collinearity exists then emerging markets would no longer satisfy the normal mean variance asset selection criterion and therefore there is no much benefit of diversification that can be derived by investing in such markets. Apart from determining segmentation or integration characteristics of emerging markets, the empirical research has also attempted to find answer to three important questions with regard to segmentation and integration conflict: Firstly, what factors would move emerging markets from state of segmentation to state of integration? Secondly, is integration an immediate or a gradual process? Thirdly, does the process of integration affect expected returns in emerging markets?

Janakiraman, S. and Lamba, A. (1998) explore the linkages between stock markets in the Pacific-Basin region with that of the US using Vector Autoregression (VAR) methodology. Evidence that the US market influences the stock markets in all Pacific-Basin countries under investigation, except Indonesia, was clearly shown. None of the markets in the region were found to

have influence on over the US market. An important finding of the study was that the stock markets located in close proximity and those which were economically related tend to influence one another to a greater extent. It was further supported by the fact that markets closing later in the day were influence by the markets closing earlier on the very same day.

Cha, B. and Cheung, Y. (1998) empirically investigate the impact of the U.S. and the Japanese markets on the Asian emerging markets (Hong Kong, Korea, Singapore, and Taiwan) by using a tri-variate vector autoregression (VAR) model. The authors justify VAR model since it avoids the problems inherent in the single-equation method while it provides the best econometric evidence to examine the relative importance of the two major markets on the emerging markets. The study uses weekly indices for the above markets and selecting Wednesday closing prices for the period from March, 1975 to September, 1992. The whole sample period is further divided into three subperiods: March 15, 1975–December 29, 1979 (Period I), January 5, 1980–October 10, 1987 (Period II), and October 31, 1987–September 5, 1992 (Period III) to examine the stability of the result. It is found that the four Asian emerging markets react differently to the price movements in the U.S. and the Japanese markets and that the U.S. plays an important role in leading other equity markets. While most of forecast error variance of the return rates in these markets is explained by domestic own innovations, U.S. and Japanese innovations have more explanatory power in Hong Kong and Singapore than in Korea and Taiwan. This foreign effect is

pronounced after the Crash of the October 1987, especially in Singapore. The results show that the U.S. market affects the Hong Kong and the Singapore markets, but not the Korean and the Taiwanese markets while the Japanese market has little impact except on the Korean market. Second, the Asian markets appear to be efficient in that foreign and domestic shocks are absorbed quickly, in most cases within 3 weeks. They also observe that the U.S. market's influence on Hong Kong increased substantially in Period III on account of the linked exchange rate system between the U.S. dollar and the Hong Kong dollar set up in 1983.

Dekker, A., Sen, K. and Young, M. (1998) employing generalized VAR approach in examining the linkages between countries in Asia-Pacific region gave evidence of strong linkages among these markets and also found that US market exerts a great deal of influence on these countries. Besides they conclude that the markets with strong economic ties and close geographic proximity are more closely linked than isolated markets.

Wolf, H. (1996) enquire whether countries with similar characteristics in terms of macroeconomic performance, development stage, and risk factors exhibit above-average correlations, and, conversely, whether country pairs with, above-average correlations exhibit greater similarities along these dimensions. The findings of the study based on the U.S. dollar-denominated total return series on individual stocks from 24 countries and 21 sectors may be summarized as

follows: First, Wolf finds that differences in sectoral composition have reduced the extent of stock market comovements. Controlling for sectoral composition, it is found that the conditional correlation of country returns exceeds substantially the unconditional correlation of market indices. The increase is quite widespread. Of the 105 country pairs examined, for 88 the correlation of conditional country returns exceeds the correlation of market index returns. This finding suggests that a good part of the benefits from international diversification documented in the literature might reflect gains from sectoral and idiosyncratic diversification rather than from "market" diversification. However, while exceeding the correlation of index returns, the average correlation of country returns remains small at 0.22; further more, substantial cross-section variability in the correlations are observed. Holger next examined whether observed differences in correlations can be linked to differences in "fundamentals." Whereas they find weak support for an above-average comovement of countries with the best macroeconomic performance, overall the explanatory power of fundamentals - which are measured quite roughly and at low frequency - for the correlation pattern is less than convincing. Besides Holger finds that differences in correlations are significantly influenced by the degree of development of emerging stock markets and by their location, a finding consistent with, though not proof of, moderate contagion.

Phylaktis, K. and Ravazzolo, F. (1998) investigate the linkages and dynamic interactions amongst a group of Pacific-Basin stock markets and the

industrialized countries of US and Japan. The authors mainly examine the impact of foreign exchange restrictions on financial linkages between markets. Besides they evaluate whether alternative financial vehicles such as Country Funds, provide channel through which international investors access capital markets. Using multivariate cointegration technique, the authors conclude that international investors have opportunity for portfolio diversification by investing in Pacific Basin countries. The authors find that Pacific Basin countries were not linked together in 1980s or 1990s indicating that relaxation of foreign exchange restrictions is not sufficient to attract international investors' attention and strengthen international market interrelations. The authors however, did find evidence that for Taiwan and Thailand markets, the first forms of linkages correspond to the period of introduction of country funds. Further, they find that neither Japan nor US has unique influence in the Pacific Rim.

Darrat, A., Elkhal, K. and Hakim, S. (2000) assesses market linkages in the case of three emerging markets in the Middle East; namely, Cairo (Egypt), Casablanca (Morocco), and Amman (Jordan). They employ monthly time series of the three Middle Eastern stock markets and the US. The time period covers 35 months from October 1996 through August 1999, the largest possible data set. Results from the Johansen-Juselius test suggest that the Middle East emerging stock markets are segmented globally, but appear highly integrated within the region. Moreover, the Gonzalo- Granger test, in conjunction with error-correction models, indicates that the market in Egypt is a dominant force driving

other markets in the region. The apparent segmentation of the markets in the Middle East from the global market implies that these emerging markets provide international investors with potential diversification gains.

Morck, R., Yeung, B. and Yu, W. (2000) present empirical evidence that stock returns are more synchronous in emerging economies than in developed economies. They show that this result is not an artifact of structural characteristics of economies, such as market size, fundamentals volatility, country size, economy diversification, or the co-movement of firm-level fundamentals. Though some of these factors contribute to stock return synchronicity, a large residual effect remains, and this effect is correlated with measures of institutional development. They also show that, in developed economies, providing public shareholders with stronger legal protection against corporate insiders is associated with lower synchronicity. Overall, the results suggest that stock markets in emerging economies may be less useful as processors of economic information than stock markets in advanced economies.

Oxelheim, L. (2000) presents a regional study of routes to equity market integration. The focus is on the Nordic region - Denmark, Finland, Norway and Sweden. The study is an analysis of market segmentation in terms of existing regulatory and informational wedges, based on conditions in the Nordic welfare states. It is found that no barriers remain to crossborder equity market transactions, nor consequently to the perfect global integration of Nordic equity

markets in a capital-flow perspective. However, certain residual crossborder tax wedges do challenge the view of perfect equity market integration. The authors find that the Nordic markets as a whole are not perfectly integrated, but a segment of the market consisting of large companies exposed to detailed scrutiny on the global market, comes very close to it. Further, continuing cross-border information gaps for small and medium-sized companies indicate the presence of a two-tier equity market integration.

Leong, S. and Felmingham, B. (2003) studied share price indices of the East Asian region, namely, Japan's Nikkei, Singapore Straits Times, Korea composite, Hang Seng and the Taiwan weighed. The evidence from this study sums to the following: the correlation of these five indices strengthens following the Asian crisis beginning in June 1997. The authors apply bivariate cointegration technique to study the market linkages. In ten of the twenty potential pairings of East Asian indices, they find some evidence of bivariate cointegration. Both long and short run causal links between the five markets are evident and in those cases where cointegration is not evident, there is still some evidence of short run Granger causality.

Tan, K. and Tse, Y. (2001) employed VAR and Gewek's (1992) measure in analyzing East and South East Asian equity markets from 1988 to 2000 and conclude that national markets have become more interdependent. The authors give evidence of significant market responses across all markets, most of which

are completed in 24 hours. Stronger comovement of the markets with respect to Japan was also noticed.

Kaminsky, G. and Schmukler, S. (2001) propose a new approach to examine the dynamics of international integration of financial markets and to evaluate whether controls on capital flows persistently isolate domestic markets from international markets or whether the insulation they provide is just ephemeral. They examine the evidence using data from six emerging economies (Brazil, Chile, Colombia, Venezuela, Malaysia, Thailand) during the 1990s. The results can be summarized as follows: First, as to the central issue of short- and long-run integration of these economies with world-financial markets, markets seem to be more linked at longer horizons. Moreover, The results suggest equity prices to be more internationally connected than interest rates. Second, with regard to the claim that capital controls insulate domestic markets from global spillovers, they find little evidence that controls effectively segment domestic from international markets. When they do, the effects seem to be short lived. Third, with regard to the insulation they provide, controls on outflows do not seem to differ from controls on inflows. For example, controls on outflows in Venezuela during the 1994 crisis and the unremunerated reserve requirements in Chile and Colombia during the capital inflow episode seem to have shielded domestic markets at the most at very high frequencies. Fourth, interestingly, the degree of overall financial sophistication does not seem to affect the conclusions on the insulation provided by capital controls. It is true that more developed financial markets,

such as those in Brazil, are more closely linked to international markets than those in Colombia and Venezuela, which are far more illiquid. But capital controls do not seem to provide an extra cushion against international spillovers even in these latter cases.

Flavin, T., Hurley, M. and Rousseau, M. (2001) study 27 countries from Europe and Asia and US, Japan and UK to examine the question of whether geography also matters for asset markets. They use Gravity Model Approach which are predominantly empirical models that seek to explain the connection between markets. The basic idea behind the method is that geography matters. Geographical variables have long been known to explain linkages between goods markets. The analysis shows that this result is also applicable to financial asset markets. Gravity models can explain cross-country equity return correlation. They find that measures of stock market proximity as well as sharing a common border are important explanatory variables for stock market correlation. These geographical measures may be acting as a proxy for informational asymmetries across the investment community. They also find that more conventional financial variables such as market size and risk (level of concentration) influence cross-country correlation. In particular, larger markets tend to be more correlated. Further the industrial composition of markets also helps to explain stock market correlation.

Neaime, S. (2002) studied the properties and characteristics of the MENA (Middle East and North Africa) stock markets using weekly closing price series from 1990 to 2000 for the MENA stock markets of Bahrain, Kuwait, Saudi Arabia, Jordan, Egypt, Morocco, and Turkey and the prospects and implications of enhanced financial liberalization in the region. He also explored whether these markets can offer international investors unique risk and returns characteristics to diversify international and regional portfolios. The paper divides the MENA stock markets into two groups. The first consists of the GCC member countries: Bahrain, Kuwait and Saudi Arabia, while the second includes: Egypt, Jordan, Morocco, and Turkey. For the World main financial markets the study uses the US, the UK and the French stock markets. Johansen cointegration tests reveal that the GCC equity markets still offer international investors portfolio diversification potentials while other emerging MENA stock markets like those of Turkey, Egypt, Morocco and to a lesser extent Jordan have matured and are now integrated with the world financial markets. Granger causality tests and impulse response functions show that shocks to the US and UK stock markets are transmitted to the MENA region but not to the GCC stock markets. Shocks to the French market insignificantly affect the MENA stock markets.

Piesse, J. and Hearn, B. (2002) examined volatility transmission across the returns structure of stock market indices from eleven national equity markets that collectively dominate the Latin American and the Caribbean regions, plus

New York and Toronto, two highly developed markets in the region that can be expected to exert considerable global influence. The method used is a univariate exponential generalised autoregressive conditionally heteroskedastic (EGARCH) model, suggested by Nelson (1991). The authors opine that EGARCH models are appropriate for the analysis of Latin American market index series, as they have been found to model asymmetric impacts of good news (market advances) and bad news (market retreats) on volatility transmission with high levels of accuracy. The data consists of the most commonly used and representative indices of closing stock market prices for all markets in the sample, obtained from Datastream and the individual national Stock Exchanges. All data was weekly, and was converted to natural logarithms. Thirteen countries were included in this study, with the analysis split into two samples. In the first sample, long-term transmission effects are examined. The second includes a wider group of countries to consider specifically the periods of global financial crisis in 1997 and 1998. The results show that four countries act as hubs of activity; Peru, Mexico, Argentina and Jamaica, with each acting as a focus of activity for their neighbours. The positive aspect of these patterns of volatility transmission is the impact on liquidity and market activity for the nascent markets of the region. However, they concluded that the negative impact was the increased likelihood of the spread of financial crises where markets are integrated.

The findings of **Barari, M. (2003)** based on monthly returns of equity markets of Latin America for the period 1988 to 2001 suggest a trend toward increased regional integration till the mid 1990s. However a distinct change in trend is noted during the second half of 1990s with global integration proceeding faster than regional integration.

Lin, J. and Wu, C. (2006) analyze the China stock markets and examine their price and volatility linkages with those of Hong Kong, Taiwan and United States. In particular, the authors analyze the direction of information flow among A-share and B-share stocks of Shanghai and Shenzhen Stock Exchanges as well as Hong Kong H-share and Red-Chip markets. Two methods are employed in the study. The first approach employs direct graph theory to determine the contemporaneous causal order of the residual vectors obtained from restricted VAR model and then use the Bernanke-Sims decomposition to compute the impulse response. The second approach involves estimating the multivariate GARCH models of several market returns to investigate the directions of spillover in mean level as well as in volatility level. Using the data from January 5, 2000 to May 30, 2003, the authors conclude that Chinese stock markets have a weak linkage with Hong Kong, Taiwan and US markets. As for the four domestic markets, spillover in mean returns goes unidirectionally from A-share market to B-share market but spillover in volatility is bi-directional. Further, Shanghai stock market seems to play a dominating role over Shenzhen stock market.

Forbes, K. and Chinn, M. (2003) test if real and financial linkages between countries can explain why movements in the world's largest markets often have such large effects on other financial markets, and how these cross-market linkages have changed over time. More specifically, the study attempts to answer four questions. First, how important are cross-country linkages with large financial markets, as compared to global and sectoral factors, in explaining financial market returns in countries around the world? Second, how important are bilateral trade flows, trade competition in third markets, bank lending, and investment exposure in explaining these cross-country linkages? Third, how has the relative importance of these various global linkages changed over time? Finally, how does the relative importance of these global linkages differ across stock markets and bond markets? The study estimates a factor model in which a country's market returns are determined by: global, sectoral, and cross-country factors (returns in large financial markets), and country-specific effects. Then it uses a new data set on bilateral linkages between the world's 5 largest economies and about 40 other markets to decompose the cross-country factor loadings into: direct trade flows, competition in third markets, bank lending, and foreign direct investment. Estimates suggest that both cross-country and sectoral factors are important determinants of stock and bond returns, and that the U.S. factor has recently gained importance, while the Japanese and U.K. factors have lost importance. From 1996-2000, real and financial linkages became more important determinants of how shocks are transmitted from large economies to other markets. They conclude that in particular, bilateral trade flows are large and

significant determinants of cross-country linkages in both stock and bond markets. Bilateral foreign investment is usually insignificant. Therefore, despite the recent growth in global financial flows, direct trade still appears to be the most important determinant of how movements in the world's largest markets affect financial markets around the globe.

Darrat, A. and Benkato, O. (2003) empirically examined return and volatility relations between the Istanbul Stock Exchange (ISE) (the largest and most liquid in the MENA region) and the four matured stock markets of the US, the UK, Japan and Germany. Using monthly data spanning the period January 1986-March 2000, they obtain results for first-moment (market return) interdependence from the Johansen-Juselius test of multivariate cointegration and further then examine second-moment (return volatility) interdependence using GARCH processes that allow for the common time-varying behavior of return variances. Throughout the analysis, the authors focus on the possible impact of capital market liberalization in Turkey that began in late 1989, and also examine changes in the ISE behavior in the aftermath of the East Asian and Russian financial crises in mid-1997 and mid-1998. Several conclusions emerge from their empirical analysis. First, there exists a significant cointegrating relation binding the ISE with the four matured markets. Thus, although stock prices in the ISE may temporarily drift away from those in matured markets in the short-run, strong equilibrating forces would prevent such a divergence to take place over the long-term. Second, they also find strong evidence that the

Turkish market has become significantly integrated with the global market particularly in the post-liberalization period. Therefore, the lifting of capital controls in Turkey seems to have provided an important propagation mechanism for a more visible and robust linkage of the ISE to matured markets.

Narayan, P., Smyth, R. and Nandha, M. (2004) examine the dynamic linkages between the stock markets of Bangladesh, India, Pakistan and Sri Lanka using daily stock price indices over the period 1995-2001 and employing a temporal Granger causality approach by binding the relationship among the stock price indices within a multivariate cointegration framework. The major finding of the study is that there is a long-run relationship between the stock prices of the four countries when stock prices in Pakistan is the dependent variable. The second main finding is that in the long run, stock prices in Bangladesh, India and Sri Lanka Granger-cause stock prices in Pakistan, meaning that Pakistan bears the burden of adjustment in the long-run equilibrium relationship. In the short run there is unidirectional Granger causality from stock prices in Pakistan to India, stock prices in Sri Lanka to India and from stock prices in Pakistan to Sri Lanka. Also from the Granger causality analysis the authors conclude that Bangladesh is the most exogenous of the four South Asian markets. They further find that the Indian market is more exogenous than either the Pakistani or Sri Lankan markets.

Brooks, R. and Negro, M. (2005) explore the link between international stock market comovement and the degree to which firms operate globally and further investigate whether the importance of this link has changed over the chosen sample period. Using stock returns and balance sheet data for companies in 20 countries, the authors estimate a factor model that decomposes stock returns into global, country-specific and industry-specific shocks. The results suggest that global shocks are a more important source of return variation for stocks whose underlying company is globally diversified, according to various measures of firm-level globalization and also that country-specific shocks are less important for such stocks. Further they conclude that the positive link between firms' exposure to the global stock market factor and the international component of their sales has more than doubled in magnitude from the late 1980s to the late 1990s. Over the same period, the link between firms' stock market country betas and their international sales ratio has gone from positive to negative. These changes are driven by a large rise in the importance of the global factor and a decline in the importance of country-specific shocks. Investigations on the driving forces behind these changes, suggest that the declining importance of country factors is more pronounced for countries in which companies are highly international, according to their international sales. Further it is observed that the decline is more pronounced for more financially open countries and countries with fewer capital account restrictions.

Bhamra, H. (2005) study the effect of stock market liberalization on stock market return volatilities and comovement in international stock returns. In a two-country, continuous-time model, the author solves for equilibrium in closed-form in two versions of an economy, which differ in their levels of cross-border risk sharing. In the first version there is no international stock market investment, but cross- border lending/borrowing at the riskless rate is unrestricted. In the second version, the stock market of only one country is open to foreign investment. He further compared equilibrium prices across the two versions of the economy and found that there is a decrease in the equity risk premium and stock-return volatility in the liberalized country. The degree of comovement in international stock market returns increases if the liberalizing country has a smaller economy, but decreases otherwise. The volatility of stock returns increases in the country that does not liberalize its stock market. To explain these results an international CAPM is derived, which shows that discount rates in different countries change as the level of cross-border risk sharing changes.

Chollete, L., Pe˜na, V. and Lu, C. (2005), assess the dependence structure of international financial markets and investigate whether developed and emerging markets move together more in downturns than in upturns? The authors use market returns for three sets of countries, namely, the G5 countries, Asian economies, and Latin American economies. The G5 countries are France, Germany, Japan, the United Kingdom and the United States. These were chosen

to represent developed markets. The Asian countries are Hong Kong, Korea, Singapore and Taiwan. The Latin American countries are Argentina, Brazil, Chile and Mexico. The returns are calculated from their respective MSCI price indices nominated in U.S. dollars. The data consists of 3239 daily observations from 1/2/90 to 5/31/02, or 646 weekly observations, from 1/10/90 to 5/29/02. The study employs copula estimation in three stages, using individual elliptical and Archimedean copulas, then a mixture normal-gumbel copula, and finally the most comprehensive mixture, t-gumbel copula. They find that the largest dependence is between France and Germany, and the lowest dependence is between Japan and the US. The high dependence between France and Germany might stem from the establishment of the Euro currency. The low dependence between Japan and the US may reflect the fact that the long Japanese recession in the 1990s separated Japan from the rest of the world. The results for the Asian economies show that the largest dependence occurs for the Hong Kong-Singapore pair, with a correlation of 0.555. The smallest dependence is for the Taiwan-US pair, with a correlation of 0.178. The results for the Latin American countries indicate the largest and smallest dependence are for the Mexico-US and Chile-US pairs, with correlations of 0.473 and 0.277 respectively. For the Latin American and Asian countries, the authors also find evidence of asymmetric dependence, although to a lesser extent than for G5 countries.

Voronkova, S. and Lucey, B. (2005) examined the linkages between the Russian stock market and those of its largest neighbors in Central and Eastern Europe,

and the world stock markets over the 10 year period 1995-2004. Using traditional Johansen multivariate cointegration approaches and examining Impulse Response Functions from Vector-Error Correction Models they find that the extent of the relationship differs markedly before and after the Russian crisis of 1998. They find a very little evidence of influence from (or to) regional markets such as Poland or Hungary. With further examination, using the Gregory-Hansen approach, their results indicate that the effect of the Russian crisis is more complex, and that Russian market shows significantly more evidence of integration with developed markets. The USA remains the dominant market from which shocks impact on the Russian market. A DCC-GARCH model indicates that the conditional relationships between the Russian market and the main developed markets are shifting.

Krishnasamy, G., Santhapparaj, S. and Malarvizhi, C. (2006) investigate long run and short run relationship among selected Asian stock index futures markets, namely, Malaysia, Singapore, Taiwan and Hong-Kong. Johansen's cointegration is used to examine the long-run equilibrium among selected futures indices. The study found existence of a long-run equilibrium relationship among the four indices in futures markets. Hence, the potential for risk reduction from diversification across these markets is minimal for investors with long holding period. However, the study did show that when there is disequilibrium in the short run, the stock index futures series exhibit slow convergence towards long-run equilibrium indicating avenue for short term

diversification benefits across all the markets under investigation. The Taiwan stock index futures market was found to be playing leading role in the market prominently because of its long trading hours enabling it to impound more information in other markets; and also because of its high liquidity characteristic. As **Masih and Masih (1999)** postulate that greater the liquidity of a particular stock market (in terms of trading volume transacted), the more leading a market is expected to be in the information context.

2.1.3 Major Conclusions from Studies on Stock Market Integration Dynamics

The linkage dynamics of stock markets thus has been one of the most important topics of research. While some studies have concentrated on only finding out the existence or otherwise of comovements between markets, some others have also studied reasons for such comovements. Studies also vary according to the techniques and tools used, the markets studied (scattered or regional) as well as period of study (normal, dynamic or crisis). Major conclusions from these studies are as under:

i) Emerging markets - Segmented or Integrated

So far as segmentation and integration characteristics of emerging markets are concerned, the empirical findings are at best mixed. The findings differ not only for different markets but also for the set of same markets within a region. Early research in the context of emerging markets concludes that

emerging markets are segmented and that emerging market returns are more influenced by local rather than global information variables. The emerging markets are found to have lower correlations than developed markets. Correlations are generally lower during periods of capital market segmentation than during integration. The empirical work has even shown that recent globalisation also has not reduced the diversification benefits and maximum global diversification including emerging markets offers 65 per cent risk reduction.

However, another subset of empirical work supports the integrated market hypothesis for emerging markets, with reasons that can hardly be ignored. The stock markets of regions such as Middle East also have been proved as matured markets and are found to be integrated with the world financial markets. The returns of these markets are found to be significantly influenced by shocks originating in developed markets of US and UK. Studies also conclude that stock returns are more synchronous in emerging economies than in developed economies. The equity prices in emerging markets of Brazil, Chile, Columbia, Venezuela, Malaysia and Thailand are found to be more internationally connected than even interest rates. In fact capital controls also have failed to effectively insulate and segment domestic markets from international markets. When they do, their effects seem to be short lived. Richard Levich (2001) also argues that absence of substantial capital flows (either gross or net) between markets because of capital controls need not imply markets segmentation because investors could be setting prices to eliminate expected

value gains and using synthetic instruments to mimic the returns of oversees assets. The liberalisation process has certainly increased the intensity of integration in emerging markets as it is clearly evident from reduction in the cost of capital to firms raising funds in these markets after the implementation of liberalisation policies [Richard Levich (2001)]. Liberalisation and such policies have tendency of creating a common binding relationship factor among countries participating in economic exchange process. And this binding factor acts as a bridge for transfer of risk factors from one market to other markets thereby moving the otherwise segmented markets to integrated category. This is especially found true if liberalizing country has a smaller economy.

The interaction between emerging markets and developed markets has also increased through the decades of new economic policies in emerging markets. The effect of this interaction is now visible in financial markets. Several researches in this context [for instance, Voronkova and Lucey(2005), Simon Neaime (2002), Tan and Tse (2001), Su Chan Leong and Bruce Felmingham (2003), Baekin Cha, Yan-Heung Cheung (1998), Dekker, Sen and Young (1998)] have shown that emerging market indices do factor in the innovations from developed markets such as US and Japan. At the same time some other studies (eg. Heng Chen, Bento Lobo and Wing-Keung Wong [2006]) report that US markets do not Granger-Cause or lead some of the emerging markets with respect to return.

The studies also provide evidence of increasing regionalism that can be observed with respect to stock market integration. The benfits of regional

diversification within the European Union region have shrunk and the financial links among EU member states have been considerably strengthened. Likewise, economic integration is providing a channel for financial integration for Pacific-Basin countries. The Middle East emerging stock markets have been found to be segmented globally, but highly integrated within the region.

Thus, it has been observed that while some emerging markets are segmented, others are already integrated either with the developed markets or other emerging markets. However, at the same time a great deal of confusion still exists since the same markets have been found to be either segmented or integrated at different times.

ii) Causes of Dynamic Linkages Between Emerging Market Indices and Returns

Research in emerging markets has revealed number of causes behind dynamic linkages between emerging markets. Strong economic ties, close geographic proximity, emerging markets, country size, economy diversification or co-movement of firm level fundamentals and even sharing of common language across countries have been found to contribute to observed synchronicity in emerging markets return. The level of development in countries has been another reason for inter-market linkages. The reason for this could be that market microstructures in such countries allow for easy transmission of information across the borders and thus the shocks from one market to another. The increasing trade openness in emerging market economies is further

enhancing these linkages. Chui, Hall and Taylor (2002) suggest that the strength of such trade and financial channels between emerging market economies (EMEs) has changed over time and importance of EME trade linkages has probably increased through time as trade openness has risen. In fact bilateral trade more than bilateral foreign investment is found to be the most important determinant of linkages between emerging stock markets in recent times; the phenomenon observed for linkages in developed markets.

Crisis in emerging market economies also lead to creation of binding stochastic components for emerging markets. During the period of financial market instability, market participants tend to move together across a range of countries. Shocks originating from one market readily get transmitted to other markets.

Thus, several concrete reasons have been examined and proved by the researchers as those explaining the linkage dynamics of emerging market returns. In the coming times, these reasons are going to further become more stronger and only increase in number as the world becomes truly a global village. This, however, would reduce the options available to an international fund manager for portfolio risk diversification, thereby putting pressure on his skills for active fund management.

2.2 Relationship Between Macroeconomic Factors and Stock Prices

One of the most fundamental tenets of financial theory is that the value of common stocks is equal to the present value of expected future dividends. Since

a firm pays out dividends from earnings, which depend on real economic activity, stock prices should reflect current and expected future real economic activities. Since macroeconomic theory posits a significant relationship between macroeconomic policies - both monetary and fiscal - and expected future economic activity, there should exist a strong intertemporal relationship between aggregate stock prices and macroeconomic policies.

A very simple dividend-discount stock valuation model which assumes the constant growth of dividends perpetually can further explain this relationship. The model may be represented by:

P = D1 / (k-g), where P = stock price, D1 = dividends after first period, k = required rate of return and g = dividend growth rate. Economic forces affect discount rates and the ability of firms to generate cash flows and hence yield future dividends. It is through this mechanism that economic forces become risk factors in equity markets. Much of the previous work to determine which economic factors are significant has been done within the APT framework. The APT approach essentially seeks to measure the risk premia attached to various risk-factors to see if they are significant or if the factors are 'priced' into stock market returns. **Chen, Roll and Ross (1986)** provided the basis for the belief that a long-term relationship equilibrium exists between stock prices and macroeconomic variables. **Granger (1986)** proposed that this can be verified through cointegration analysis.

Within the settings of efficient market hypothesis, it can be said that if the stock market is informationally efficient with respect to macroeconomic factors,

then stock prices should quickly incorporate any changes in these factors once their information becomes publicly available. Past information on these variables is of no use in explaining current fluctuations in stock prices in an efficient market since this information is already included in past prices. On the other hand, in an informationally inefficient market with respect to macroeconomic variables, past information on these variables is useful in explaining current movements in stock prices since there exists a lag in the adjustment of stock prices to new information.

Researchers have attempted to examine the issue of stock market efficiency with respect to macroeconomic variables in several different ways and the literature exists largely for developed stock markets although in recent times, there is growing amount of work seen even in emerging markets.

2.2.1 Studies in Developed Markets

Kraft, J. and Kraft, A. (1977) tested for causal relationship between money supply (M1), the rate of change in the money supply (M1%), risk free rate (long term rate of US Government), the corporate interest rate (Moody's AAA Corporate Bond Rate) and stock prices (S&P 500) for US monthly data from 1955 through 1974. Using regression analysis they reported that the future values of the stock price measure are not significant in explaining selected macroeconomic variables and reverse was also found to be true.

Umstead, D. (1977) presents extensive statistical investigation of aggregate quarterly stock prices (S & P 500) and their relationship to a leading indicator of business activity (The Leading Composite Index of NBER). The study covers the period 1948-1974. Using Box-Jenkins methodology for building stock price forecasting model, the author concludes that stock prices are determined by expectations, which unfortunately are not measurable. He found that business cycle related information unfolds gradually in cyclical pattern over time. Thus stock prices appear to be systematically overvalued during economic expansions and undervalued during contractions.

Chen, Roll and Ross (1986) illustrated that economic forces influence discount rates, the ability of firms to generate cash flows, and future dividend payouts. Employing a set of macroeconomic variables comprising of term structure, industrial production, risk premium, inflation, market return, consumption and oil prices, Chen et al (1986) found strong relationship between the macroeconomic variables and the expected stock returns. **Flannery and Protopapadakis (2002)** also conclude that macroeconomic variables are excellent candidates for determining returns because changes in these measures will affect firm's cash flows and influence the risk-adjusted discount rate.

Prasad, A. and Rajan, M. (1995) examined the impact of exchange rate fluctuations and interest rate risk on equity valuation in Germany, Japan, the UK and the US. Their estimates indicate significant cross-sectional variations in the

currency exposure of US industries and interest rate exposure of Japanese industries. Exchange risk was found to be priced in the US for the overall period of analysis and in the Japanese and the UK markets for the second subperiod. Interest rate was found not priced in any of the markets during the overall sample period of January 1981-December 1989.

Booth, J. and Booth, L. (1997) examined the impact of the stance of monetary policy on security returns in US over the period August 1954 through December 1992. They conclude that the two measures of the stance of monetary policy used, the federal funds rate and an index based on the change in the discount rate, contain significant information that can be used to forecast expected stock and bond portfolio returns. Further examining a portfolio of small stocks and a portfolio of large stocks to determine whether the findings related to either the business conditions or monetary stringency have a differential impact given firm size they find that a restrictive (expansive) monetary policy stance decreases (increases) returns of large and small stock portfolios and, in some cases, corporate bond portfolios. The monetary policy stance measures have explanatory power in forecasting stock and bond returns, beyond the business conditions proxies.

Cheung and Ng (1998), using data for Canada, Germany, Italy, Japan and the US, investigated the relationship between national stock market indices and country-specific aggregate economic variables. They concluded that changes in

stock market indices were typically cointegrated with a country's aggregate real economic activity such as its oil price, consumption, money stock and output.

Some other studies in developed markets include that of **Darrat (1990)**, who employing multivariate Granger causality tests on Canadian data, found that fiscal policy moves exerted a significant lagged effect on the stock market. **Clare and Thomas (1994)** conclude that oil prices, default risk, and the retail price index are significant determinant of stock prices in UK.

2.2.2 Studies in Emerging Markets

Emerging markets have been identified as being at least partially segmented from global capital markets. As a consequence, it is argued that local risk factors rather than world risk factors are the primary source of equity return variation in these markets. Several researchers have thus attempted to explore whether macroeconomic may proxy for local risk sources in stock prices in emerging markets.

Sim and Mayasami (2000) examined the impact of economic forces on stock prices in Singapore market using Johansen's multivariate cointegration analysis and concluded that inflation and money supply are insignificant in cointegration framework while interest rate and exchange rate have strong impact on stock market indicating market response that is consistent with open economy character of the country.

Osman and Yakup (2002) studied the relationship between stock index in Turkish stock market and macroeconomic factors of M1, Dollar exchange rate, trade balance and industrial production for the period from January 1990 to November 2001 and found that future share returns cannot be estimated by using time paths of the macroeconomic variables.

Murinde, V. and Poshakwale, S. (2004) investigate price interactions between two main components of European emerging financial markets, namely the foreign exchange market and the stock market, before and after the adoption of the Euro by most European Union (EU) economies. Applying econometric procedures to analyse daily observations on the stock price index and nominal exchange rate for Hungary, Czech Republic and Poland, during 2/1/1995 - 31/12/1998 for the pre-Euro period and 1/1/1999 - 31/12/2003 for the Euro period they find that for the pre-Euro period, mutually reinforcing interactions between exchange rates and stock prices are found in the Czech Republic and Poland but no interaction seem to exist for Hungary. During the Euro period, exchange rates unidirectionally Granger-cause stock prices in all the three sample economies.

Naka, Mukherjee and Tufte, D. (1995) studied the relationship among select macroeconomic variables and the Indian stock market. Selecting industrial production, CPI, M1 and money market rate as explanatory macroeconomic variables the authors found that industrial production is the largest positive

determinant of stock prices in India while inflation is the largest negative determinant.

Lee, U. (1997) examined whether the stock markets of the Pacific Basin countries of Hong Kong, Singapore, South Korea and Taiwan are informationally efficient with respect to macroeconomic policies. Employing Granger Causality in the context of Vector Error Correction Model, to test the relationship between aggregate stock prices and monetary and fiscal policies, the author conclude that there exists long-run equilibrium relationship between stock prices, money supply, and budget deficit in all the four countries. Additionally, both money supply and budget deficit were found to Granger cause the stock prices in all the four countries.

Islam, M. (2003) examined the short run dynamic adjustment and the long-run equilibrium relationship between four macroeconomic variables - interest rates, inflation rate, exchange rate and industrial productivity and Kuala Lumpur Stock Exchange (KLSE) Composite Index and concludes that there exist statistically significant short-run and long-run relationship among the macroeconomic variables and the KLSE stock returns.

Omran, M. (2003) focused on examining the impact of real interest rates as a key factor in the performance of the Egyptian stock market, both in terms of market activity and liquidity. The cointegration analysis indicated significant long-run

and short-run relationship between the variables, implying that real interest rates had an impact upon stock market performance.

Gunasekarage, A., Pisedtasalasai, A. and Power, D. (2004) examined the influence of macroeconomic variables on stock market equity values in Sri Lanka, using the Colombo All Share Price index to represent the stock market and money supply, treasury bill rate, consumer price index and exchange rate as macroeconomic variables. With monthly data for 17 year period from January 1985 to December 2001 and employing Johansen's Cointegration test, provide evidence that lagged values of consumer price index, money supply and treasury bill rate have a significant influence on the Sri Lankan stock market.

Nwokoma, N. (2004) studied the long-term equilibrium between a group of macroeconomic factors and the Nigerian stock exchange all-share index. The macroeconomic variables included in the study industrial production index, the consumer price index, money supply, and interest rate. With the use of quarterly data spanning 1988-2002 period and using Johansen's cointegration technique, the author conclude that industrial production and interest rates are significant determinant of stock returns in Nigeria. The short run analysis however, indicated that stock market in Nigeria respond more to developments within it than to the changes in macroeconomic variables.

Maghyereh, A. (2004) examined the dynamic linkages between crude oil price shocks and stock market returns in 22 emerging economies by employing generalized VAR methodology on daily data spanned from January 1998 to April 2004. Maghereh et. al. finds that crude oil price shocks have no significant impact on any of the emerging stock market under investigation. Specifically, in all cases, the study finds that crude oil shocks explain less than 2% of the forecast error variances and in 16 of the 22 emerging markets this ratio falls to less than 1%. Within that the author finds that the impact of oil shocks on stock market is highest in the largest Asian and Emerging Europe economies, as they have higher energy intensity consumption than most other emerging markets. With reference to the speed with which the responses to crude oil shock are sustained in emerging markets, the study reveals that the innovations in the oil market are slowly transmitted in all of the emerging markets i.e. only after 2 days after the initial shock. The size of the responses was found to be between 0.00051 to 0.00126 on day to reflecting that oil market is very weak in influencing stock markets in emerging economies. These findings may also suggest that the stock market returns in the emerging economies do not rationally signal changes in the crude oil prices.

Mayasami, R., Howe, L. and Hamzah, M. (2004), interestingly use sectoral approach in studying long-run equilibrium relationship between Singapore stock market's sectoral indices represented by the SES All-S Equities Finance Index, SES All-S Equities Property Index and SES All-S Equities Hotel Index, as

well as the composite index and macroeconomic factors. The study finds that there exist a sectoral difference with respect to influence of macroeconomic factors on stock prices. The property index was found to have significant long-run relationship with all the macroeconomic factors under investigation, namely, interest rate, inflation, industrial production, money supply and exchange rate. The real economic activity and money supply were found to have no significant relationship with finance index and the hotel index shared no significant long-run equilibrium relationship with money supply and interest rates. More specifically, the property index was found to have negative relationship with exchange rate and interest rate while positive with rest of the variables; inflation, money supply and interest rates were found to have positive relationship with finance index and negative with hotel index. The findings of this study highlight the fact there exist opportunity for sectoral diversification for investors. The fact that specific sectors are individually affected to different extent by various macroeconomic variables points to the possibility of superior returns based on selecting stocks from specific sectors of the economy as information becomes available on specific macroeconomic variables.

Ray, H. (2008) investigates the relationship among the exchange rate, industrial production, money supply (M3), FII investments and Indian stock prices. His findings using Johansen's Cointegration techniques suggests that in the long-run, the exchange rates are positively related to stock prices and money supply; and negatively related to output and foreign institutional investments.

2.2.3 Major Conclusions on Relationship Between Micro-economic Factor and Stock Prices:

The hypothesis that changes in macroeconomic variables have a pervasive impact on asset prices has been subjected to extensive research. Chen, Roll and Ross (1986) illustrated that economic forces influence discount rates, the ability of firms to generate cash flows, and future dividend payouts. Employing a set of macroeconomic variables comprising of term structure, industrial production, risk premium, inflation, market return, consumption and oil prices, Chen et al (1986) found strong relationship between the macroeconomic variables and the expected stock returns. Subsequent to their research there have been ample number of empirical studies in this area. Granger (1986) and Johansen and Juselius (1990) showed existence of long-term equilibrium among selected variables through cointegration analysis. Darrat (1990), employing multivariate Granger causality tests on Canadian data, found that fiscal policy moves exerted a significant lagged effect on the stock market. Clare and Thomas (1994) conclude that oil prices, default risk, and the retail price index are significant determinant of stock prices in UK. Cheung and Ng (1998), using data for Canada, Germany, Italy, Japan and the US, investigated the relationship between national stock market indices and country-specific aggregate economic variables. They concluded that changes in stock market indices were typically cointegrated with a country's aggregate real economic activity such as its oil price, consumption, money stock and output. Flannery and Protopapadakis (2002) conclude that macroeconomic variables are excellent candidates for

determining returns because changes in these measures will affect firm's cash flows and influence the risk-adjusted discount rate. A number of other studies both for industrialized countries as well as developing countries (Unroo Lee, 1997; Mayasami and Sims, 2000, Mukhopadhya and Sarkar, 2003, Omran 2003) have documented significant impact of macroeconomic variables on stock prices.

Following are the major conclusions derived from the above literature:

1. Industrial production was found to be the largest positive determinant of stock prices in India while inflation, the largest negative determinant.
2. Inflation and money supply were found to be insignificant in determining stock prices while interest rate and exchange rate have strong impact on stock market.
3. Stock prices appeared to be systematically overvalued during economic expansions and undervalued during contractions.
4. A restrictive (expansive) monetary policy stance decreases (increases) returns of large and small stock portfolios and, in some cases, corporate bond portfolios.
5. Exchange rates are positively related to stock prices in India.
6. Pacific-Basin countries were found to be not efficient with respect to macroeconomic policies.
7. Emerging markets are found to be inefficient in capturing shocks in crude oil prices.

Even though researchers have documented a great deal of evidence that fundamental economic activities in developed countries are strongly linked to stock market returns, the literature is scant in the context of emerging markets. Further, most of the researchers have focused on composite stock market indices only and the literature assessing the impact of macroeconomic variables on sectoral stock prices is minimal.

2.3 Problem of the Study

Significant amount of literature is available in the context of linkage dynamics of national stock markets. While this aspect is extensively studied in the context of developed markets, the literature is growing even for emerging markets. However, there exists a regional gap in empirical work on emerging markets. The emerging stock markets of Latin America and Europe have been extensively researched. The stock markets of Gulf region, emerging Asia and Africa have not attracted much attention. Among these three regions, the Asian region is of immense significance from the viewpoint of international portfolio diversification. Asia attracts huge volume of portfolio investments compared to other emerging market regions and is home for some of the fastest growing economies including India and China. A major question to be resolved while dealing with asset allocation among such competing markets is to what extent do these markets get influenced by other markets within the region. A relatively higher allocation can be made to the market which is not integrated with other markets. Given the fact that platforms like ASEAN successfully operate in the

region, examination of possible stock market integration is useful from viewpoint of international portfolio managers. Countries like China and India which till recently had limited trade and investment interests in most of the Asian countries are expanding their economic ties with several countries in the region. Recent years have also seen greater cross-border acquisitions within Asian region. Similarly, it would be worthwhile to determine if innovations in large and dominant economies like South Korea, India and China substantially affect the smaller economies in the region.

The empirical literature on Asian markets is available largely in the context of either developed Asian markets in the region or those on the verge of becoming developed markets (for eg. Hong Kong, Singapore, Taiwan etc.). Though some studies do exist on other Asian emerging markets, they are largely focusing on period surrounding Asian crisis and evaluate the impact of Asian crisis on linkage dynamics of Asian markets. Further, the period studied after the Asian crisis is restricted upto 2002 in most studies. However, as the research has already proved that, during the crisis period the degree of stock market comovement increases significantly, it is left to be examined if in recent times, whether there has been any systematic relationship developing among emerging Asian stock markets.

The study also aim at examining the influence of developed market of US on emerging Asia since US has established itself as leading market for several other developed and developing markets [for example, Eun and Shim (1989), Chan (2002)]. The study of US influence on Asian stock markets becomes all the

more relevant in the light of the fact that post Asian crisis of 1997, the Asian economies have been recovering and developing at a tremendous speed [Yu (2001)]. With this incredible growth in Asian emerging markets, it is possible that the nature of linkages have changed significantly and in particular, linkages between Asian stock markets and the US stock market have weakened. Again, within the Asian region country like South Korea, which was a poor, rural peasant economy in the 1950s, has transformed itself into a full-fledged market economy with series of wide-ranging reforms. The third poorest country in Asia in 1960 has today emerged as economic powerhouse and leader in the Asian region. Therefore, examination of impact of developments in South Korean market on other regional markets entails attention. Study of South Korean market is also important because it attracts significant international portfolio investments and is a strong competitor to other emerging markets in the region like India in this context.

With reference to the role of macroeconomic factors in determining stock price returns it can be said that this aspect has been studied largely using single composite stock market index. However, as well known, a composite stock index includes stocks from different sectors and there is a possibility that macroeconomic variables may affect different sectors differently. Therefore, we focus on examining long-run relationship between macroeconomic variables and stock prices on aggregate basis as well as on sectoral indices for emerging Indian market.

2.4 Importance of the Study

This research is important given the fact that Asia attracts huge volume of portfolio investments compared to other emerging market regions and is home for some of the fastest growing economies including India and China. Additionally, continued reform efforts in emerging Asian economies and developments in information technology and market micro-structures has resulted in bringing about efficiency in information transmission across the markets. Therefore, the assessment of linkage dynamics of emerging markets within the Asian region as well as with empirically proven developed markets like US is useful for international portfolio managers in making asset allocation decision.

In the light of increasing trend towards regionalism in achieving economic goals of emerging market countries the study becomes all the more important. According to UNCTAD [2007], intraregional trade is growing more rapidly than extraregional trade. The China-ASEAN free trade agreement is expected to be fully implemented in 2010. ASEAN is also negotiating a Free Trade Agreement with India. Another emerging bloc in the region is Asia-Pacific Trade Agreement which combines the leading economies of China, India and Republic of Korea together with other Asian countries. A number of countries have reduced their dependence on traditional export markets such as US, Japan and European Union and are instead focusing on emerging markets which is further accelerating intra-regional trade linkages. As well documented in the literature, such trade ties have tendency to synchronize the movements in stock

markets in these countries. The possible implication of these developments is the integration of otherwise segmented markets with other markets in the region and such integrated markets may no longer provide required diversification benefits.

In the context of emerging markets, examination of long-run equilibrium between stock returns and macroeconomic variables becomes all the more significant on account of four important reasons: firstly, several emerging markets have initiated a number of economic reforms that are responsible for a boost in their real economic activity which in turn is expected to significantly affect the stock returns. Secondly, the capital market reforms, increasing participation of foreign investors on the basis of economic fundamentals of emerging markets as well as increased supply of information on macroeconomic data through technological advancements in these economies are some of the channels through which stock markets are expected to capture macroeconomic information. Thirdly, there is a growing evidence of integration of emerging market economies with global economy on account of which it becomes imperative to evaluate the influence of local risk factors vis-à-vis global risk factors. Finally, the even the local risk factors may not influence the stock returns across all the economic sectors in similar way. Therefore, it is required to examine if there exists a sectoral differences with respect to long-run equilibrium between stock prices and macroeconomic variables. In that case, the opportunities for sectoral diversification may be exploited by international investors while investing in emerging markets.

2.5 Objectives of the study

2.5.1 To identify the significant linkages among the emerging markets of Asia viz. India, China, Malaysia, Indonesia, S. Korea and Thailand.

2.5.2 To examine the dynamic co-movements of stock indices of selective Asian emerging stock markets with that of developed market of US

2.5.3 To examine the relationship between macroeconomic factors and stock prices in emerging Indian stock market

2.6 Methodology

The study is broadly divided into two areas;

(i) Examining significant linkages between selected stock market indices with major focus on behavior of these indices to innovations in their own and other markets in Asia and US.

(ii) Examining long-run relationship between macroeconomic factors and stock prices in emerging Indian stock market.

The relevant period of study, sample design, data variables, and tools and techniques with respect to the study objectives are detailed as under:

2.6.1 Methodology for Examining Dynamic Linkages between Sample Stock Market Indices

i) Period of Study

For the purpose of examining dynamic linkages between stock indices of selected Asian countries, the study covers a period of 10 years from January 1, 1998 through December 31, 2007. The study period chosen is especially relevant given the series of financial and economic reforms that countries in the Asian region witnessed during early 1990s. The impact of these reforms is bound to be felt in later stage; at the same time international investors do take some time to formulate their investment decisions for emerging markets after considering the impact of such reforms on the country's fundamentals. Also the major aggressive reforms have been introduced in the emerging markets from mid 1990s.

ii) Sample Design

For the purpose of examining comovement between stock indices of emerging market economies, the study focuses on six Asian equity markets and the developed market of US. The six Asian equity markets are - India, China, Malaysia, Indonesia, South Korea and Thailand. These equity markets are categorized as emerging markets according to the criteria adopted by the International Finance Corporation (IFC). There are several emerging markets within the Asian region. However, while considerable evidence is available on comovement of indices among other emerging markets, this research focuses on

the return dynamics of the above markets where evidence is limited and restricted to pre-Asian crisis period. The focus of the research is also on inclusion of India and China which have become the most attractive and prominent economies from the viewpoint of FDI and international portfolio investments, the two crucial drivers of financial linkages between economies.

iii) Data Variables and Data Sources

In order to examine dynamic linkages between equity markets of India, China, Malaysia, Indonesia, South Korea and Thailand and further their linkages with developed market of US, the study uses daily returns data of the composite stock market indices of the respective countries. The equity market indices used in the study are - NSE Nifty (India), Shanghai Composite (China), KLSE Composite (Malaysia), JKSE Composite (Indonesia), KOSPI (South Korea), SET Index (Thailand) and S&P500 (US). The daily adjusted closing price of each of the above index series has been collected from ISI Emerging Market Database, ECONSTAT database available online at www.econstat.org and website of National Stock Exchange (NSE), for the period from January 1, 1998 through December 31, 2007. All the above index series were obtained in the respective home currency. However, local currency data does not consider the effect of exchange rate risk which is an important factor for international investors. Therefore, we converted all the indices of selected Asian markets into US Dollar to factor the exchange rate risk and bring uniformity and comparability in data variables under study. The US Dollar is used as the common currency for two

reasons - (i) US Dollar is the most widely used currency in the context of international trade and investments and (ii) the study also includes US Dollar denominated S&P500 index to examine dynamic linkages between US and Asian markets. This research objective can be accomplished with econometric accuracy only if exchange rate risk is factored into the regression model by denominating all the stock market indices in US Dollar. For the purpose of converting sample Asian equity market indices into dollar denominated indices, the daily exchange rate data between each of the countries in the sample and the US Dollar was collected from online ECONSTAT database (www.econstat.com) Finally, consistent with convention, the daily stock market index data used in the study has been transformed by taking natural logarithm of the raw index data. This is required on account of the fact that there is a tendency for the dispersion of the series to increase with the absolute level (Perron [1988]).

For each country, daily returns RET are computed as the first difference of the natural logarithms of stock price indices (P) multiplied by 100.

$$RET_t = (\ln P_t - \ln P_{t-1}) * 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Following Eun and Shim (1989), daily stock index returns data is used to capture potential interactions between sample markets, since a month or even a week may be long enough to obscure interactions that may last only for a few days.

iv) Econometric Techniques

a) Stationarity of stock market return series

The very first step in building suitable econometric models with time series data is to examine the non-stationarity in the series. Using non-stationary variables in time series analysis causes the problem of spurious regressions Granger and Newbold (1974). When a series is trended then it is considered to be non-stationary. By stationarity we mean a special characteristic of a series. A typical stationary (in mean) series is one that has a mean value which, in the long-run, is constant. Thus, because this is the norm and not the exception, econometricians have to deal with it and with the problems that causes. The problem with this kind of data is that the standard procedures of a regression analysis, can easily lead analysts to conclude on existence of relationship between variables under study when in fact there could be none. The model coefficient of determination (r^2) may be over 0.95 with non-stationary data and the *t*-ratios are usually well over 4. But these results will often be totally spurious and therefore cannot be considered in drawing conclusions. Typically a stationary series:

(a) Exhibits mean reversion in that it fluctuates around a constant long-run mean.

(b) Has a finite variance that is time-invariant.

(c) Has a theoretical correlogram that diminishes as lag length increases.

In simplest terms a time series y_t is said to be stationary if:

(a) $E(y_t)$ = constant for all t,

(b) $Var(y_t)$= constant for all t, and

(c) $Cov(y_t, y_{t+k})$ = constant for all t and all $k \neq 0$

or if its mean, its variance and its covariances remain constant over time. Thus, these quantities would remain the same whether observations for the time series were, for example, from 1975 to 1985 or from 1985 to 1995.

A formal test for stationarity was firstly proposed by Dickey and Fuller (1979) who developed a procedure to formally test for the presence of a unit root. The proposed test starts with the assumption that a series y_t is following an AR(1) process of this form:

$$y_t = a_1 y_{t-1} + e_t$$

and then testing for the case of a_1 being equal to one (unity and hence "unit root").

In case of a_1 =1 then the above equation can be expressed as:

$$\Delta y_t = e_t$$

and the y_t series is said to be integrated of order one denoted as I(1) or non-stationary; while the Δy_t is integrated of order zero denoted as I(0) or stationary.

In fact instead of testing for a_1 =1 we can test an alternative version of the same thing using this equation:

$$\Delta y_t = \gamma y_{t-1} + e_t$$

and now testing whether γ=0, which is clearly equivalent to the above mentioned case.

Dickey and Fuller (1979) actually consider three different regression equations that can be used to test for the presence of a unit root:

$$\Delta y_t = \gamma y_{t-1} + e_t$$

$$\Delta y_t = a + \gamma y_{t-1} + e_t$$

$$\Delta y_t = a + \gamma y_{t-1} + a_2\ t + e_t$$

The difference between the three regressions concerns the presence of the deterministic elements a and a_2.

The parameter of interest in all the regression equations is γ; if γ=0, the series contains a unit root. The test involves estimating one (or more) of the equations above using OLS in order to obtain the estimated value of γ and associated standard error. Comparing the resulting t-statistic with the appropriate value reported in the Dickey-Fuller tables allows the researcher to determine whether to accept or reject the null hypothesis γ=0.

Another popular presentation of the test for Unit Roots is the Augmented Dickey-Fuller test. The ADF test simple includes AR(p) terms of the Δy_t term in the three alternative models. Therefore we have:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{n} \beta_i \Delta y_{t-i} + e_t$$

$$\Delta y_t = a + \gamma y_{t-1} + \sum_{i=1}^{n} \beta_i \Delta y_{t-i} + e_t$$

$$\Delta y_t = a + \gamma y_{t-1} + a_2\ t + \sum_{i=1}^{n} \beta_i \Delta y_{t-i} + e_t$$

The first model is used when the time series is flat and does not exhibit trend and potentially slow-turning around zero. The second model is to be

implemented when the time series is flat and potentially slow-turning around a non-zero value. Lastly, the third model for testing of stationarity is to be used when time series exhibits trend in it (either up or down) and is potentially slow-turning around a trend line that is drawn through the data. The difference between the three regressions thus again concerns the presence of the deterministic elements a and a_2.

The lag length n in all the above models is determined by minimizing the suitable information criterion such as Akaike Information Criteria (AIC) due to Akaike (1974) or Schwarz Information Criteria (SIC) due to Schwarz (1978) and Hannan-Quinn Information Criteria (HQC) due to Hannan-Quinn (1979). The information criteria are measure of goodness of fit and are generally used as a guide to model selection in time series analysis. As a general rule that model is selected at which the chosen information criteria is minimum.

The ADF test does not follow standard t-distribution as the sampling distribution of this test statistic is skewed to the left with a long, left-hand-tail. The critical test statistics for ADF are given in McKinnon (1996). If the absolute value of computed t-statistic for γ is exceeds the absolute critical value given in McKinnon (1996) then the null hypothesis that the variable is non-stationary must be rejected against its alternative. If on the other hand, it is less than the critical value, it is concluded that the series is non-stationary. If the series is found non-stationary, its first differenced will be used to run the ADF regression.

Another alternate test available for testing unit roots in time series is Phillips-Perron (1988) test. The Phillips-Perron (PP) tests are based on the following ADF regression, and the critical values are the same as those used for the ADF tests

$$\Delta X_t = \lambda_0 + \lambda_1 X_{t-1} + \lambda_2 T + \sum_{i=1}^{n} \Psi_i \Delta X_{t-i} + \varepsilon$$

where Δ is the difference operator, X is the natural logarithm of the series, T is a trend variable, λ_1 and λ_2 are the parameters to be estimated and E is the error term. The PP unit root test is utilised in this case in preference to ADF unit root tests for the following reasons. First the PP tests do not require an assumption of homoscedasticity of the error term (Phillips, 1987). Secondly, since lagged terms for the variable of interest are set to zero there is no loss of effective observations from the series (Perron, 1988), which is especially useful if the number of data points is limited. The PP unit root test corrects the serial correlation and autoregressive heteroscedasticity of the error terms by a technique called the Bartlett window. This aims at providing unit root tests results that are robust to serial correlation and time dependent heteroscedasticity of errors. In both the PP and ADF unit root tests the null hypothesis is that the series is nonstationary

We conduct the tests of stationarity on the return time series using both ADF as well as PP test and provide the results.

b) Vector Autoregression (VAR) methodology

In order to examine dynamic linkages between selected stock indices we employ the econometric methodology of Vector Autoregression (VAR) developed by Sims (1980) and popularized by researchers such as Litterman (1984) and Doan(1984). The VAR technique has become well established methodology to examine dynamic interaction between variables under study. Several earlier studies have used the VAR methodology to consider the issues similar to those considered in this study. VAR model does not require any explicit economic theory to estimate a model. It uses only the observed time series properties of the data to forecast economic variables. The VAR models have many applications (Cooley and Leory, 1985).

VAR model is ideal in this situation as it provides a multivariate framework where changes in particular variable (in our case stock market index) are related to changes in its own lags and to changes in other variables and the lags of those variables. The model thus can help in identifying main channels of interactions and simulates the responses of a given market to innovations in other markets. VAR estimates unrestricted reduce form equations that have uniform sets of the lagged dependent variables of every equation as regressors. The VAR thus estimates dynamic simultaneous equation system, free of *a priori* restrictions on the structure of relationships. Since no restrictions are imposed on the structural relationships among variables, the VAR model can be viewed as a flexible approximation to the reduced form of the correctly specified but unknown model of the actual economic structure.

The VAR model can be expresses in its standard form as:

$$\mathbf{RET_t} = \mathbf{C} + \sum_{k=0}^{p} \mathbf{A_k R_{t-k}} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where $\mathbf{RET_t}$ is the m x 1 (in our study 7 x 1) column vector of daily returns on the market indices at time t, **C** is the m x 1 (in our study 7 x 1) column vector of constant terms, $\mathbf{A_k}$ are m x m ((in our study 7 x 7) matrices of coefficients such that the (i, j)th component of A_k measures the effect of change in the jth market on the ith market after k periods, ε_t is an m x 1 (in our study 7 x 1) column vector of unobserved disturbances assumed to satisfy the usual assumptions of the errors from an OLS regression. Eq. (2) assumes a return generating process where the return of each market is a function of a constant term, its own lagged returns, the lagged returns of other variables in the system, plus an error term ε_{it}, which is serially uncorrelated but can be contemporaneously correlated. In other words, the returns of a market incorporates not only its own past information, but also the past information of other markets.

To analyze the dynamics of the system, the VAR model in Eq. (2) can be transformed into a moving average representation expressed as:

$$\mathbf{RET_t} = \sum_{k=0}^{\infty} \mathbf{B_k} \varepsilon_{t-k} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

so that the returns of a market is expressed in terms of its own past shocks plus the shocks from other markets in the system. Interpretation of the general output

of VAR model is difficult on account of several coefficients related to number of parameters which depend upon number of lags specified in the VAR model. Therefore, the VAR model s used to generate impulse response functions (IRFs) and forecast error variance decomposition (FEVD) which help in drawing meaningful conclusions from VAR model.

Impulse Response Functions (IRFs)

An impulse response function (IRF) traces the effect of a one standard deviation shock to one of the innovations on current and future values of endogenous variables. A shock to the *i*-th variable directly affects the *i*-th variable and is also transmitted to all of the endogenous variables through the dynamic structure of VAR. As mentioned earlier, the innovations in Eq. (2) may be contemporaneously correlated such that the covariance matrix of innovations is not diagonal. Such contemporaneous correlation implies that a shock in one market may transmit to other markets through the innovations. It is customary to transform these correlations by orthogonalizing the innovations in VAR system by Cholesky decomposition according to pre-specified causal ordering so that the covariance matrix of the resulting innovations is diagonal. The results of orthogonalized VAR are thus not invariant to ordering of variables in the system. After the transformation, Eq. (3) can be expressed as:

$$\mathbf{RET}_t = \sum_{k=0}^{\infty} C_k \xi_{t-k} \quad \text{..... (4)}$$

where the transformed innovations ξ_t are no longer contemporaneously correlated. Eq. (4) thus provides with a convenient framework for tracing the dynamic responses to shocks in the system. The *(i, j)*th component of C_k now represents the impulse response of the *i*th market in the k periods after a shock of one standard deviation in the *j*th market. The major aspect to examine here is how long it takes for the impulse responses to decay following the shock. Theoretically, the impulse response should converge to zero in a stationary system. If the speed of convergence of one pair of the markets is faster than the other pair, then it can be concluded that the first pair of markets are better integrated.

Forecast Error Variance Decomposition (FEVD)

Forecast error variance decomposition (FEVD) provides a different method of depicting the system dynamics. IRFs traces the effects of a shock to an endogenous variable on the variables in the VAR. By contrast, variance decomposition decomposes the variation in an endogenous variable into the component shocks to the endogenous variables in the VAR. The decomposition allocates the variance of the forecast error into percentages that are accounted for by innovations in all markets including the market's own innovations. This is particularly useful when in respect of each of the market we would like to derive the proportion of movements in that market returns due to its **'own'** shocks versus shocks to other markets in the system. This computation will provide us evidence as to the significant role played by one market in causing fluctuations

in returns in other market. VAR model helps to derive this information by decomposition of forecast error variance. This thus explains the relative importance of each market in generating variations in its own and other markets' returns.

However, as mentioned earlier, for the purpose of calculating impulse responses and variance decompositions, the ordering of variables is important. The variables under study can be ordered by following some sound economic logic. While ordering of certain variables such as macroeconomic variables is relatively easier on account of clear identification of relationships among them, with respect to stock markets such benefit of a priori relationships is not available. Researchers have used different criteria for ordering market indices while studying linkage dynamics using unrestricted VAR model. Eun and Shim (1989) order the stock market indices using the market opening time. On the other hand Dekker, Sen and Young (2001) and Tan and Tse (2001) follow market closing time. Their approach is consistent with that taken by Janakiramanan and Lamba (1998) who also order the equity market indices using market closing time. Ito, Engle and Lin (1992) argued that shocks in stock markets are transmitted as meteor showers rather than heat waves. The heat waves hypothesis assumes that volatility has only country-specific autocorrelation. An innovation in a particular market will persist only in that market and will not have a spillover effect to other markets. The meteor shower hypothesis asserts that innovations are transmitted from one market to others. A shock in one market tends to continue after that market closes, producing volatility in

geographically distant markets opening several hours later. This is similar to the effect of meteor showers on earth as the globe turns. While Asian markets operate within the same time zone, there exists a difference between market opening and closing time. We order the markets according to their closing time with the market closing first ranked first and the market closing last ranked last. With respect to US stock market, several studies have shown that it is the most exogenous market. To determine the exogeneity of US market returns, any ordering that puts the US at the top would suffice (Doan and Litterman [1981]). We thus follow the following order of variables in VAR system:

U.S. SOUTH KOREA CHINA MALAYSIA INDONESIA THAILAND INDIA.

VAR and Stationarity

An argument that arises in the context VAR modeling is whether one should use levels or first differences is the problem of non-stationarity. Clearly if the variables are I(0) this is not an issue. The difficulty arises, however, when the variables are found to be non-stationary, thereby requiring the series to be differenced to get stationary process. Because of the information lost in differencing, Sims (1980) and Doan (1992) have argued against using first difference series in VAR modeling. The majority view highlighted by Granger and Newbold (1974) and Phillips (1986) is that stationary data should be used since non-stationary data can lead to spurious regression results. However, Engel and Granger (1987) provide evidence that even if variables are non-stationary and I(1), there may exist a linear combination of such I(1) variables

that may be stationary or I(0). In such case, the variables are said to be cointegrated. There is a growing body of literature that supports the idea that if the data series are non-stationary but cointegrated, then the series is required to be made stationary by differencing and instead of estimating VAR model, a vector error correction model (VECM) or cointegrated VAR is required to be estimated by including vector of cointegrating residuals in estimation. If variables are non-stationary and not cointegrated then transform the data into stationary by differencing and then estimate. By doing so we put back the information lost by differencing. If data is stationary then we can directly estimate VAR in levels.

VAR and Lag Length

In specifying VAR model, number of lags to be included cannot be determined arbitrarily. If we choose a long lag length, then it consumes degrees of freedom (for 'p' lags every equation has 'np+1' coefficients). On the other hand, smaller lag length may lead to model misspecification. The lag length in VAR models is determined by minimizing the suitable information criterion such as Akaike Information Criteria (AIC) due to Akaike (1974) or Schwarz Information Criteria (SIC) due to Schwarz (1978) and Hannan-Quinn Information Criteria (HQC) due to Hannan-Quinn (1979). The information criteria are measure of goodness of fit and are generally used as a guide to model selection in time series analysis. As a general rule that model is selected at which the chosen information criteria is minimum. It is worth noting here that

none of these criteria is statistically superior to others (Gujarati, 2003). We follow AIC criterion to determine optimal lag length in VAR model.

2.6.2 Methodology for Examining Relationship Between Macroeconomic Factors and Stock Prices in Emerging Indian Stock Market

i) Period of study:

For the purpose of examining relationship between macroeconomic factors and stock prices in Indian emerging market we cover the study period from April 1, 1995 through March 31, 2007. The data period captures the significant phase of economic reforms introduced in Indian economy. The significant developments have also been introduced during the same period to enhance market microstructure so as to improve market efficiency.

ii) Data Variables and Data Sources

We study the impact of industrial production (IIP), Broad money supply (M3), Inflation (CPI), Exchange rate (Rs./$), International oil prices (Crude prices $/barrel) and Foreign Direct Investment (FDI in US $) on stock prices in India by taking S&P CNX Nifty as proxy for Indian stock prices. The data for all the variables has been collected with monthly frequency from CMIE Business-Beacon database and RBI Database on Indian Economy. The data for Nifty index is collected from the official website of NSE.

Further, the long-term linkages between above macroeconomic variables and sectoral indices is also examined. The sectoral indices selected for the

purpose of study include broadly Manufacturing sector and Financial services sector. Besides, within manufacturing sectors, the sub-sectors of Textile, Chemicals, Telecommunication and Food and Beverage are also included in the study to examine which of the above macroeconomic variables significantly affect the sectoral stock prices. The sectoral indices used are the monthly market capitalization weighted CMIE COSPI (CMIE Overall Share Price Indices) indices for respective economic sectors. The required index series data is collected for the period from April 1995 to March 2007 from CMIE Prowess database.

iii) Econometric Techniques:

a) Pre-test for stationarity and lag length

As discussed earlier, all the variables, macroeconomic as well as stock indices, are tested for stationarity to avoid the problem of spurious regressions. ADF test is employed to test for stationarity in variables.

b) Johansen's Cointegration Test

The principal method employed to analyse impact of macroeconomic variables on sectoral indices is the Johansen's multivariate cointegration analysis developed in Johansen (1988) and applied in Johansen and Juselius (1990). This methodology has become a well established methodology to test the long-run relationships among variables. The first step in this process is to test for stationarity of each variable. We employ the popular Augmented Dickey Fuller test for testing for unit roots in all th time series and thus determine their order

of integration. According to Hansen and Juselius (2002), to find cointegration between non-stationary variables, at least two variables of all the variables included in the cointegration system have to be I(1). Once the order of integration is obtained we proceed to test the cointegration relationship between the sectoral indices and set of macroeconomic variables using maximum likelihood procedure developed in Johansen (1988). Cointegration test look for linear combination of I(d) time series that are stationary and the linear combination of I(d) which is stationary is called as cointegration equation and may be interpreted as a long-run relationship between variables. Consider an n-dimensional vector autoregressive model

$$X_t = c + \sum_{i=1}^{k} \pi_i X_{t-i} + \varepsilon_t \qquad (5)$$

Where, X_t is an n x 1 vector of I(1) variables, π_i is an n x n matrix of parameters and c is a constant. The vector ε_t is white noise, which may be contemporaneously correlated. We write the model in error correction form:

$$\Delta X_t = c + \Gamma_1 \Delta X_{t-1} + \cdots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \varepsilon_t \qquad (6)$$

where ΔX_t is the vector of changes in period t and

$$\Gamma_m = -I + \sum_{i=1}^{m} \pi_i \quad m = 1, 2, \ldots, k-1,$$

$$\Pi = -I + \sum_{i=1}^{k} \pi_i$$

where r is the short-run dynamics and I is an identity matrix. Π is known as the long-run matrix and the rank r determines the number of stationary linear

combinations of $\mathbf{X}_t$. Π can be of full rank. In this case, the assumed stationarity of the error item requires that the levels of the $\mathbf{X}_t$ process themselves be stationary, implying the absence of any stochastic trends whatsoever in the data, and contrary to the original I(1) specification. Π could have rank zero, in which case Eq. (6) reduces to a standard VAR in first differences, and there are no stationary longrun relations among the elements of $\mathbf{X}_t$. For $0 < r < n$, there exist **r** cointegrating vectors. In that case, Π can be factorized as $\alpha\beta'$, where both α and β are **n x r** matrices. This model reflects a dynamic equilibrium relation, in which the expression $\beta'\mathbf{X}_{t-1}$ represents the extent to which the system is 'out of equilibrium'. The series are linked together over time by the long-run relation in β', ensuring that the series never move too far apart. α are the error-correction parameters and take into account the speed of adjustment.

Johansen (1988, 1991) proposes two methods for estimating the number of cointegration vectors: the trace test and the maximal eigenvalues test. The trace test is a likelihood ratio test for maximum r cointegration vectors against the alternative equal to n.

$$\lambda_{trace} = -T \sum_{i=r+1}^{k} \ln(1 - \tilde{\lambda}_i) \qquad (7)$$

The maximal eigenvalues test has an identical null hypothesis, while the alternative is (r + 1) cointegration vectors.

$$\lambda_{max}(r, r+1) = -T \ln(1 - \tilde{\lambda}_{i+1}) \qquad (8)$$

Both tests have a non-standard asymptotic distribution.

Cointegration Regression

Assume there is a single equilibrium relationship connecting the elements of X_t (r = 1). The disequilibrium measure is $\beta' X_t = \Pi_t$, a stationary random variable. Given that we can multiply β (a vector here) by an arbitrary non-zero constant we can take any element of it we choose to be 1 (we normalize β so that the choosen element is 1), and obtain something that looks like a regression model. Suppose we choose to think of the first element of β as 1 and write

$$\beta' X_t = X_{1t} + \beta_2 X_{2t} + \ldots + \beta_k X_{kt} = \mu_t$$

or $$X_{1t} = - \beta_2 X_{t2} - \ldots - \beta_k X_{kt} + \mu_t$$

This is certainly an equation we can consider estimating the parameters of by OLS and is usually called the conintegrating regression. It has been shown that the asymptotics for the OLS estimators in this equation are non-standard.

Chapter Three

EMPIRICAL ANALYSIS OF LINKAGES AMONG EMERGING STOCK MARKETS OF ASIA

CHAPTER THREE

EMPIRICAL ANALYSIS OF LINKAGES AMONG EMERGING STOCK MARKETS OF ASIA

Finance theory predicts that there are potential gains from international portfolio diversification if returns from investment in different national stock markets are not perfectly correlated and the correlation structure is stable. Empirical findings in the context of emerging markets indicate that they have weak correlation with other emerging markets as also developed markets. However, as the emerging markets grow in size and sophistication, there is a possibility of change in this correlation structure as global risk factors contribute to expected returns in the securities. Further, in globalized world, unexpected developments in international stock markets seem to have become important 'news' events that influence domestic stock markets [Eun and Shim (1989)]. Thus structure of interdependence among national stock markets has to be examined in order to derive suitable conclusions on role played by different stock markets in return-generating process in a given stock market.

Asian emerging markets attract huge inflows of portfolio investments. In recent times, economic development together with favourable regulatory changes and technological advancement has brought a significant change to Asian emerging markets. In the light of growing economic integration observed within the region [UNCTAD (2007)], the benefits of portfolio diversification in Asian emerging markets has to be evaluated by observing the correlation

structure and the inter-market dynamics in the region. Specifically, the research addresses the following issues:

(i) How much of the movements in one Asian stock market can be explained by innovations in other Asian markets?

(ii) Does the US stock market influence the Asian emerging markets?

(iii) How rapidly are the shocks originating in one market transmitted to other markets and how long the impact of such stock remains in that market?

The answers to above issues are derived empirically using Vector Autoregression methodology.

3.1 Summary Statistics of Daily Returns for Asian Emerging Markets

For the purpose of empirical analysis, using the levels series of individual stock market indices will not make much sense as the indices of different countries are not comparable due to the use of different bases for their computation. The return based approach used in this study therefore makes use index returns as centre variable of the study. Examining the results in terms of returns makes sense in terms of interpretation and comparison of different markets with different levels indices. Further, the returns are computed as logarithmic differences of individual stock market indices since there is a tendency for the dispersion of the series to increase with the absolute level [Perron (1988)]. The descriptive statistics based on logarithmic returns series of selected stock market indices viz. RSP500 (US), RJKSE (Indonesia), RKLSE

(Malaysia), RKOSPI (South Korea), RNIFTY (India), RSET (Thailand) and RSSEC (China) are presented in Table 3.1.

Table 3.1

Summary Statistics of Daily Logarithmic Returns of Asian Emerging Markets and US Market (January 1998 - December 2007)

	RSP500	RJKSE	RKLSE	RKOSPI	RNIFTY	RSET	RSSEC
Mean	0.016150	0.053296	0.040266	0.084956	0.066503	0.049692	0.061745
Median	0.026811	0.086660	0.000816	0.092605	0.112513	0.026814	0.032152
Maximum	5.574432	30.48604	24.27852	17.45090	8.307008	15.38466	9.403204
Minimum	-7.043759	-24.10770	-24.15339	-12.75241	-12.90013	-15.69170	-9.101291
Std. Dev.	1.108794	2.484924	1.692861	2.265646	1.633872	1.914695	1.450184
Skewness	-0.068200	0.328314	0.990007	0.190779	-0.398648	0.405615	-0.046854
Kurtosis	5.796786	24.12767	51.78298	7.622259	7.387040	11.17353	8.073135
Jarque-Bera	851.6868	48534.68	258929.4	2336.617	2159.660	7328.349	2796.603
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	42.10373	138.9420	104.9740	221.4808	173.3730	129.5467	160.9695
Sum Sq. Dev.	3203.879	16091.66	7468.221	13377.00	6956.813	9553.749	5480.505
Observations	2607	2607	2607	2607	2607	2607	2607

The following significant observations can be made from the Table 3.1:

(i) The mean returns of all the markets are positive although it can be observed that the average daily return of US market is the least (0.016150) while emerging Asian markets have average daily returns well above that of develop market of US. The South Korean market has the highest average daily returns at 0.084956.

(ii) The prevalence of high returns in emerging Asian markets is also evident from the higher magnitude of maximum daily returns as observed in the

case of six selected emerging Asian markets. The S&P 500 index of US has maximum return of 5.574432 which is well below in comparison to the maximum return observed for the six Asian markets. Within the group of Asian markets, Indonesian market has the highest magnitude of maximum daily return at 30.48604 while Indian market has the lowest magnitude of maximum return at 8.307008 during the study period.

(iii) Likewise, the magnitude of minimum returns is also highest in case of the six emerging Asian markets under study while it is lesser for US market.

(iv) The fact that the emerging markets are more volatile is evident from the statistics on standard deviation of daily returns in these markets. In general, the US returns are least volatile with standard deviation of 1.108794. The Indonesian market though provides highest magnitude of maximum daily returns, it is accompanied with high volatility as exhibited by the highest standard deviation of 2.484924. Similarly, South Korea has the highest average daily returns and at the same time it also has very high degree of standard deviation at 2.265646.

(v) With minimum rate of change and low volatility the US stock market can be considered as the most efficient market among all the markets under study. All the emerging markets on the other hand are relatively inefficient markets.

(vi) All the Kurtosis values of the stock markets investigated in this study display a value more than three, showing a leptokurtic curve, which demonstrates that the distribution of stock returns in these countries

contain extreme values. The values of Kurtosis accompanied with those of Jarque-Berra statistic clearly indicate that the emerging market returns are not normally distributed. These findings are consistent with Harvey (1994), Bekaert, Erb, Harvey and Viskanta (1998), Derrabi and Leseure (2002). Under large departure from normality, the mean-variance criterion [as given by Markowitz (1952)] can lead to application of wrong portfolio weights [Jondeau and Rockinger (2005)]. For risk-averse investors, the use of sub-optimal mean-variance criterion in portfolio construction can result in substantial opportunity cost. The non-normality of returns in emerging markets therefore compels the international investors to use distinct and typical models for determining expected returns of portfolios comprising emerging market assets.

3.2 Correlation Structure of Stock Market Returns in Emerging Asia

Correlation is one of the simplest but most widely used tools used by portfolio managers in making asset allocation decisions. The correlation analysis revolves round the measure of strength or degree of linear association between two variables. The understanding of linear association between stock market returns of different countries is of vital significance in portfolio construction and diversification of risk. Portfolio theory suggests that correlation is an indicator of opportunity to diversify non-systematic risk of investment. Correlation structure across stock markets returns gives a preliminary idea on stock market linkages. Stock markets sharing high correlation coefficients can be interpreted as those

having significant linkages. Portfolio diversification across such markets will therefore be not beneficial for international investors. On the other hand low correlation reflects segmentation property of stock markets and therefore existence of opportunity to diversify risk. Further, markets in common region are more correlated because these markets are more prone to get influenced by their regional news and developments and also because of reasons such as trade and economic ties. Literature on emerging markets suggests that emerging markets have low correlations with other markets [for example, Harvey, C. (1995), Shashikant, U. (1998)].

The correlation structure of emerging Asian markets have been examined to detect preliminary evidence on potential diversification benefits in the region. Table 3.2 presents the log-return correlation matrix of returns of markets under investigation.

Table 3.2

Log Return Correlation Matrix of Emerging Markets in Asia and US Market (January 1998 - December 2007)

	RJKSE	RKLSE	RKOSPI	RNIFTY	RSET	RSSEC	RSP500
RJKSE	1.000000						
RKLSE	0.304249	1.000000					
RKOSPI	0.268148	0.242584	1.000000				
RNIFTY	0.183504	0.160431	0.262625	1.000000			
RSET	**0.335313**	**0.382636**	**0.336021**	**0.212159**	1.000000		
RSSEC	0.045351	0.060505	0.057150	0.071862	**0.068307**	1.000000	
RSP500	0.163181	0.205632	**0.316028**	0.181584	0.194813	0.040925	1.000000

One methodological issue to be handled in the context of log return correlation matrix in the above table is the existence of timing difference or difference in trading hours between Asian markets and the US stock market. While all the Asian markets under study operate in the same time zone, there exists a whole working day difference in the market opening time among the US and the sample Asian markets. On account of this the contemporaneous correlation among the US market and the Asian markets is not of much importance. Therefore, the correlation matrix is derived taking into account the one day lagged returns for US market. The same approach is followed for subsequent analysis of return data throughout the study.

The examination of correlation structure of log returns from Table 3.2 gives following important findings:

(i) All the Asian emerging markets exhibit positive correlation with each other indicating movement in tandem not only with regional markets but also with the developed market of US. At the same time it can be observed that in general, however, the Asian equity markets share low correlation coefficients (less than 0.50) during the whole sample period. Harvey, C. (1995, 1999) shows that even if emerging markets are highly volatile, a well-diversified portfolio of financial assets weakly correlated can reduce the overall portfolio volatility. In that sense, the Asian emerging markets as portfolio assets can thus help in risk reduction.

(ii) Thailand market exhibits highest positive correlation with all the markets in the region (except China). The high correlation coefficients of Asian

markets with respect to Thailand stock market gives a preliminary indication of high sensitivity of Asian markets to developments in Thailand stock market. It is interesting to note the existence of this phenomenon among Asian equity markets even a decade after Asian crisis wherein Thailand was the point of origination of the crisis which spread subsequently to several other markets in the region.

(iii) Chinese stock market exhibit lowest correlation coefficients with respect to all the other Asian markets as well as US market. This indicates that Chinese market is by far the most isolated market in the region which further is an indication of potential diversification benefits. The relatively low correlation of Chinese equity market with respect to other markets can be attributed to the existence of regulatory barriers in Chinese market.

(iv) All the Asian stock markets under investigation share a relatively high coefficient of correlation with respect to South Korean market than even with US market providing preliminary evidence of emergence of South Korean market as one dominant market in the Asian region. Further, South Korean market is found to have highest correlation with US stock market (0.316028).

3.3 Dynamic Linkages in Emerging Asian Markets

For the purpose of analyzing dynamic linkages between Asian emerging markets, the study progresses by first examining stationarity of return time series of each of the sample market and subsequently constructing and

interpreting the VAR model with the help of forecast error variance decomposition and impulse response function analysis.

3.3.1 Results of Stationarity Test on Return Time Series

Non-stationary variables result in spurious regression results [Granger and Newbold (1974)] and therefore each of the return time series is tested for stationarity or in other words for the presence of unit root in the return time series, using two popular alternate econometric tests viz. Augmented Dicky-Fuller test and Phillip-Perron test. The results of both the stationarity tests with and without trend are tabulated in Table 3.3 and Table 3.4.

Table 3.3

Results of Unit Root Test using ADF test

Market	ADF Test Statistics			
	Without trend	P value	With Trend	P value
RJKSE	-39.46147*	0.0000	-39.48559*	0.0000
RKLSE	-22.60292*	0.0000	-22.59602*	0.0000
RKOSPI	-48.01525*	0.0001	-48.00643*	0.0000
RNIFTY	-47.88627*	0.0001	-47.97892*	0.0000
RSET	-32.86044*	0.0000	-32.86053*	0.0000
RSSEC	-50.43709*	0.0001	-50.51686*	0.0000
RSP500	-52.30062*	0.0001	-52.29057*	0.0000

Notes: (a) Lag selection for ADF test is automatic based on SIC (Schwartz Information Criterion)
(b) MacKinnon (1996) one-sided p values use for rejection of hypothesis of unit root.
(c) Test critical values are -3.432666, -2.862449 and -2.567299 for 1%, 5% and 10% respectively for test without trend and -3.961565, -3.411532 and -3.127629 at 1%, 5% and 10% respectively for test with trend as deterministic term.
(d) * indicated significance at 1% level.

Table 3.4

Results of Unit Root Test using Phillip-Perron (PP) test

Market	PP Test Statistics			
	Without trend	P value	With Trend	P value
RJKSE	-38.95072*	0.0000	-38.93735*	0.0000
RKLSE	-47.57199*	0.0001	-47.56914*	0.0000
RKOSPI	-47.92627*	0.0001	-47.91689*	0.0000
RNIFTY	-47.88420*	0.0001	-47.97916*	0.0000
RSET	-46.80945*	0.0001	-46.80899*	0.0000
RSSEC	-50.44643*	0.0001	-50.51417*	0.0000
RSP500	-52.70347*	0.0001	-52.69234*	0.0000

Notes: (a) MacKinnon (1996) one-sided p values use for rejection of hypothesis of unit root.
(b) Test critical values are -3.432666, -2.862449 and -2.567299 for 1%, 5% and 10% respectively for test without trend and -3.961565, -3.411532 and -3.127629 at 1%, 5% and 10% respectively for test with trend as deterministic term.
(c) * indicated significance at 1% level.

Both the ADF test as well as PP test reject the null hypothesis of unit root at 1% significance level. The results of stationarity test using ADF and PP test, thus, reveal that all the return time series are stationary at log levels. Therefore it is concluded that all the return time series are I(0), i.e. integrated of order zero. Therefore VAR model is constructed using the log levels of return series data and will not be misspecified and the dynamic relationships among the return variables analyzed below are not spurious. The absence of unit root further indicates that there are no short run deviations among the return series of sample stock markets and there is no need to test for long-run equilibrium of cointegrating relationship between the markets. The Johansen's Cointegration

test requires that atleast two variables to be included in the model are I(1) whereas we find that the return series are all I(0).

3.3.2 Lag Length Selection for VAR Model

Appropriate lag structure of the VAR is vital for the system. Long lag length consumes degrees of freedom while smaller lag length may lead to model misspecification. Since the main purpose of the VAR model is inference and hypothesis testing, it is important to avoid the model being under-parameterized or over-parameterized. The lag length for our seven market VAR system is selected scientifically using AIC (Akaike Information Criterion). The results of the lag length selection process are tabulated in Table 3.5. The AIC criterion selects the lag length of 6 and therefore the VAR model is constructed with 6 lags. Each equation thus has seven stock market daily returns times 6 lags plus a constant.

3.3.3 VAR Model Stability Test

Upon constructing and estimating VAR model with 6 lags of each variable, the stability of VAR model is tested under VAR diagnostic views of inverse roots of the characteristic AR polynomials in Eviews 5.1 software. In order for the VAR model to be stable, all the roots should have modulus less than one and lie inside the unit circle. The results of VAR model stability test are presented in Table 3.6. The results indicate that estimated VAR model with 6 lags is stable since no roots lie outside the unit circle.

Table 3.5

Test Results for VAR Model Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-34438.48	NA	823.1699	26.57830	26.59413*	26.58404
1	-34275.50	324.9581	753.8653	26.49035	26.61696	26.53623*
2	-34204.82	140.5297	741.3633	26.47363	26.71102	26.55966
3	-34158.59	91.68352	742.9486	26.47576	26.82394	26.60194
4	-34100.09	115.6868	737.5264	26.46843	26.92739	26.63475
5	-34041.91	114.7479	732.3239	26.46135	27.03109	26.66781
6	-33987.27	107.4637	729.1513*	26.45700*	27.13752	26.70361
7	-33950.37	72.37488	736.0002	26.46634	27.25764	26.75309
8	-33917.09	65.09440	744.9946	26.47847	27.38056	26.80537
9	-33872.43	87.11868	747.5078	26.48181	27.49469	26.84886
10	-33827.84	86.73779	750.0748	26.48522	27.60887	26.89241
11	-33780.60	91.62950	751.1198	26.48658	27.72101	26.93391
12	-33742.85	73.03200	757.6943	26.49525	27.84047	26.98274
13	-33709.57	64.19240	766.9762	26.50739	27.96339	27.03501
14	-33681.62	53.76491	779.5755	26.52363	28.09041	27.09140
15	-33644.44	71.32913*	786.7614	26.53275	28.21031	27.14066

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

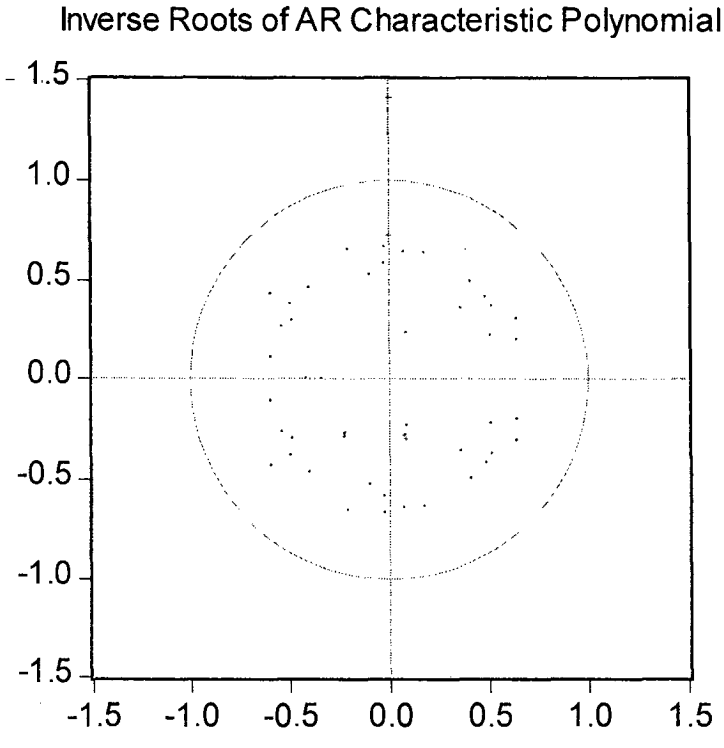
Table 3.6

Eviews 5.1 Output for Inverse Roots of Characteristic AR Polynomial of Estimated VAR Model

Root	Modulus	Root	Modulus
-0.591069 + 0.429586i	0.730689	-0.491568 + 0.378365i	0.620322
-0.591069 - 0.429586i	0.730689	-0.398796 - 0.460994i	0.609551
0.643594 + 0.304656i	0.712059	-0.398796 + 0.460994i	0.609551
0.643594 - 0.304656i	0.712059	-0.592485 - 0.107051i	0.602078
-0.206204 + 0.653919i	0.68566	-0.592485 + 0.107051i	0.602078
-0.206204 - 0.653919i	0.68566	-0.535753 + 0.263183i	0.596906
0.643791 - 0.197961i	0.673539	-0.535753 - 0.263183i	0.596906
0.643791 + 0.197961i	0.673539	-0.023928 + 0.585216i	0.585705
-0.021919 - 0.667269i	0.667628	-0.023928 - 0.585216i	0.585705
-0.021919 + 0.667269i	0.667628	-0.483211 + 0.295378i	0.56634
0.176447 + 0.636020i	0.660041	-0.483211 - 0.295378i	0.56634
0.176447 - 0.636020i	0.660041	0.513492 - 0.219988i	0.558631
0.075257 + 0.639951i	0.644361	0.513492 + 0.219988i	0.558631
0.075257 - 0.639951i	0.644361	-0.096306 + 0.525194i	0.533951
0.410850 + 0.493777i	0.64235	-0.096306 - 0.525194i	0.533951
0.410850 - 0.493777i	0.64235	0.363206 - 0.358317i	0.510205
0.486997 + 0.414937i	0.639796	0.363206 + 0.358317i	0.510205
0.486997 - 0.414937i	0.639796	-0.414805	0.414805
0.518538 + 0.370905i	0.637536	-0.338143	0.338143
0.518538 - 0.370905i	0.637536	0.086926 + 0.231163i	0.246966
-0.491568 - 0.378365i	0.620322	0.086926 - 0.231163i	0.246966
No root lies outside the unit circle.			
VAR satisfies the stability condition.			

Fig 3.1

Eviews 5.1 Output on Inverse Roots of AR Characteristic Polynomial



3.3.4 VAR Results for Forecast Error Variance Decomposition

The forecast error variance decomposition allows the relative importance of each market in generating unexpected variations in the returns of its own market and the other markets to be measured over different time horizons. Tables I-1 to I-7 in Appedix-I display the results of forecast error variance decomposition over different time horizon, obtained from the VAR system. These tables provide detail information that is useful in identifying the main channels of influence in the Asia emerging markets under study. Further, Table 3.7 and Table 3.8 provide the summary results of 1, 2, 5, 10 and 15 day ahead

forecast error variances of stock market returns into fractions that are accounted for by the innovations of different markets.

The 'innovations' in VAR system are the residuals in equations for each of the selected markets since it is that component of market return which is 'new' in the sense of not being predicted from past values of variables in the system. More specifically, the innovations in VAR equation below

$$\mathbf{RET_t} = \mathbf{C} + \sum_{k=0}^{p} \mathbf{A_k R_{t-k}} + \varepsilon_t$$

are defined as,

$$\varepsilon_t = RET_t - P[RET_t \mid RET_{t-1}, RET_{t-2}, \ldots]$$

where P denotes the linear least squares projection of RET_t in the space spanned by $[RET_{t-1}, RET_{t-2}, \ldots]$. The moving average representation of Eq. (2) enables us to trace out the reactions of international stock markets to news, $\varepsilon_{t,}$ in the form of unexpected developments in a national stock market. These innovations in Eq.(2) may be contemporaneously correlated such that the covariance matrix of innovations is not diagonal. Such contemporaneous correlation implies that a shock in one market may transmit to other markets through the innovations. It is customary to transform these correlations by orthogonalizing the innovations in VAR system by Cholesky decomposition according to pre-specified causal ordering so that the covariance matrix of the resulting innovations is diagonal. Following Janakiraman and Lamba [1998] we order the Asian markets in VAR system according to the market closing time with market closing first being given the priority in the system.

Table 3.7

Summary Results of Forecast Error Variance Decomposition for Sample Markets for 1, 2, 5, 10 and 15 day horizon

Variance Decomposition of RSP500:								
Period	**S.E.**	**RSP500**	**RKOSPI**	**RSSEC**	**RKLSE**	**RJKSE**	**RSET**	**RNIFTY**
1	1.099738	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	1.110306	98.22165	1.061486	0.034028	0.023249	0.019974	0.376366	0.263248
5	1.114347	97.71926	1.100122	0.123685	0.143846	0.112733	0.395278	0.405078
10	1.118596	97.11916	1.152510	0.275843	0.169886	0.187604	0.577261	0.517732
15	1.118641	97.11189	1.154145	0.276692	0.171392	0.187875	0.580011	0.517998
Variance Decomposition of RKOSPI:								
Period	**S.E.**	**RSP500**	**RKOSPI**	**RSSEC**	**RKLSE**	**RJKSE**	**RSET**	**RNIFTY**
1	2.215675	9.979414	90.02059	0.000000	0.000000	0.000000	0.000000	0.000000
2	2.240471	9.910958	88.25712	0.009543	0.695182	0.090929	0.967832	0.068434
5	2.260641	10.16656	86.91745	0.116997	0.956511	0.393994	1.355526	0.092960
10	2.279602	10.10648	85.61235	0.249616	1.614741	0.713442	1.532070	0.171303
15	2.279991	10.10407	85.58444	0.252511	1.622173	0.717406	1.546562	0.172840
Variance Decomposition of RSSEC:								
Period	**S.E.**	**RSP500**	**RKOSPI**	**RSSEC**	**RKLSE**	**RJKSE**	**RSET**	**RNIFTY**
1	1.442574	0.160096	0.145397	99.69451	0.000000	0.000000	0.000000	0.000000
2	1.445408	0.209433	0.228361	99.31524	0.092883	0.080550	0.030420	0.043115
5	1.456284	0.413027	0.349329	98.44095	0.204536	0.118155	0.112828	0.361175
10	1.462484	0.573643	0.418241	97.78119	0.382333	0.237889	0.130289	0.476413
15	1.462668	0.576304	0.421051	97.76011	0.388162	0.241470	0.132177	0.480721

Notes: (a) S. E. represents standard error

(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market.

(Contd...)

Table 3.7 (*Contd...*)
Summary Results of Forecast Error Variance Decomposition for Sample Markets for 1, 2, 5, 10 and 15 days horizon

Variance Decomposition of RKLSE:								
Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.613604	4.152847	3.603289	0.197539	92.04632	0.000000	0.000000	0.000000
2	1.621815	4.113555	3.758782	0.239219	91.49296	0.104917	0.250297	0.040269
5	1.659236	4.084262	4.499779	0.293431	89.21144	0.970973	0.631279	0.308841
10	1.672597	4.316738	4.484481	0.421989	88.42762	1.051985	0.930076	0.367114
15	1.673179	4.323655	4.485016	0.422806	88.40055	1.052179	0.947918	0.367873
Variance Decomposition of RJKSE:								
Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	2.263612	2.383017	4.845400	0.033226	3.690474	89.04788	0.000000	0.000000
2	2.361860	2.250292	6.611996	0.031995	5.676326	84.78616	0.609784	0.033446
5	2.382871	2.404231	6.664271	0.080677	6.197936	83.63944	0.890528	0.122912
10	2.418972	2.397197	7.539016	0.111340	6.619750	81.73839	1.435085	0.159218
15	2.420000	2.402786	7.536828	0.116201	6.646864	81.67503	1.457592	0.164701
Variance Decomposition of RSET:								
Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.865977	3.553461	8.089973	0.195266	7.572580	2.393369	78.19535	0.000000
2	1.888211	3.715678	8.805619	0.211901	7.465186	3.403508	76.39158	0.006533
5	1.908930	4.121703	9.370386	0.364108	7.554952	3.740494	74.80967	0.038686
10	1.920897	4.101688	9.652620	0.513152	7.666064	3.947705	73.97619	0.142577
15	1.921147	4.103581	9.651881	0.515841	7.668876	3.949003	73.96450	0.146319
Variance Decomposition of RNIFTY:								
Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.617497	3.254848	4.950167	0.301568	0.722921	0.932529	0.581879	89.25609
2	1.623697	3.468770	5.222459	0.299618	0.745522	0.925661	0.615510	88.72246
5	1.636654	3.805079	5.564272	0.491775	0.936384	1.006496	0.642082	87.55391
10	1.646514	3.767913	5.574906	0.650085	1.259241	1.169072	0.802928	86.77586
15	1.646739	3.769732	5.575635	0.652994	1.269228	1.169594	0.807827	86.75499

Notes: (a) S. E. represents standard error
(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market.

(a) Foreign market contribution to error variance in Asian emerging markets

The insight on integration of emerging Asian markets with each other can be obtained from the analysis of aggregate foreign market influence on individual Asian markets and further analysis of between market impact of innovations. Table 3.7 presents the percentage contribution of domestic and

foreign innovations to forecast error variance in each of the Asian market. The entries in 'Foreign Innovations' column denote total percentage forecast error variance in each market explained by all the other foreign markets including US market.

All the Asian emerging markets are found to be largely driven by their own innovations. The proportion of domestic innovation in forecast error variance of each of the Asian market ranges from 78.20% (least) at Day 1 for Thailand market to as high as 99.69% (highest) at Day 1 for Chinese stock market. Further, the percentage contribution of domestic innovations remain significantly higher at 2, 5, 10 and 15 Days horizons [approximately upto 75% (least) for Thailand market and over 97% (highest) for Chinese market]. The substantial contribution of domestic innovations exhibits opportunity for international portfolio diversification.

While the proportion of foreign markets in error variance of Asian markets remain relatively low, the Asian market display delayed reactions to innovations in foreign market. This is indicated by increasing percentage share of foreign markets in total forecast error variance in all the sample markets. The percentage share of foreign market innovations in the most endogenous Thailand market increases from 21.80% at day 1 to 26.04% at day 15. Also, even for the most exogenous Chinese market the percentage share of foreign market innovations increase from 0.31% at day 1 to 2.24% at day 15. Similarly, for the same horizon,

Table 3.8

Proportion of domestic and foreign innovations in forecast error variance of given Asian emerging market

Period	Domestic/Own Innovations (%)	Foreign Innovations (%)	Period	Domestic/Own Innovations (%)	Foreign Innovations (%)
SOUTH KOREA			CHINA		
1	90.02	9.98	1	99.69	0.31
2	88.26	11.74	2	99.32	0.68
5	86.92	13.08	5	98.44	1.56
10	85.61	14.39	10	97.78	2.22
15	85.58	14.42	15	97.76	2.24
MALAYSIA			INDONESIA		
1	92.05	7.95	1	89.05	10.95
2	91.49	8.51	2	84.79	15.21
5	89.21	10.79	5	83.64	16.36
10	88.43	11.57	10	81.74	18.26
15	88.40	11.60	15	81.68	18.32
THAILAND			INDIA		
1	78.20	21.80	1	89.26	10.74
2	76.39	23.61	2	88.72	11.28
5	74.81	25.19	5	87.55	12.45
10	73.98	26.02	10	86.78	13.22
15	73.96	26.04	15	86.75	13.25

the percentage share of foreign market innovations increase from 9.98% to 14.42% for South Korean market, from 7.95% to 11.60% for Malaysia, from 8.57% to 15.92% for Indonesia and from 7.49% to 9.48% for Indian stock market. This increase also highlights the fact that Asian markets experience delayed reactions to innovations in foreign markets.

Table 3.9 decomposes the forecast error variance in each of the sample market into contribution by aggregate foreign innovations and by Asian market innovations. It is observed that the innovations in Asian markets play relatively less role in explaining variance in South Korean market. The entire foreign market influence of 9.98% at day 1 in South Korean market comes from US market. Subsequently, though, from day 2 the South Korean market shows reaction to Asian market innovations which increased from 1.83% at day 2 to 4.32% at day 15, which constitute 30% of aggregate foreign market influence. For other Asian markets (except for China), however, the influence of regional market remain significant. In particular, the Asian regional markets collectively contribute significantly to forecast error variance in Thailand market; from 18.25% at day 1 to 21.94% at day 15. For Malaysia, the regional influence increases from 3.80% of its total error variance at day 1 (48% of total foreign market contribution) to 7.28% at day 15 (63% of total foreign market contribution). Likewise, for Indonesia, the innovations from Asian markets account for 8.57% at day 1 (78% of total foreign market contribution) to 15.92% at day 15 (87% of total foreign market contribution) and for India, 7.49% at day 1 (70% of total foreign market contribution) to 9.48% at day 15 (71.55% of total

Table 3.9

Decomposition of Forecast Error Variance of Each Sample Asian Market Into Domestic, All Foreign and All Asian Market Innovations

Day	Domestic Innovations (%)	Foreign Innovations (%)	All Asian Market Innovations	Domestic Innovations (%)	Foreign Innovations (%)	All Asian Market Innovations
	SOUTH KOREA			CHINA		
1	90.02	9.98	0.00	99.69	0.31	0.15
2	88.26	11.74	1.83	99.32	0.68	0.47
5	86.92	13.08	2.91	98.44	1.56	1.15
10	85.61	14.39	4.28	97.78	2.22	1.65
15	85.58	14.42	4.32	97.76	2.24	1.66
	MALAYSIA			INDONESIA		
1	92.05	7.95	3.80	89.05	10.95	8.57
2	91.49	8.51	4.40	84.79	15.21	12.96
5	89.21	10.79	6.71	83.64	16.36	13.96
10	88.43	11.57	7.25	81.74	18.26	15.86
15	88.40	11.60	7.28	81.68	18.32	15.92
	THAILAND			INDIA		
1	78.20	21.80	18.25	89.26	10.74	7.49
2	76.39	23.61	19.89	88.72	11.28	7.81
5	74.81	25.19	21.07	87.55	12.45	8.64
10	73.98	26.02	21.92	86.78	13.22	9.45
15	73.96	26.04	21.94	86.75	13.25	9.48

Notes: (a) Entries in "All Asian Market Innovation" is sum total of forecast error variance of given market explained by all Asian markets taken together.
(b) The forecast error variance decomposition has been standardized for each of the explained market so that the total error variance sums to 100 per cent.

foreign market contribution). For Indian market thus, the contribution of Asian market innovations remain relatively stable over different horizon. The Chinese market display considerable degree of exogeneity in terms of absorbing shocks from other Asian markets as they account for significantly lower proportion of

total forecast error variance in Chinese stock market. It is a negligible 0.15% at 1 day horizon which increases to maximum of 1.66% at day 15.

(b) Inter-Market Linkages among Asian Emerging Markets

The inter-market linkages among sample Asian emerging markets have been analysed using summary results of forecast error variance decomposition obtained from VAR system. While doing so, the concentration is on integration dynamics of only Asian markets excluding the impact of US stock market. The analysis of integration of Asian emerging markets with US stock market is discussed separately.

South Korea

The South Korean market exhibits properties of leading market in the region. A leading market is one that substantially influences other markets while does not get itself influenced substantially by other markets. On day 1, none of the Asian markets contribute to the forecast error variance of South Korean market. On day 2, the Asian markets account for merely 1.84% of its total forecast error variance. Further this contribution increases marginally on day 5 to 2.91% with major part of it coming from Thailand market (1.36%). The analysis of day 10 to day 15 also indicates that though there is some degree of delayed response observed, the overall contribution of Asian markets to variance in South Korean market remains substantially low.

On the other hand South Korean market contributes significantly to forecast error variance of other Asian markets except Chinese stock market. The maximum contribution of South Korean market comes to forecast error variance of Thailand stock market (from 8.09% on day 1 to 9.37% on day 5 and subsequently to 9.65% on other horizons). The other markets significantly impacted by South Korean market are Indonesia (4.84% on day 1 to over 7.50% for day 10-15), India (4.95% on day 1 to over 5.57% for day 10-15) and Malaysia (3.60% on day 1 to about 4.50% for day 10-15). South Korea thus is found to have widespread impact on other regional markets.

China

Chinese stock market is the most exogenous market in the Asian region. The Chinese market neither absorbs foreign market innovations significantly nor does it impact other regional markets significantly. On day 1 99.69% of its error variance is explained by its own innovations. The impact of domestic innovations remains strong in explaining its error variance even at subsequent horizons (least of 97.76% at 15 days horizon). Even the most influential South Korean market accounts for negligible 0.23% of its error variance on day 2 which increases to maximum of 0.42% at 10-15 days horizon. The Indian stock market has equivalent explanatory power in accounting for error variance in Chinese stock market. The innovations in Chinese stock market account for maximum of 0.25% of error variance in South Korean market, 0.42% in Malaysian market, 0.11% in Indonesian market, 0.52% in Thailand and 0.65% in Indian stock

market. The explanatory power of innovations in Chinese stock market remains significantly lower.

Malaysia

The domestic innovations account for 92.05% of error variance in Malaysian stock market which subsequently reduces to 89.21% for 5 days period and subsequently to marginally above 88% at 10-15 days horizon. Overall, the domestic innovations account for substantial proportion of its error variance. Among Asian markets, the South Korean market contributes significantly to its error variance, where the proportion ranges from 3.60% at day 1 to about 4.50% at subsequent horizons. The next highest contribution from regional market comes from Indonesian market which remains insignificant at 1.05% at 10-15 days period.

The Malaysian stock market however, shares significant linkages with Indonesian and Thailand stock markets. The innovations in Malaysian stock market account for 3.69% of error variance of Indonesian stock market on day 1 and further to 5.68% at day 2. This proportion reaches its maximum of 6.65% at 15 days horizon. Similarly, it accounts for 7.57% of error variance in Thailand market on day 1 and 7.67% at 10 and 15 days horizon. This impact of innovations in Malaysian market on Thailand market is even more than that of US market.

Indonesia

The domestic innovations account for 89.05% of error variance in Indonesian market at day 1 which reduce to 84.79% on day 2 and subsequently to 81.68% at 15 days horizon with impact of other Asian markets becoming significant in explaining its error variance. South Korean market explains 4.85% of variance in Indonesian market on day 1 which increases to 6.61% on day 2 and further to 7.54% at 15 days horizon. The other important market that explains variance in Indonesian market is Malaysia which explains 3.69% of its error variance on day 1 and 6.65% at 15 days horizon. South Korea and Malaysia account for almost complete (8.54%) Asian market influence on error variance in Indonesian market at day 1 and continue to explain significantly on other horizons.

Thailand

Thailand is the most endogenous market in the Asian region although its domestic innovations account for significant amount of its error variance at all the horizons. For instance, at day 1, the domestic innovations explain 78.20% of error variance in Thailand market which reduce to 76.39% at day 2 and subsequently to 73.96% at 15 days horizon. However, Thailand market is significantly affected by innovations in South Korean, Malaysian and Indonesian markets. Innovations in South Korea account for 8.09% of error variance in Thailand market at day 1 and this proportion remains significant at 9.65% at 10-15 days horizon. Similarly, innovations in Malaysian market account for over 7%

of error variance in Thailand market at different horizons. Indonesian market contributes to maximum of approximately 4% of its error variance although at day 1 it is relatively lower at 2.39%.

The linkages between stock markets of South Korea, Malaysia and Indonesia and the Thailand market is essentially one way, i.e., these markets impact Thailand market significantly while the reverse is not true. Innovations in Thailand market contribute insignificantly to forecast error variance in the above markets (maximum of 1.55% for South Korea, 0.94% for Malaysia and 1.46% for Indonesia).

India

The Indian market is also significantly affected by domestic innovations which account for 89.26% of its error variance at day 1. This proportion remains significantly higher at all the other subsequent horizons (minimum of 86.75% at day 15). Among all the other Asian markets, only South Korean market exhibits significant linkages with Indian stock market. The innovations in South Korean market account for 4.95% of error variance in Indian stock market at day 1 and above 5% at all the other horizons. Besides, innovations in Indian stock market contribute insignificantly to forecast error variance in other Asian markets (maximum of 0.52% for Chinese market).

3.3.5 Impulse Response Analysis for Asian Markets

From the estimated VAR system, the dynamic responses of each of the markets in the system to innovations in a particular market can be traced out over a defined time horizon using simulated responses of the VAR system. This practice is referred to as impulse response analysis and enables additional insight into the mechanism of the international transmission of stock market movements. If markets are inefficient in the transmission of new information, investors may be able to profit on the lag between leading and lagging markets. The impulse responses of the markets in the VAR model to a typical shock of one standard error in a particular market are analyzed. The speed with which the innovations in a particular market are transmitted to the other markets in the system indicates responsiveness of markets and the efficiency with which new information, or innovations, are transmitted between markets. Further, the size of a market's response to a shock in a particular market indicates how influenced that market is. While the forecast error variance decomposition reveals how strongly the markets are linked, the impulse response analysis can be used to further examine these linkages and the efficiency with which innovations are transmitted between markets.

The information from the forecast error variance decomposition can be used to help determine on which markets to analyze the effect of a shock. There is actually, a little to be gained from studying the impact of shocks in a market that exerts only a minor influence on the other markets in the system. Therefore, the findings in respect of impulse response analysis are presented below in a

more general framework focusing prominently on markets sharing significant linkages, as identified through forecast error variance decomposition analysis. The impulse responses of each of the sample markets to shock of one standard error in other markets are presented in Appendix-II from Table II-1 through Table II-7.

(i) Fig 3.1 shows the impulse response analysis results graphically for all the sample Asian emerging markets as well as US market. Overall, it is observed that all the Asian markets respond significantly to shocks originating in domestic markets. These findings are in line with conclusions drawn from forecast error variance decomposition. The size of response to domestic innovations remains significantly high at 2.10 for South Korea on day 1, 1.44 for China, 1.55 for Malaysia, 2.14 for Indonesia, 1.65 for Thailand and 1.53 for Indian stock market.

All the responses are within the confidence band thereby indicating that there is no overreaction in the markets.

(ii) Fig 3.2 shows that the innovations in South Korean stock market are rapidly transmitted in all the sample Asian emerging markets (except China) with markets responding to the shocks on the same day. The size of the response of Asian markets to unit shock in South Korean market are also large on day 1 (0.31 for Malaysia, 0.50 for Indonesia, 0.53 for Thailand and 0.36 for Indian stock market), reflecting strong influence of South Korean stock market on Asian markets. The size of response

Fig. 3.1

Impulse Responses of Sample Stock Market to One Standard Error Shock in Other Markets

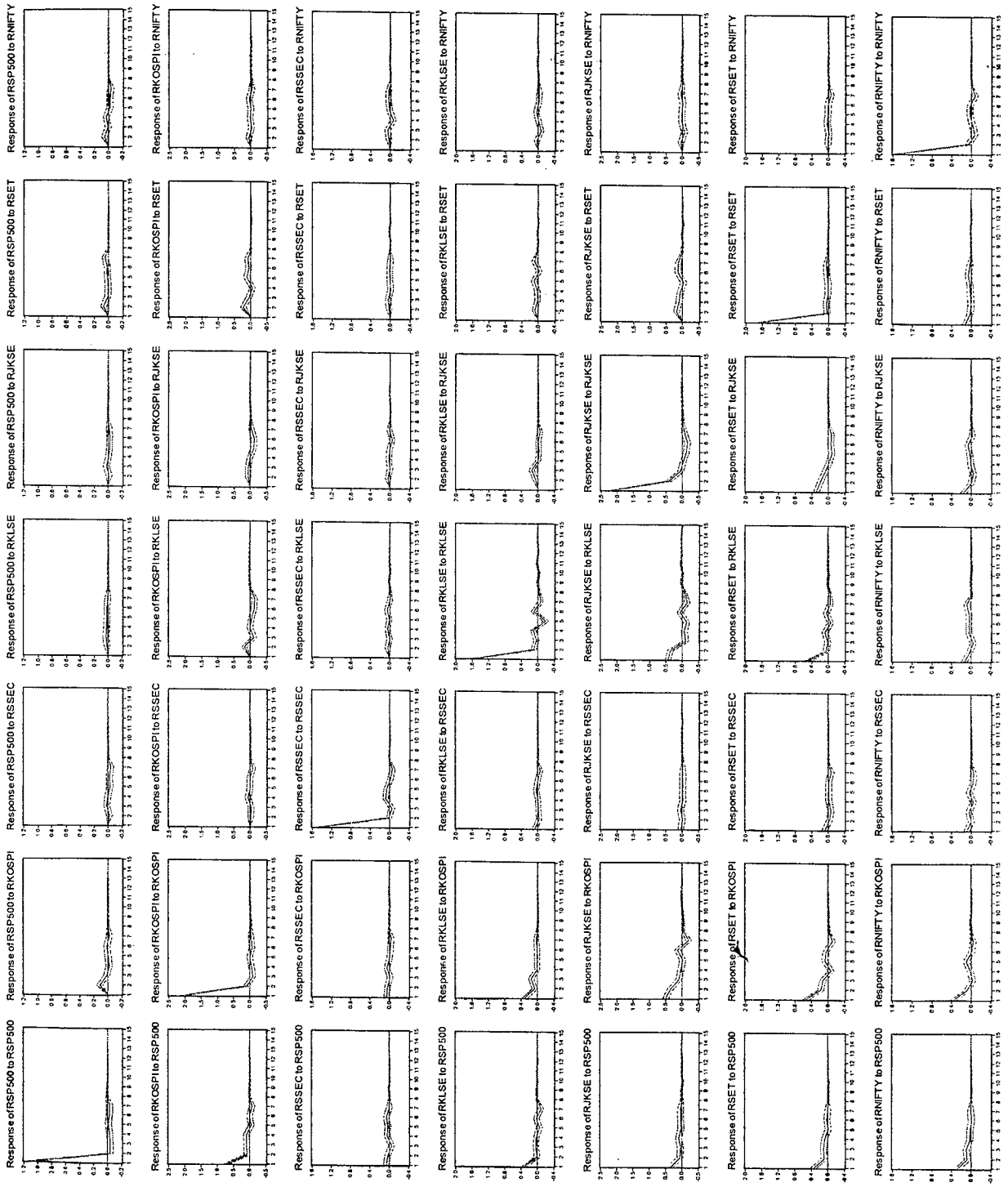
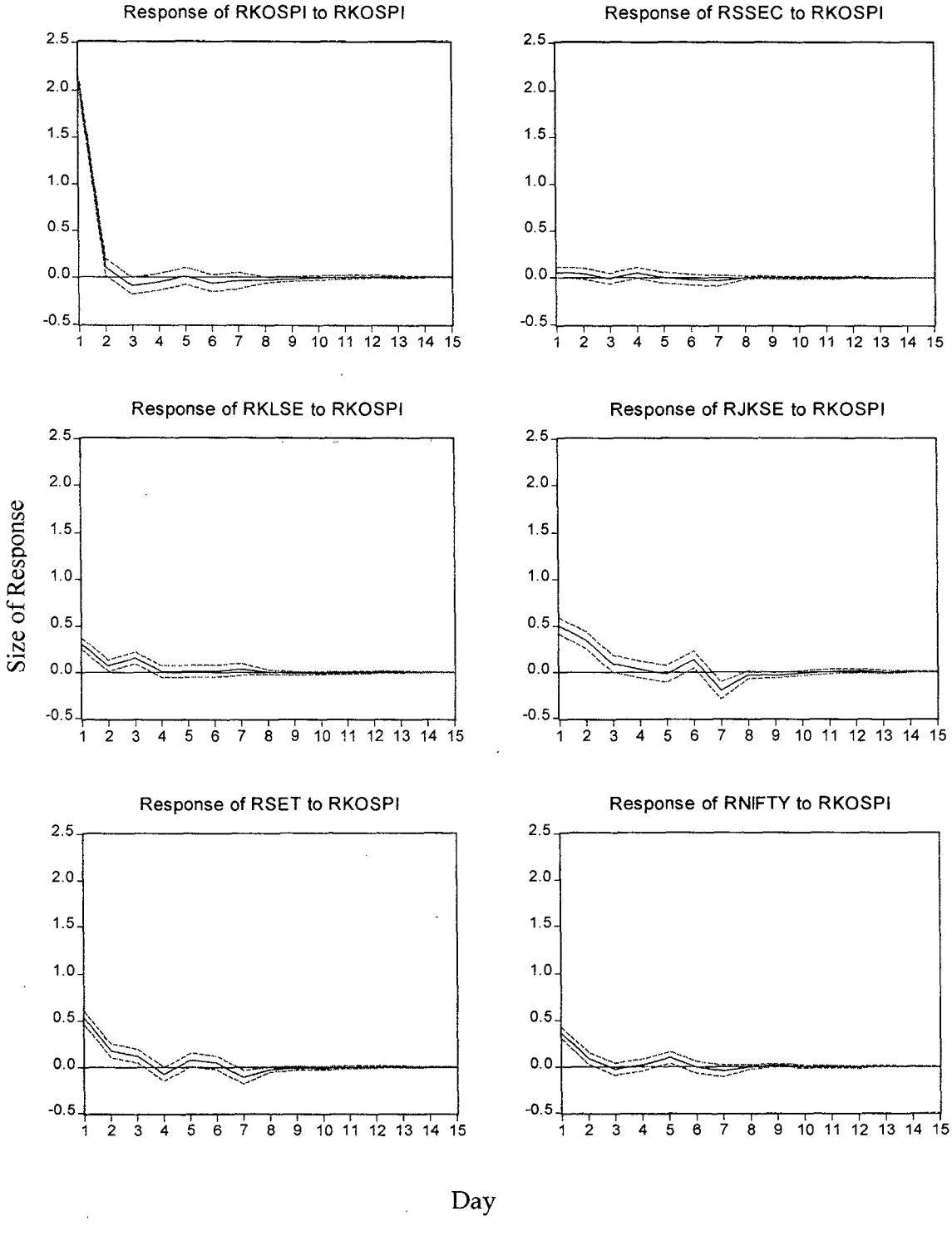


Fig. 3.2

Response of Sample Asian Stock Markets to Shocks Originating in South Korean Markets



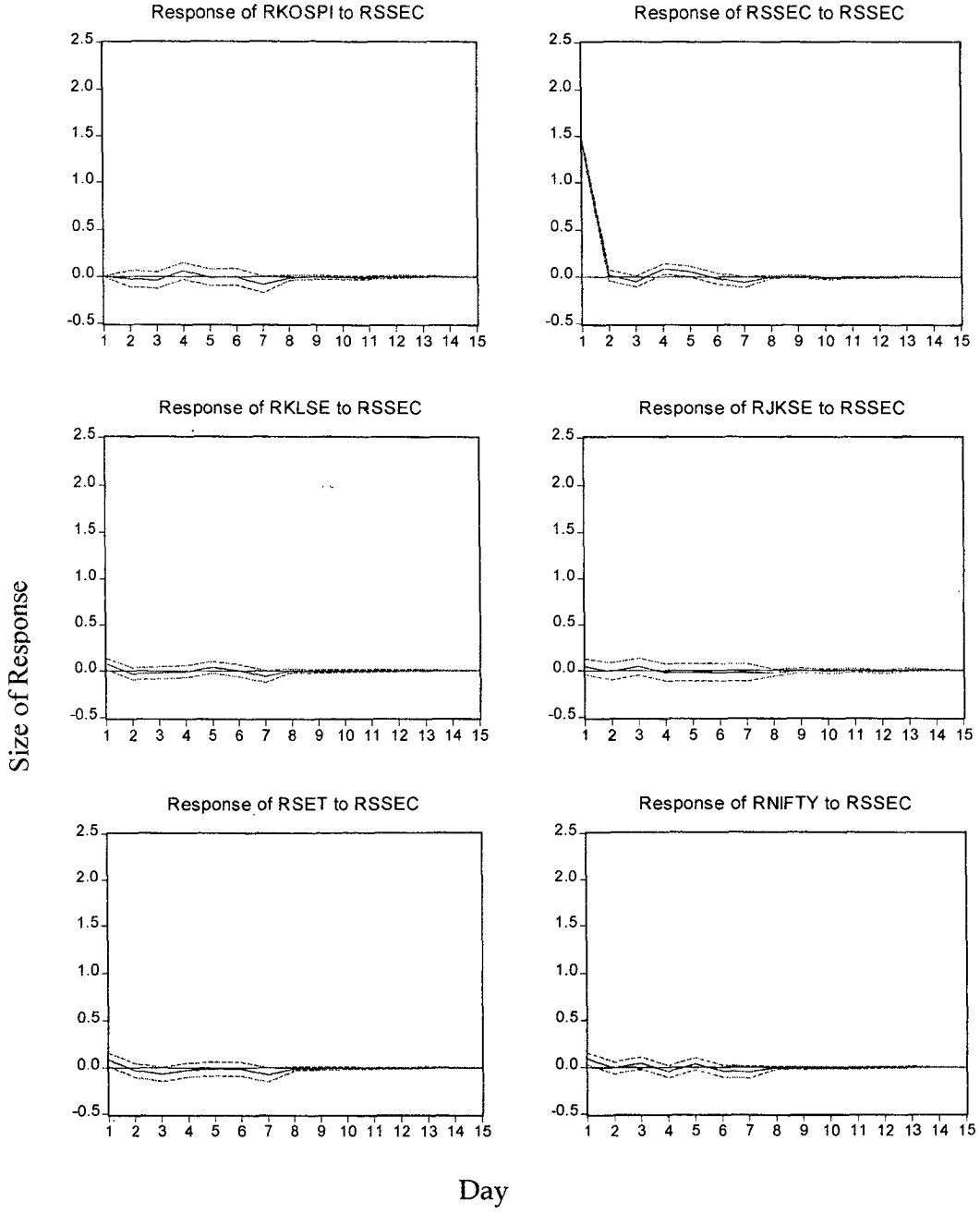
however reduces significantly for most markets on subsequent days although the responses taper off to zero after about 8 to 10 days. The impact of shock remains significant for Indonesian market on day 2 at 0.35 while for others it is less than 0.20. In terms of absorbing shocks from other Asian markets, it is observed that the South Korean market reacts to one standard error shock in Malaysia and Thailand on day 2 (0.19 and 0.22 respectively). Given that these markets operate in the same time zone this reaction can be considered as delayed reaction. At the same time the size of response is much less compared to the size of response of Asian markets to shock in South Korean market. For all other Asian markets the response of South Korean market remains low (less than even 0.10). These findings thus reveal dominant position of South Korean market among all Asian markets in influencing other regional markets.

(iii) Fig 3.3 shows the response of Asian emerging markets to one standard error shock in Chinese stock market. One unit shock to Chinese market produces negligible response (less than even 0.10) in other Asian markets. The highest response, though insignificant, to shock in Chinese stock market is experienced by Indian market at day 1 (0.08). Similarly, Shocks to other Asian markets do not create significant impulse response in Chinese stock market. In addition to forecast error variance decomposition analysis, these findings further confirm that Chinese stock market is inefficient in absorbing innovations in other Asian stock

markets. Therefore, it provides maximum opportunities for profitable diversification.

Fig. 3.3

Response of Asian Stock Market to Shocks Originating in Chinese Stock Markets



(iv) The forecast error variance decomposition analysis revealed significant linkages among Malaysia, Indonesia and Thailand stock markets. Within this group Malaysian market emerged as significant market. The impulse response analysis for these three markets is presented in Fig 3.4 to Fig 3.6 which further confirm the findings of forecast error variance decomposition. The size of response of Indonesian market to shock in Malaysian market is 0.43 on day 1 and remains high at 0.36 on day 2. Similarly, for Thailand it is 0.51 on day 1. On the other hand the size of response of Malaysian stock market to shock in Indonesia and Thailand market is relatively much lower and delayed (0.15 on day 3 and 0.10 on day 5 for Indonesia and Thailand markets respectively). Indonesian market shows small but lagged responses to shocks in Thailand market at 0.18 on day 2, 0.13 on day 6 and 0.12 on day 7. Thailand market on the other hand shows efficiency in absorbing shocks from Indonesian market which is 0.29 on day 1 and 0.19 on day 2. Subsequently, the responses remain significantly lower.

(v) Fig 3.7 presents impulse response analysis for Indian stock market. Indian stock market opens after all the other Asian markets close. Therefore, the markets absorbs shocks from other Asian markets and significantly from South Korea (0.36 on day 1). The response to shocks in other Asian markets is low and typically less than 0.20 (Malaysia 0.14, Indonesia 0.16 and Thailand 0.12 on day 1). Further, the response quickly fall significantly after the initial shock.

Fig. 3.4

Response of Malaysian, Indonesian & Thailand Stock Market to Shocks Originating in Malaysian Market

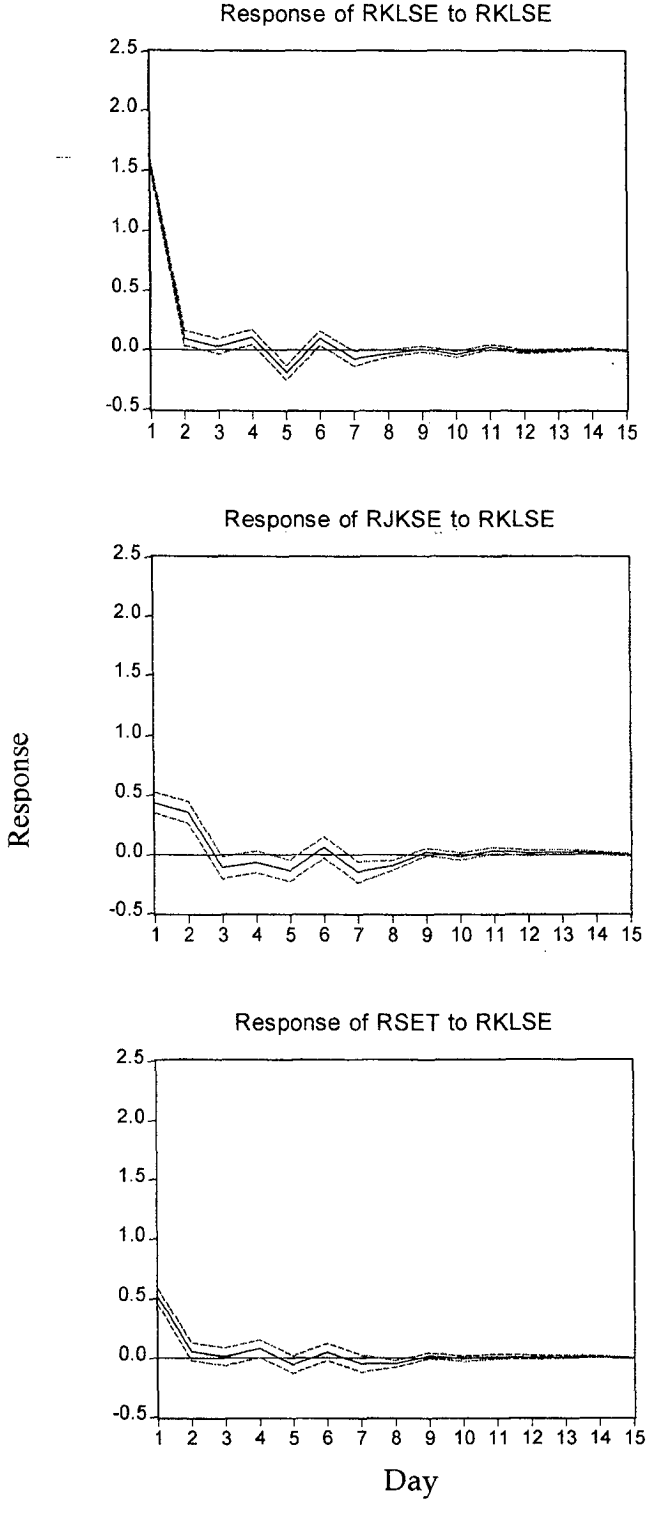


Fig. 3.5

Response of Malaysian, Indonesian & Thailand Stock Markets to Shocks Originating in Indonesian Market

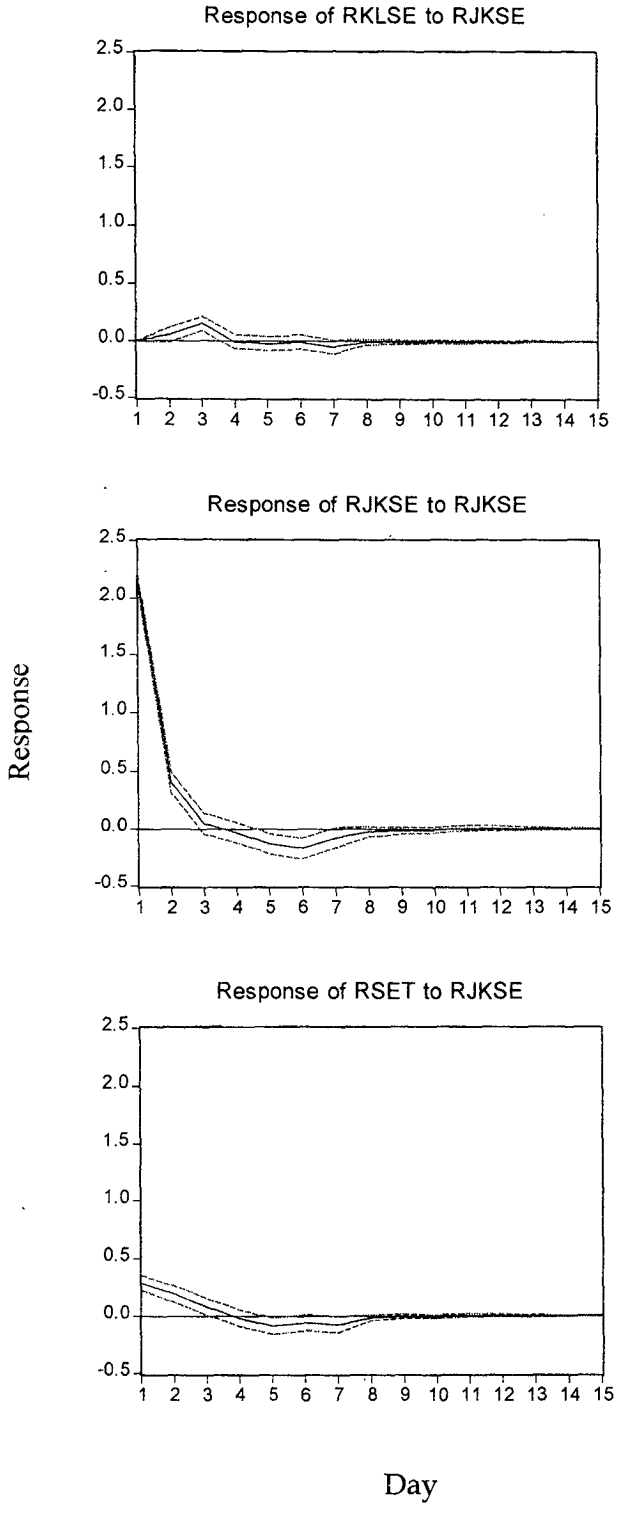


Fig. 3.6

Response of Malaysian, Indonesian & Thailand Stock Market to Shocks Originating in Thailand Market

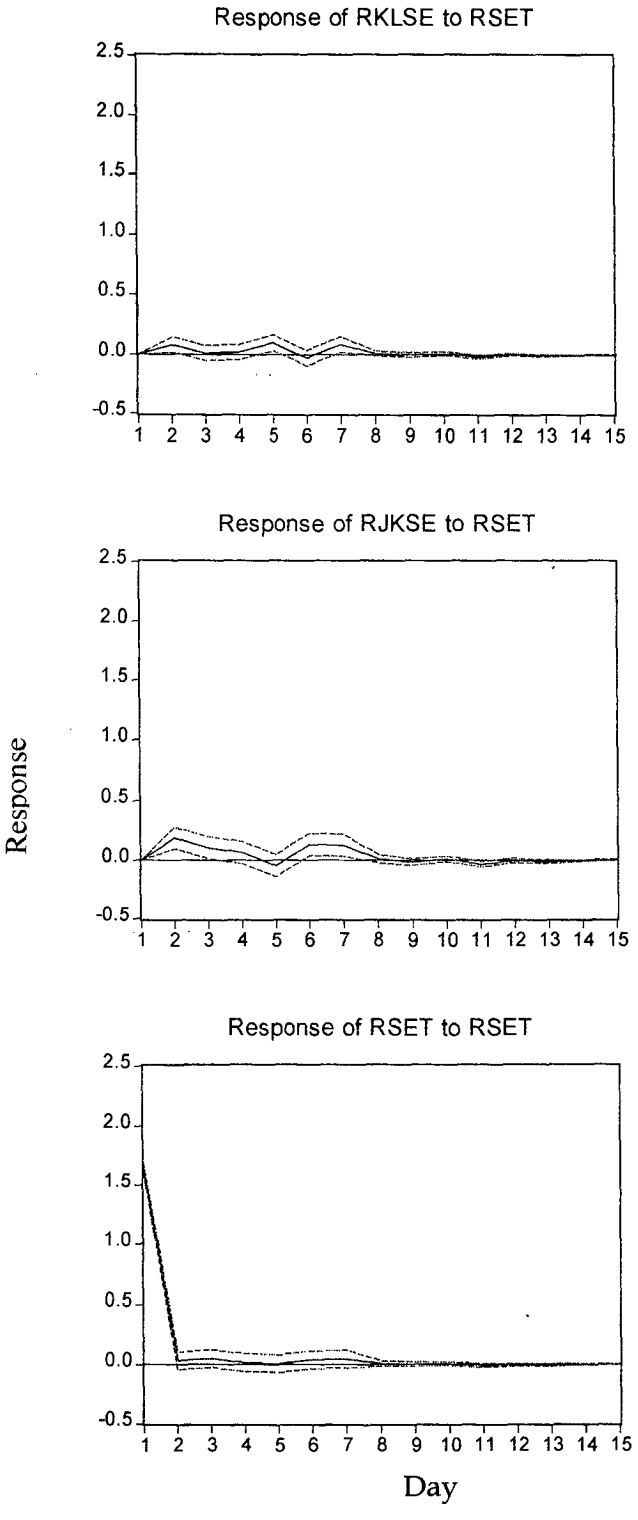
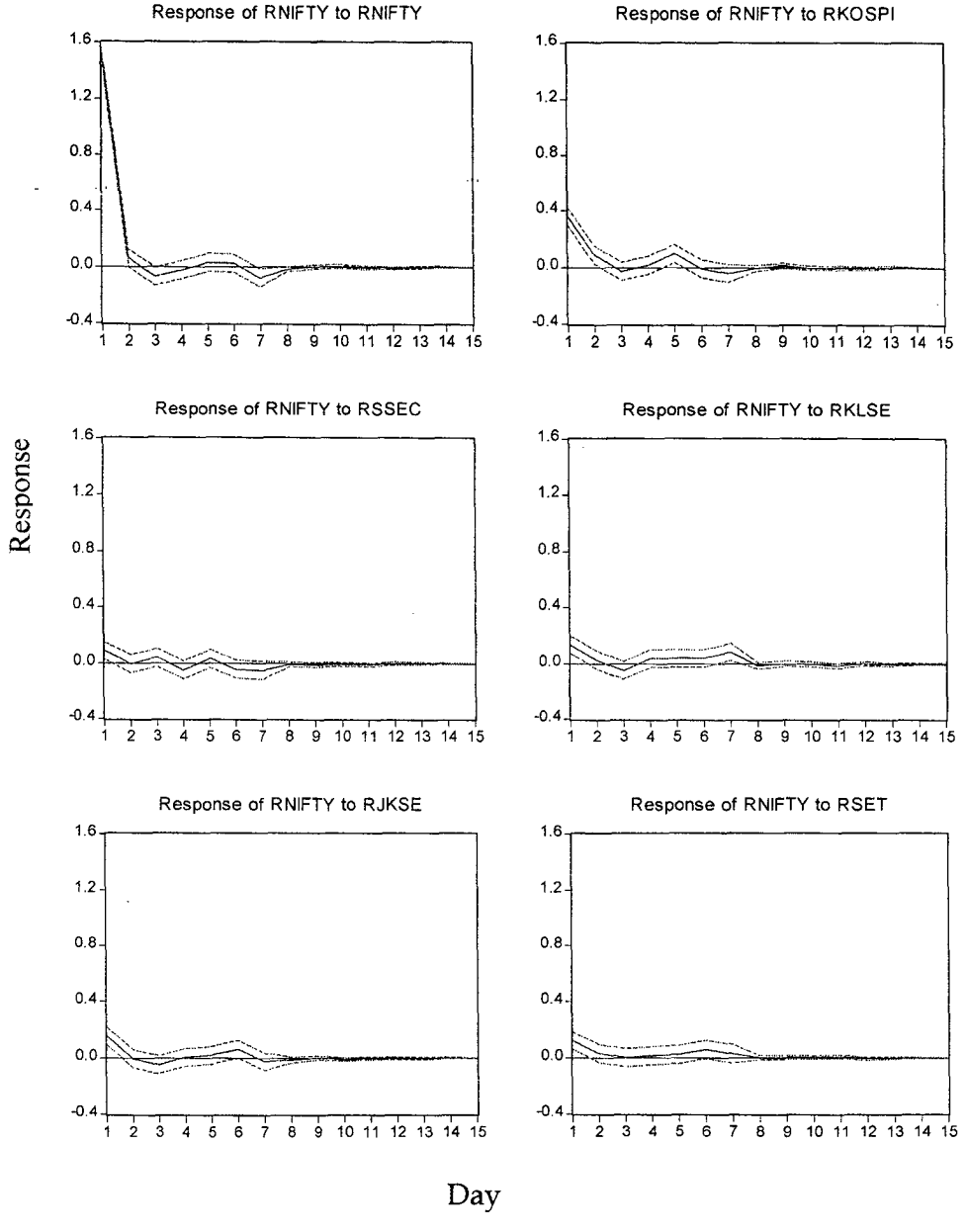


Fig. 3.7

Response of Indian Stock Market to Shocks Originating in Asian Markets



In general, it is observed that among all the Asian markets under study, the South Korean market plays dominant role in causing impulse response among other markets in the region. The Chinese market on the other hand

indicates marked inefficiency in responding to or causing responses in other markets in the emerging Asian region. While for the rest, the magnitude of the responses from each of the markets differ, depending upon the market experiencing the shock, the pattern is much the same. There is quick response on day 1, falling rapidly thereby, and then fluctuating mildly around zero until around 8 to 10 days at which point the response effectively becomes zero.

3.3.6 Dynamic Linkages Between Asian Emerging Markets and Developed Market of US

Literature has proved US market as one of the most influential market for other developed and emerging markets in the world. This section discusses various aspects of dynamic linkages between Asian emerging markets unders study and developed market of US. The analysis again focuses on interpreting results of forecast error variance decomposition and impulse response analysis.

i) Results of forecast error variance decomposition for US market

Table 3.10

Contribution of Domestic and Asian Markets to Forecast Variance in US Market

Day	Contribution of Domestic (US) Innovations	Contribution of Asian Markets Innovations
1	100%	0%
2	98.22%	1.78%
5	97.72%	2.28%
10	97.12%	2.88%
15	97.11%	2.89%

Table 3.11

Contribution of US Innovations to Forecast Variance in Asian Markets

Day	S. Korea	China	Malaysia	Indonesia	Thailand	India
1	**9.98%**	**0.16%**	4.15%	2.38%	3.55%	3.25%
2	**9.91%**	**0.21%**	4.11%	2.25%	3.71%	3.47%
5	**10.17%**	**0.41%**	4.08%	2.40%	4.12%	3.81%
10	**10.11%**	**0.57%**	4.32%	2.40%	4.10%	3.77%
15	**10.10%**	**0.58%**	4.32%	2.40%	4.10%	3.77%

The results of forecast error variance decomposition for US market clearly shows that none of the Asian emerging market significantly contribute to forecast error variance of US stock market. On day 1, 100% of its error variance is accounted for by its own innovations and the magnitude of contribution of domestic innovations remains significantly high at over 97% for all the horizons. The maximum contribution to its error variance comes from South Korean market from day 2 which is barely 1.06% and reaches to maximum of 1.15% for day 7 to 15.

So far as the contribution of US market innovation to error variance in Asian markets is concerned, the results indicate that US stock market has largest impact on South Korean market. The one day lagged innovation contribute about 10% to error variance in South Korean market on day 1 and maximum of 10.17% on day 5. The innovations in US market do not have significant contribution to error variance in Chinese stock market (maximum of 0.58% at day 15). The contribution of US market to error variance of Malaysian, Thailand

and Indian markets is around 4%. The impact of US market innovations is found to be widespread across Asian markets although not of higher magnitude. In fact for Indonesian, Thailand and Indian stock markets, the contribution of US market innovations to their error variance is less than that of South Korean market innovations and similar to it in case of other markets.

ii) Analysis of Impulse Response Functions for US Market

The results of impulse response analysis for US stock markets are presented graphically in Fig 3.8 and Fig 3.9. The results of impulse response analysis also indicate that US market reacts significantly to its own shocks (1.10). Interestingly, US market shows lagged reaction to Asian markets and is found to react (although marginally) to shocks in South Korea (0.11), Thailand (0.07) and India (0.06). However, this lagged reaction does not indicate inefficiency in absorbing shocks since the only day US stock market can react to the shocks in Asian market is the next day when it opens after the close of all the Asian markets, the previous day. The responses are not large enough and quickly fall to around zero the next day.

Fig. 3.8

Response of Asian Stock Market to Shocks Originating in US Stock Market

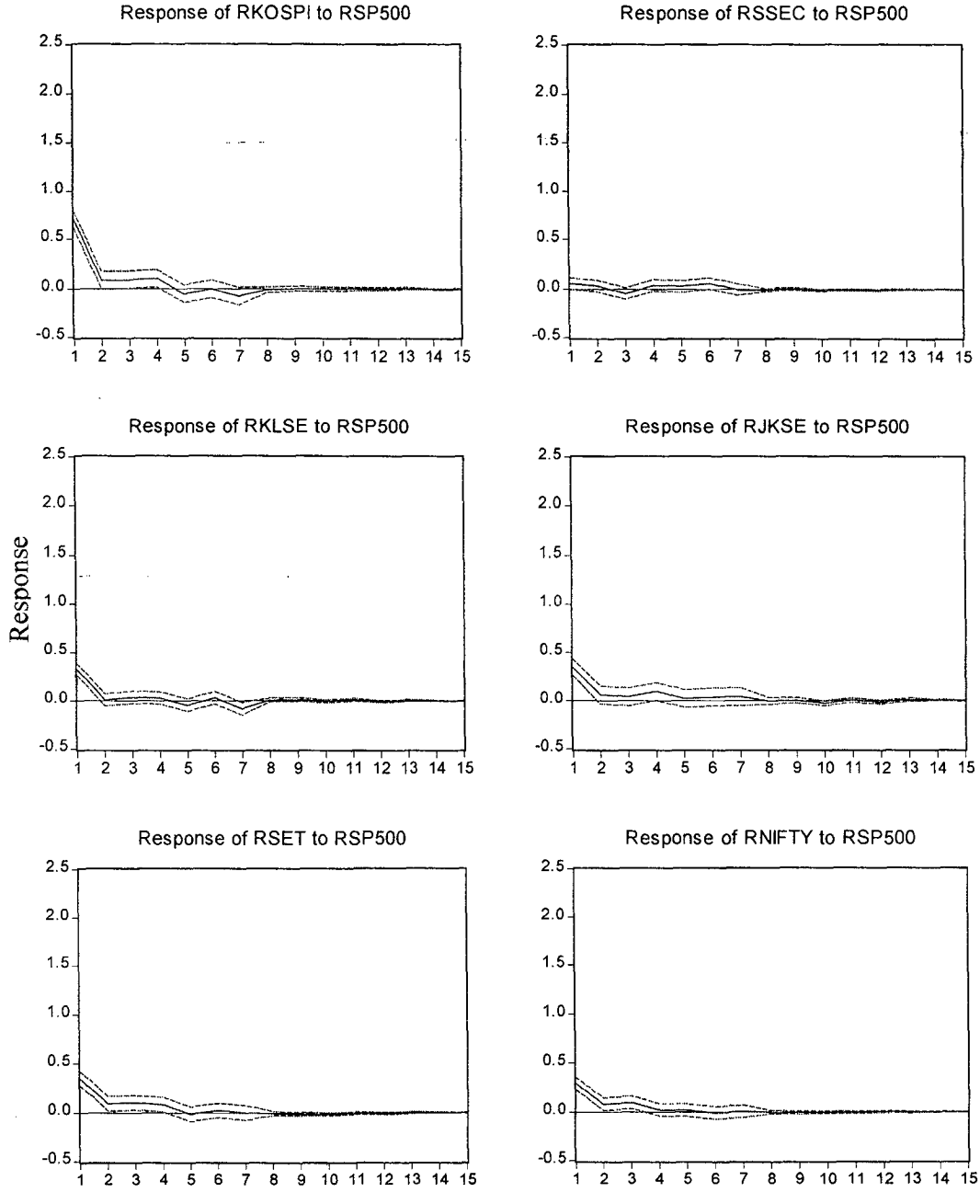
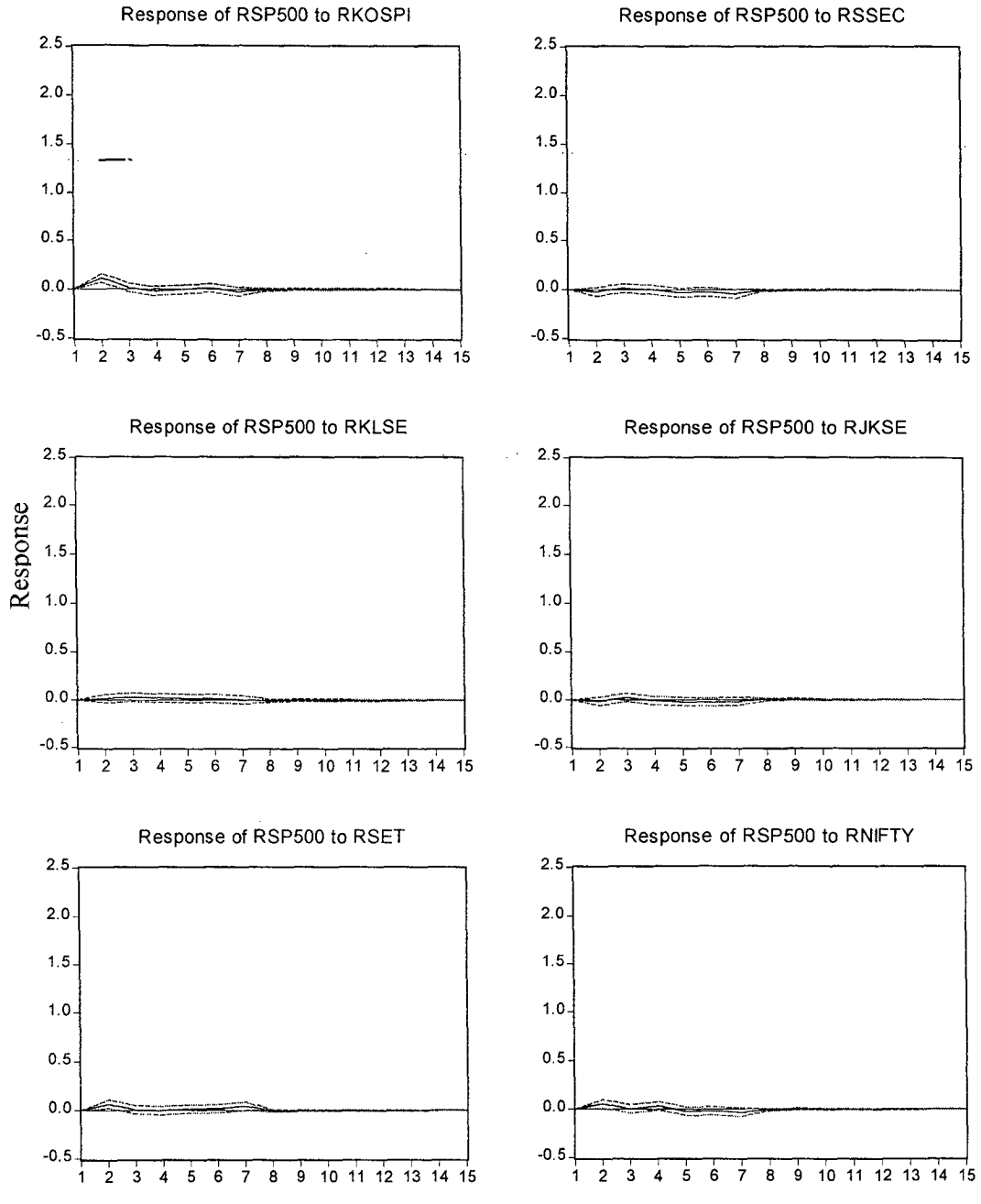


Fig. 3.9

Response of US Stock Market to Shocks Originating in Asian Stock Market



The results of forecast error variance and impulse response analysis broadly point to the fact that Asian emerging stock markets are largely driven by their own domestic innovations. At the same time, Asian equity market are not completely isolated markets. The evidence indicate that Asian markets are moving towards regional integration. The contribution of Asian markets to variance in other regional markets is more pronouncing than even that of US Stock Market at least in respect of some of the markets.

The markets within the region exhibit heterogeneous characteristics. China is the most isolated market in the regional while Thailand is the most exogenous market. South Korean Stock Market exhibit properties of leading market within the set of Asian emerging markets. Further noticeable linkages exist among three Asian Stock Markets of Thailand, Indonesia and Malaysia.

The existence of differing integration dynamics across markets calls for differing asset allocation strategies across Asian emerging markets.

Chapter Four

IMPACT OF MACRO-ECONOMIC FACTORS ON SHARE PRICES IN INDIA

CHAPTER FOUR

IMPACT OF MACRO-ECONOMIC FACTORS ON SHARE PRICES IN INDIA

A number of studies conducted in developed markets provide substantial evidence that share returns fluctuate with changes in macroeconomic variables. Therefore, aggregate equity prices are expected to have strong relationship with macroeconomic variables. The argument suggests that the intrinsic value of equity shares depends on the present value of dividends which is distributed out of company earnings; these earnings are influenced by real economic activities and, therefore, there should be a relationship between economic fundamentals and share prices. However, it remains to be observed whether the argument holds true in the context of emerging markets too. Compared to their developed counterparts, the emerging markets are smaller in size and relatively less liquid. Further, the investor perception in emerging markets may be different from those in developed markets and thus the behavior of market prices of equities may be driven by the speculative activities of irrational investors rather than economic fundamentals. Further, the existing literature on developed as well as emerging markets reveal that the role of macroeconomic factors in determining stock price returns has been studied largely using single composite stock market index. It is well known, a composite stock index includes stocks from different sectors and there is a possibility that macroeconomic variables may affect different sectors differently.

Considering the two significant sectors of Indian economy viz. manufacturing and financial services sectors, the research addresses the following issues: **(A)** Does the long-run relationship exists between macroeconomic variables and stock prices in manufacturing and financial services sectors in emerging Indian market? **(B)** Is there any significant difference between macroeconomic factors affecting stock returns in manufacturing sector and those in financial services sector? **(C)** Is there any significant difference observed in relationship between share prices in sub-sectors of manufacturing sector and macroeconomic variables?

The principal method employed to analyse impact of macroeconomic variables on sectoral indices is the Johansen's multivariate cointegration analysis developed in Johansen (1988) and applied in Johansen and Juselius (1990). This methodology has become a well established methodology to test the long-run relationships among variables. The first step in this process is to test for stationarity in the time series of variables being considered for examining long-run equilibrium relationship. The stationarity test provides the evidence on the order of integration of the variables. For this purpose, popular Augumented Dickey-Fuller (ADF) test for unit root is used. Once the order of integration is determined, cointegration analysis is undertaken to determine whether time series of indices and macroeconomic variables display a stationary process in a linear combination. For this purpose Johansen's (1991) method of multivariate cointegration is employed. A finding of cointegration implies existence of a long-term relationship between the market index and the macroeconomic variables.

For this purpose there has to be at least one cointegrating relationship among the variables.

4.1 Results of Unit Root Test

The results of the stationarity test are presented in Table 4.1. The first column displays the variables included for cointegration analysis; the second

Table 4.1

Panel A: ADF Test Results for Selected Aggregate and Sectoral Indian Stock Market Indices

Variable	Intercept t-Stat	Trend & Intercept t-Stat
LNIFTY	0.568330	-1.017862
LCOSPIMFG	1.166432	-1.587096
LCOSPITEX	-0.87795	-1.535288
LCOSPICHEM	0.782407	-1.774505
LCOSPITEL	0.800703	-0.835502
LCOSPIFB	0.496745	-1.434076
LCOSPIFINSERV	0.797347	-1.146787
ΔLNIFTY	-12.13866*	-12.34022*
ΔLCOSPIMFG	-11.22660*	-11.62957*
ΔLCOSPITEX	-9.860990*	-10.63474*
ΔLCOSPICHEM	-11.59209*	-11.86990*
ΔLCOSPITEL	-11.01105*	-11.16390*
ΔLCOSPIFB	-12.57893*	-12.70512*
ΔLCOSPIFINSERV	-12.51181*	-13.11291*

Table 4.1

Panel B: ADF Test Results for Selected Macroeconomic Variables in Indian Context

Variable	Intercept t-Stat	Intercept & Trend t-Stat
LIIP	3.246247	1.026277
LM3	-0.071223	-2.686561
LCPI	-1.628353	-2.795027
LER	-2.921390**	-1.600355
LINTOIL	-0.094902	-1.765753
LFDI	-0.906245	-1.707665
ΔLIIP	-2.671251***	0.0140**
ΔLM3	-6.256098*	-6.278400*
ΔLCPI	-7.873531*	-6.370070*
ΔLER	-8.955636*	-9.433737*
ΔLINTOIL	-10.42632*	-10.43375*
ΔLFDI	-14.40691*	-14.50337**

Notes:(a) MacKinnon (1996) Critical values used for testing of unit root hypothesis. Crital values are -3.48, -2.88 and -2.58 at 1%, 5% and 10% respectively for test with intercept and -4.02, -3.44 and -3.15 at 1%, 5% and 10% respectively for test with trend and intercept.

(b) *, **, *** represents significance at 1%, 5% and 10% respectively.

column reports the ADF test statistic when a constant (intercept) term is only included in the ADF model as a deterministic regressor while the third column shows the results when both a constant term (intercept) and a time trend are

incorporated in the model. All the index variables are found to be non-stationary at levels and stationary at first difference. Likewise, IIP, Money Supply, Inflation, International Oil Prices, and FDI are also found to be integrated of order one, I(1). Exchange Rate is I(0) when only constant term is included as deterministic regressor in ADF model while it is I(1) when constant and trend is incorporated in ADF model. However, the AIC value is least in constant only model for ADF test and therefore it is considered that Excahnge Rate is I(0) variable. According to Hansen and Juselius (2002), to find cointegration between non-stationary variables, at least two variables of all the variables included in the cointegration system have to be I(1). The findings of ADF test are consistent with this requirement. Therefore all the variables are ideal for testing for long-run equilibrium using Johansen's Cointegration test.

The final vector of variables to be included is:

$$X_t = (LNIFTY_t\ LIIP_t\ LM3_t\ LCPI_t\ LER_t\ LINTOIL_t\ LFDI_t)$$

for the model examining the cointegration relationship between aggregate stock market index and macroeconomic variables;

$$X_t = (LCOSPIMFG_t\ LIIP_t\ LM3_t\ LCPI_t\ LER_t\ LINTOIL_t\ LFDI_t)$$

for the model examining the cointegration relationship between manufacturing sector index and macroeconomic variables;

$$X_t = (LCOSPITEX_t\ LIIP_t\ LM3_t\ LCPI_t\ LER_t\ LINTOIL_t\ LFDI_t)$$

for the model examining the cointegration relationship between textile sector index and macroeconomic variables;

$$X_t = (LCOSPICHEM_t\ LIIP_t\ LM3_t\ LCPI_t\ LER_t\ LINTOIL_t\ LFDI_t)$$

for the model examining the cointegration relationship between chemical sector index and macroeconomic variables;

$$X_t = (LCOSPITEL_t\ LIIP_t\ LM3_t\ LCPI_t\ LER_t\ LINTOIL_t\ LFDI_t)$$

for the model examining the cointegration relationship between telecom sector index and macroeconomic variables ;

$$X_t = (LCOSPIFB_t\ LIIP_t\ LM3_t\ LCPI_t\ LER_t\ LINTOIL_t\ LFDI_t)$$

for the model examining the cointegration relationship between food and beverage sector index and macroeconomic variables and;

$$X_t = (LCOSPIFINSERV_t\ LIIP_t\ LM3_t\ LCPI_t\ LER_t\ LINTOIL_t\ LFDI_t)$$

for the model examining the cointegration relationship between financial services sector index and macroeconomic variables.

4.2 Results of Johansen's Cointegration test

The results of both trace test and maximum eigenvalue test for macroeconomic variables and stock price indices are presented in Table 4.2 through Table 4.8. The results for cointegration test are based on lag of 3 as suggested by AIC criterion. Further, inclusion of too many lags in cointegration analysis reduces the power of test due to estimation of additional parameters and loss of degrees of freedom.

Table 4.2

Cointegration test results for LNIFTY (Composite Index) and Macroeconomic Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.460914	165.0884	124.24	133.57
At most 1	0.171949	79.82099	94.15	103.18
At most 2	0.128026	53.78300	68.52	76.07
At most 3	0.094355	34.87753	47.21	54.46
At most 4	0.075377	21.20057	29.68	35.65
At most 5	0.053461	10.38568	15.41	20.04
At most 6	0.020110	2.803479	3.76	6.65
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**5 Percent Critical Value**	**1 Percent Critical Value**
None **	0.460914	85.26745	45.28	51.57
At most 1	0.171949	26.03799	39.37	45.10
At most 2	0.128026	18.90547	33.46	38.77
At most 3	0.094355	13.67696	27.07	32.24
At most 4	0.075377	10.81490	20.97	25.52
At most 5	0.053461	7.582196	14.07	18.63
At most 6	0.020110	2.803479	3.76	6.65
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				

Table 4.3

Cointegration test results for LCOSPIMFG (Manufacturing Sector Index) and Macroeconomic Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.456514	161.1838	124.24	133.57
At most 1	0.154793	77.03802	94.15	103.18
At most 2	0.131198	53.83013	68.52	76.07
At most 3	0.100489	34.42176	47.21	54.46
At most 4	0.058276	19.80698	29.68	35.65
At most 5	0.056515	11.52099	15.41	20.04
At most 6	0.024993	3.492819	3.76	6.65
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**5 Percent Critical Value**	**1 Percent Critical Value**
None **	0.456514	84.14575	45.28	51.57
At most 1	0.154793	23.20789	39.37	45.10
At most 2	0.131198	19.40837	33.46	38.77
At most 3	0.100489	14.61478	27.07	32.24
At most 4	0.058276	8.285983	20.97	25.52
At most 5	0.056515	8.028174	14.07	18.63
At most 6	0.024993	3.492819	3.76	6.65
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				

Table 4.4

Cointegration test results for LCOSPITEX (Textile Sector Index) and Macroeconomic Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.422466	170.2239	124.24	133.57
At most 1 *	0.195381	94.46350	94.15	103.18
At most 2	0.135408	64.46415	68.52	76.07
At most 3	0.117317	44.38556	47.21	54.46
At most 4	0.093578	27.16465	29.68	35.65
At most 5	0.060800	13.60609	15.41	20.04
At most 6	0.035232	4.949785	3.76	6.65
Trace test indicates 2 cointegrating equation(s) at the 5% level				
Trace test indicates 1 cointegrating equation(s) at the 1% level				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**5 Percent Critical Value**	**1 Percent Critical Value**
None **	0.422466	75.76039	45.28	51.57
At most 1	0.195381	29.99935	39.37	45.10
At most 2	0.135408	20.07859	33.46	38.77
At most 3	0.117317	17.22092	27.07	32.24
At most 4	0.093578	13.55856	20.97	25.52
At most 5	0.060800	8.656302	14.07	18.63
At most 6 *	0.035232	4.949785	3.76	6.65
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				

Table 4.5

Cointegration test results for LCOSPICHEM (Chemical Sector Index) and Macroeconomic Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.465931	162.4897	124.24	133.57
At most 1	0.153415	75.93202	94.15	103.18
At most 2	0.127219	52.94879	68.52	76.07
At most 3	0.096781	34.17105	47.21	54.46
At most 4	0.064254	20.12402	29.68	35.65
At most 5	0.054420	10.95925	15.41	20.04
At most 6	0.023185	3.237152	3.76	6.65
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**5 Percent Critical Value**	**1 Percent Critical Value**
None **	0.465931	86.55770	45.28	51.57
At most 1	0.153415	22.98324	39.37	45.10
At most 2	0.127219	18.77773	33.46	38.77
At most 3	0.096781	14.04703	27.07	32.24
At most 4	0.064254	9.164773	20.97	25.52
At most 5	0.054420	7.722099	14.07	18.63
At most 6	0.023185	3.237152	3.76	6.65
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				

Table 4.6

Cointegration test results for LCOSPITEL (Telecom Sector Index) and Macroeconomic Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.439818	160.6425	124.24	133.57
At most 1	0.166558	80.67249	94.15	103.18
At most 2	0.124806	55.53017	68.52	76.07
At most 3	0.100243	37.13339	47.21	54.46
At most 4	0.079976	22.55640	29.68	35.65
At most 5	0.057453	11.05332	15.41	20.04
At most 6	0.020710	2.887999	3.76	6.65
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**5 Percent Critical Value**	**1 Percent Critical Value**
None **	0.439818	79.97001	45.28	51.57
At most 1	0.166558	25.14231	39.37	45.10
At most 2	0.124806	18.39678	33.46	38.77
At most 3	0.100243	14.57699	27.07	32.24
At most 4	0.079976	11.50308	20.97	25.52
At most 5	0.057453	8.165324	14.07	18.63
At most 6	0.020710	2.887999	3.76	6.65
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				

Table 4.7

Cointegration test results for LCOSPIFB (Food and Beverage Sector Index) and Macroeconomic Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.441415	168.3836	124.24	133.57
At most 1	0.204173	88.01952	94.15	103.18
At most 2	0.150875	56.50396	68.52	76.07
At most 3	0.094231	33.93415	47.21	54.46
At most 4	0.068044	20.27620	29.68	35.65
At most 5	0.055594	10.55145	15.41	20.04
At most 6	0.019077	2.658047	3.76	6.65
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**5 Percent Critical Value**	**1 Percent Critical Value**
None **	0.441415	80.36412	45.28	51.57
At most 1	0.204173	31.51556	39.37	45.10
At most 2	0.150875	22.56981	33.46	38.77
At most 3	0.094231	13.65795	27.07	32.24
At most 4	0.068044	9.724743	20.97	25.52
At most 5	0.055594	7.893407	14.07	18.63
At most 6	0.019077	2.658047	3.76	6.65
Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				

Table 4.8

Cointegration test results for LCOSPIFINSERV (Financial Services Sector Index) and Macroeconomic Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.459788	182.3886	124.24	133.57
At most 1 *	0.263904	97.40914	94.15	103.18
At most 2	0.126429	55.12664	68.52	76.07
At most 3	0.098042	36.47382	47.21	54.46
At most 4	0.080296	22.23396	29.68	35.65
At most 5	0.056946	10.68293	15.41	20.04
At most 6	0.018606	2.591748	3.76	6.65
Trace test indicates 2 cointegrating equation(s) at the 5% level				
Trace test indicates 1 cointegrating equation(s) at the 1% level				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**5 Percent Critical Value**	**1 Percent Critical Value**
None **	0.459788	84.97948	45.28	51.57
At most 1 *	0.263904	42.28250	39.37	45.10
At most 2	0.126429	18.65283	33.46	38.77
At most 3	0.098042	14.23986	27.07	32.24
At most 4	0.080296	11.55103	20.97	25.52
At most 5	0.056946	8.091177	14.07	18.63
At most 6	0.018606	2.591748	3.76	6.65
Max-eigenvalue test indicates 2 cointegrating equation(s) at the 5% level				
Max-eigenvalue test indicates 1 cointegrating equation(s) at the 1% level				
***(**) denotes rejection of the hypothesis at the 5%(1%) level**				

Following are the important findings from cointegration test:

(i) The results of Johansen's Cointegration analysis indicate that there exists long run relationship between macroeconomic factors and stock prices in India. Both trace test as well as maximum eigenvalue test indicate existence of at least one cointegrating vector in the relationship between macroeconomic variables and stock price indices.

(ii) Normalized coefficients of cointegrating vector are presented in Table 4.9 below. The results of normalized coefficients indicate that industrial

Table 4.9

Normalised Coefficients of Cointegrating Relationship Between Macro-Economic Factors and Indian Stock Prices

NIFTY: Aggregate Nifty Index						
Normalized cointegrating coefficients (standard error in parentheses)						
LNIFTY	LIIP	LM3	LCPI	LEX	LINTOIL	LFDI
1.000000	-15.74786	4.036240	6.767925	-5.726071	0.200047	-0.202086
	(1.65559)	(0.97661)	(2.23510)	(1.13998)	(0.31257)	(0.13887)
	[-9.5119]	[4.1329]	[3.0280]	[-5.0230]	[.640007]	[1.4552]
COSPIMFG: Aggregate Manufacturing Sector Index						
Normalized cointegrating coefficients (standard error in parentheses)						
LMFG	LIIP	LM3	LCPI	LEX	LINTOIL	LFDI
1.000000	-18.01223	2.637924	12.26667	-6.561745	0.349848	-0.158777
	(2.00068)	(1.17965)	(2.70684)	(1.37362)	(0.37515)	(0.16725)
	[9.0031]	[2.2362]	[4.5317]	[4.7770]	[0.9326]	[0.9493]
COSPITEX: Textile Sector Index						
Normalized cointegrating coefficients (standard error in parentheses)						

Note: a) Figures in parenthesis represents standard error.
b) Figures in brackets represents t-statistics.

Table 4.9 (cont...)

LTEXTILE	LIIP	LM3	LCPI	LEX	LINTOIL	LFDI
1.000000	-32.57654	4.269036	24.67811	-8.020415	1.189509	-0.099453
	(3.93493)	(2.34429)	(4.96797)	(2.50448)	(0.69799)	(0.30981)
	[8.2788]	[1.8210]	[4.9674]	[3.2024]	[1.7042]	[0.3210]
COSPICHEM: Chemical Sector Index						
Normalized cointegrating coefficients (standard error in parentheses)						
LCHEMICAL	LIIP	LM3	LCPI	LEX	LINTOIL	LFDI
1.000000	-17.58582	3.008326	11.04375	-6.721934	0.526722	-0.140986
	(1.91212)	(1.12877)	(2.58790)	(1.29913)	(0.35855)	(0.15997)
	[9.1970]	[2.7315]	[4.2675]	[5.1742]	[1.4690]	[0.8813]
COSPITEL: Telecom Sector Index						
Normalized cointegrating coefficients (standard error in parentheses)						
LTELECOM	LIIP	LM3	LCPI	LEX	LINTOIL	LFDI
1.000000	-34.98834	8.054657	17.06064	-12.99214	1.230915	-0.536626
	(3.93219)	(2.32385)	(5.30746)	(2.62312)	(0.73271)	(0.33044)
	[8.8979]	[3.4661]	[3.2145]	[4.9529]	[1.6799]	[1.6240]
COSPIFB: Food and Beverage Sector Index						
Normalized cointegrating coefficients (standard error in parentheses)						
LFB	LIIP	LM3	LCPI	LEX	LINTOIL	LFDI
1.000000	-74.34173	13.94646	52.72350	-38.43408	3.488777	-0.792416
	(8.74701)	(5.14518)	(12.0025)	(6.27112)	(1.63183)	(0.73171)
	[8.4991]	[2.7106]	[4.3927]	[6.1287]	[2.1380]	[1.0830]
COSPiFINSERV: Financial Services Sector Index						
Normalized cointegrating coefficients (standard error in parentheses)						
LFINSERV	LIIP	LM3	LCPI	LEX	LINTOIL	LFDI
1.000000	-11.54376	-0.233851	9.986932	0.133019	0.391217	0.021870
	(1.16871)	(0.69676)	(1.60543)	(0.77631)	(0.21891)	(0.09825)
	[9.8774]	[0.3356]	[6.2207]	[0.1713]	[1.7871]	[0.2226]

Note: a) Figures in parenthesis represents standard error.
b) Figures in brackets represents t-statistics.

production and exchange rate are significant positive determinant of stock prices in India while money supply and inflation are the significant negative determinants. Positive relationship between manufacturing index and IIP indicate investor expectation of impact of changing productive activity on expected dividends which is subsequently factored in stock returns as suggested by Mayasami and Koh (2000). Positive relationship between manufacturing sector index and exchange rate is consistent with the economic theory. Depreciating Rupee besides curbing imports helps in boosting exports thereby increasing cash flows into the country assuming that demand for exports is fairly elastic. Increased volume of output and export earnings is perceived by investors as an indicator of booming economy thus the demand and thereby price of the shares increases [Dimitrova (2005)]. The findings are also consistent with Ray (2008). The findings of negative relationship between inflation and stock prices are consistent with that of Chen, Roll and Ross (1986) and Mukherjee and Naka (1995). Further money supply is also found to have negative relationship with manufacturing index given the fact that money supply results in inflation and thus increases discount rate thereby reducing stock prices as suggested by Fama (1981).

(iii) The share prices in financial services sector are found to have significant positive long-run relationship with index of industrial production. The positive and significant long-run relationship between real activity and financial services sector index indicates stimulus provided by real activity

to finance companies in terms of demand for credit and other financial services. Besides, a significant negative relationship is observed with respect to inflation and financial services sector. Boyd, Levine and Smith (2001) and Naceur and Ghazouani (2005) opine that an increase in inflation lowers the real rate of return on money as well as assets in general thereby lowering the incentive to financial intermediaries to lend. The implied reduction in real returns exacerbates credit market frictions. Since these market frictions lead to the rationing of credit, credit rationing becomes more severe as inflation rises. As a result, the financial sector makes fewer loans, resource allocation is less efficient, and intermediary activity diminishes with adverse implications for capital investment. The aggregate effect thus is seen on stock price performances.

(iv) There is a positive relationship between money supply and financial sector index and these findings are consistent with that of Mayasami, Howe and Hamzah (2004). The increasing amount of money supply indicates rising flow of credit from financial sector and creates expectation of its positive impact on profitability of financial services companies through high interest income. However, it is found that the impact of changes in money supply to the finance sector is statistically insignificant.

(v) The examination of long-run relationship between macroeconomic factors and sectoral indices (Table 4.10) indicate that all the sub-sectors of manufacturing sector under study (textile, chemical, telecom and food

and beverage) get significantly affected largely by same set of macroeconomic variables and the direction of impact is also the same for stock prices in all the sub-sectors. The real economic activity and exchange rates are found to have significant positive relationship with sectoral indices while money supply and inflation are again found to have significant negative relationship with all the sub-sectors of manufacturing sector in India.

(vi) International oil prices are found to have significant negative relationship only with textile sector and food and beverage sector although the magnitude of its impact on stock prices in these sectors is found to be much less. The findings are consistent with Maghyereh, A. (2004) who provides evidence that oil market is very weak in influencing stock markets in emerging economies and emerging markets are inefficient in transmitting innovations/shocks in the oil markets.

(vii) Share prices in none of the sector are found to have any significant long run relationship with FDI.

The main findings of cointegration analysis, thus, reveal that there is a long run equilibrium relationship between stock prices and macroeconomic variables in emerging Indian stock market. This is true for general index as well as sectoral indices. The presence of cointegrating relationship between stock prices and macroeconomic variables repudiates the conclusion of efficient market hypothesis (EMH). Principally, the behavior of stock market may be

predicted and therefore the policy makers in emerging markets need to implement macroeconomic policies carefuly if they do not desire to impact the

Table 4.10

Cointegrating Relationship Between Macroceconomic Factors and Indian Stock Prices

Index	IIP	Money Supply	Inflation	Exch. Rate	Int. Oil Prices	FDI
Nifty Composite Index	+ *	- *	- *	+ *	-	+
Manufacturing Sector	+ *	- **	- *	+ *	-	+
Textile Sector	+ *	- ***	- *	+ *	- ***	+
Chemical Sector	+ *	- *	- *	+ *	-	+
Telecom Sector	+ *	- *	- *	+ *	-	+
F&B Sector	+ *	- *	- *	+ *	- **	+
Financial Services Sector	+ *	+	- *	-	-	-

Note: *, ** and *** represents significance at 1%, 5% and 10% respectively.

stock markets significantly. Further, the findings reveal that there does not exist much scope for earning superior returns based on stock selection from specific sector as the information on macroeconomic variables is made available. This is because the sectoral share prices are affected largely by same set of factors and in the same manner. Some sectoral diversification benefits are however available between manufacturing and financial services sectors given that the share prices in financial services sector in Indian market do not get significantly impacted by exchange rate and international oil prices and money supply. Likewise, equities in textile and food and beverage sector may be avoided during rising international oil prices.

Chapter Five

SUMMARY OF FINDINGS, CONCLUSION AND SUGGESTIONS

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND SUGGESTIONS

Emerging markets have occupied significant position in the world of international investments both direct and portfolio investments. The substantial growth rate of their economies has attracted huge amount of capital inflows into these economies. Besides, economic growth rate, some of the major reasons for emerging markets occupying centre stage in international investments include their relative isolation from other markets and developed markets in particular (i.e. their relative segmentation) that make them ideal assets satisfying Markowitz diversification framework. The perception of their low correlation with developed markets provides incentives in the form of reduced portfolio risk and high returns.

Last two decades, however, have brought about significant changes in emerging market world with spate of economic reforms that have changed their relationship with outside world besides bringing about dynamism within domestic operational framework of these economies including liberalization, privatization and globalization, significant improvements in microstructure of financial markets, advancement in technology of trading and communication, spread of internet and media technology, etc.

This research focused on examining the portfolio diversification benefits of selective emerging stock markets by studying the dynamic linkages between the selected Asian markets and also their comovement with developed market of

US. Further, emerging markets are known to be informationally inefficient with respect to the macroeconomic data which is a significant driver of stock market returns as proved by several researchers. The research examined the efficiency of Indian emerging market with reference to macroeconomic information by examining the long run equilibrium relationship between Indian stock prices and selective macroeconomic variables. The research is distinct in the sense that it attempts to examine whether there exists a sectoral differences with respect to impact of macroeconomic variables on stock prices in Indian emerging market.

The significant findings from the study are summarized below with conclusion of the study with respect to the objectives and suggestions in the context on investments in emerging Asian markets and Indian stock market in particular.

5.1 Summary of Major Findings:

(A) Significant Linkages Between Emerging Stock Markets of Asia

5.1.1 The proportion of domestic innovation in forecast error variance of each of the Asian stock markets is significant at day 1 and ranges from 78.20% for Thailand stock market to 99.69% for Chinese stock market. This proportion remains significantly higher at 2, 5, 10 and 15 days horizon and ranges from approximately upto 75% for Thailand and 97% for Chinese stock market.

5.1.2 The contribution of foreign innovations is found to be increasing at different lags. For Thailand stock market it increased from 21.80% at day 1

to 26.04% at day 15. Similarly, for South Korea, it increased from 9.98% to 14.42%, for Malaysia from 7.95% to 11.60%, for Indonesia from 8.57% to 15.92%, for China from 0.31% to 2.24% while for India from 7.49% to 9.48%.

5.1.3 Regional influence is dominant for stock markets in Thailand and Indonesia where Asian markets contribute 21.94% and 15.92% respectively of forecast error variance in these markets.

5.1.4 The contribution of South Korean stock market to variance in other Asian markets is relatively significant as compared to the contribution of Asian markets to its own variance. Asian markets contribute maximum of 4.32% of variance in South Korean market while the contribution of the market to other Asian markets ranges from 4.50% to 7.50%.

5.1.5 The proportion of domestic innovations in Chinese stock market is significantly higher at 99.69% at day 1 to 97.96% at 15 days lag. The innovations in the most influential market in the region, South Korea, accounts for maximum of 0.42% to variance in Chinese stock market. On the other hand, the Thailand stock market absorbs significant information from innovations in other regional markets. The overall contribution of Asian markets to variance in Thailand market ranges from 18.25% at day 1 to 21.94% at day 15.

5.1.6 The analysis of impulse responses for Asia markets to a shock in given market reveal that size of response is highly significant for domestic shocks and ranges from 1.53 (Indian stock market) to 2.10 (South Korean

stock market). The shock originating in South Korean market is rapidly transmitted to all the sample Asian markets except China with size of response ranging from 0.31 to 0.53 on day 1. South Korean market however reacts to shocks in Malaysia and Thailand on day 2 with response size of 0.19 and 0.22 respectively. Chinese stock market produces negligible response (less than even 0.10) in other Asian markets and also does not absorb shocks from other regional markets. The three ASEAN markets viz. Malaysia, Indonesia and Thailand are found to share noticeable interaction. Shocks originating in Malaysian market create response of size of 0.43 in Indonesian market and 0.51 in Thailand market at day 1. Further, Thailand stock market shows efficiency in absorbing shocks from Indonesian market which is 0.29 at day 1. The response of Malaysia to shocks in other two ASEAN markets remain significantly low. The Indian stock market absorbs shocks from all other Asian markets although the size of response is significant with respect to shocks originating in South Korean stock market (0.36 on day 1).

(B) Dynamic Comovement Between Asian Emerging Markets and Developed Market of U.S.

5.1.7 The contribution of domestic innovations to error variance in U.S. stock market remains significant at all the horizons and ranges from 100% at day 1 to 97.11% at day 15. The Asian stock markets contribute maximum of 2.89% of error variance in U.S. stock market.

5.1.8 Innovations in U.S. stock market have largest impact on South Korean stock market where they explain 9.98% to 10.10% of its error variance at day 1 to day 15. For other regional markets the contribution of U.S. innovations ranges between 2.25% to 4.32%.

5.1.9 The impulse response analysis reveal that response of U.S. stock market is maximum to domestic shocks (1.10) although the market exhibits lagged response of lower magnitude to shocks in other Asian markets.

(C) Impact of Macroeconomic Factors on Stock Prices in Emerging Indian Stock Market

5.1.10 Both trace test as well as maximum eigenvalue test indicate presence of at least one cointegrating vector in relationship between macroeconomic variables and stock prices in India. This is true for market as a whole as well as for sectoral share prices.

5.1.11 The normalized coefficients are positive for index of industrial production and exchange rate and negative for money supply and inflation in the case of manufacturing sector as well as its sub-sectors of textile, chemical, telecom, and food and beverage. All the coefficients are also significant. Additionally, international oil prices are significant at 5% for food and beverage sector and at 10% for textile sector. The FDI factors is found to have positive relationship with manufacturing sector and the sub-sectors while it has negative relationship with financial services sector. However, the normalized coefficients for FDI are statistically insignificant.

5.1.12 Index of industrial production is significant at 1% for stock prices in financial services sector with positive relationship while inflation is significant at 1% with negative relationship. All the other macroeoconomic variables are insignificant for stock prices in financial services sector.

5.2 Conclusion:

(A) Linkage Dynamics of Emerging Asian Stock Markets

5.2.1 Any portfolio investment plan is designed to earn high returns particularly if the portfolio investments are made outside the domestic territories with significant economic and political risks. In this context the emerging Asia provides good investment opportunity for international portfolio investors since all the Asian emerging markets under study exhibit significantly high average daily positive returns. The returns are also found to be superior in comparison to developed market of US. The average daily returns are highest for South Korean stock market followed by stock markets in China and India.

5.2.2 The returns of Asian emerging markets though are high, they are found to be also significantly volatile with high degree of standard deviation. These findings are consistent with previous research in the context of several other emerging markets. This indicates that Asian markets are also high risk investment avenues for portfolio investors.

5.2.3 All the Asian markets under study are found to have positive correlation with each other. However, the coefficient of correlation is low (less than 0.50) indicating suitable diversification opportunity. This is true even when Asian markets returns are found to be highly volatile since a well-diversified portfolio with volatile but weakly correlated assets can still reduce overall portfolio volatility. The correlation structure of Asian markets also reveal that Chinese stock market is the most exogenous market with least coefficients of correlation while Thailand stock market is the most endogenous market which share high coefficient of correlation with other regional markets. Further all the Asian stock markets are found to share high degree of correlation with South Korean stock market which gave preliminary evidence on dominance of South Korean market in the emerging Asian region.

5.2.4 The results of forecast error variance decomposition indicate that the proportion of domestic innovations remain significantly high for all the Asian markets through different horizons indicating that all the markets under study are largely driven by their own domestic innovations. From the viewpoint of international portfolio investments this implies substantial opportunity for diversification benefits from investing in Asian emerging markets. At the same time the results point to the fact that Asian markets are not completely isolated markets and do exhibit weak to moderate linkages with regional markets. While the proportion of foreign markets in error variance of Asian markets remain relatively

low, the Asian markets do display delayed reactions to innovations in foreign markets.

5.2.5 The study also concludes that emerging Asia cannot be looked into as constituting a set of homogenous markets. The degree of segmentation (or integration) differs across different markets within the region. Within the set of Asian emerging markets, the South Korean market is found to exhibit the properties of leading market whereby innovations in South Korean market are found to have larger contribution to forecast error variance of other Asian markets (except Chinese stock market) while the proportion of foreign markets in its error variance remains significantly low. The maximum impact of South Korean market is felt on Thailand followed by India, Indonesia and Malaysia.

5.2.6 The Chinese stock market is found to be the most exogenous in the Asian region which neither contributes significantly to variance in other regional markets nor get influenced by any of them significantly. On the other hand Thailand stock market is found to be the most endogenous market in the region and Asian markets explain much larger proportion of variance in Thailand market. Especially, South Korea, Malaysia and Indonesia play major role in influencing Thailand stock market. This relationship is found to be one way as the innovations in Thailand market are not found to be contributing in significant manner to variance in these markets.

5.2.7 Noticeable linkages are also observed among three emerging Asian markets viz., Malaysia, Indonesia and Thailand. The impact of Malaysian market on Thailand market is even more than that of US market. Within this set, the Malaysian market is found to have greater influence on the other two markets.

5.2.8 Interestingly, the two significant economies in the region, i.e. India and China are not found to be contributing significantly to variance in any of the other Asian markets. Further, no significant linkages are observed between the two markets. The prominent BRICs economies therefore provide tremendous opportunity of portfolio diversification to global investors on account of their growth rate and weak linkages with other regional markets.

5.2.9 In so far as speed of transmission of shocks across the Asian markets is concerned, the results indicate that the Asian markets react significantly to their own shocks though they are also found to absorb shocks from other regional markets to varied extent . All the responses however are found to be within the confidence band indicating that no market shows overreaction to shocks in other regional markets. But ability of Asian markets in absorbing shocks from the other regional markets on the same day indicates the efficiency of these markets in transmission of shocks.

5.2.10 The impulse response analysis further confirm the existence of significant linkages between Malaysia, Indonesia and Thailand where stock markets of Indonesia and Thailand are found to absorb shocks originating in

Malaysia quickly the same day. The higher magnitude of responses of Indonesia and Thailand markets and lower magnitude of responses of Malaysian market to shocks in the other two markets clearly brings out importance of Malaysian market within this subset of Asian markets.

5.2.11 Indian stock market though is found to absorb shocks from all other Asian markets, the response is found to be significant only for shocks in South Korean stock market.

5.2.12 In general, it is observed that among all the Asian markets under study, the South Korean market plays dominant role in causing impulse response among other markets in the region. The Chinese market on the other hand indicates marked inefficiency in responding to or causing responses in other markets in the emerging Asian region. While for the rest, the magnitude of the responses from each of the markets differ, depending upon the market experiencing the shock, the pattern is much the same. There is quick response on day 1, falling rapidly thereby, and then fluctuating mildly around zero until around 8 to 10 days at which point the response effectively becomes zero.

5.2.13 With respect to dynamic comovement of Asian markets with developed market of US, the results clearly indicate that none of the Asian market significantly contribute to variance in US stock market. On the other hand, US is found to have widespread effect on the Asian region though its contribution to variance in Asian market is found to be weak, except for South Korean market which is found to get significantly influenced by

innovations in US market. Also, the US market is found to react weakly to shocks in Asian market. The findings reveal changing relationship between Asian markets and the US at least in terms of impact of US on Asia. The stock markets in the region are more responsive to South Korean shock as compared to the US shocks.

The findings of the study in general highlight the fact that emerging Asia is slowly progressing towards the regional integration of financial markets. The weak effect of markets like US on the region may be attribute to two important reasons; firstly, the emerging economies now derive substantial support from their own domestic demand and stabilization gains arising from improved macroeconomic policy framework attributed to continued effort of these economies towards reform process. Secondly, the shift in economic relationships between the countries in the emerging Asian region may also be contributing to visible regional linkages. The pattern of trade in emerging markets has changed dramatically in the last decade. Almost one-half of exports from emerging and developing economies is now directed towards other such economies with rising intraregional trade within emerging Asia most notable [World Development Indicators (2007)]. The share of emerging Asia in world exports more than doubled from 8 percent in 1978 to 19 percent in 2002, with a similar rise in the import share. The steady rise in emerging Asia's trade shares over the past 25 years was only interrupted by the Asian financial crisis of 1997-98 [Zebregs, H. (2004)]. The significant linkages that emerged between markets of Malaysia,

Indonesia and Thailand (the ASEAN member countries) also point to the fact that regional economic ties are contributing to the trend towards stock market integration in Asia.

(B) Impact of Macroeconomic Factors on Stock Prices in Emerging Indian Stock Market

5.2.14 The stock price in India across the sectors form significant relationship with macroeconomic variables identified. Such existence of long run relationship puts the hypothesis of efficient market in doubt.

5.2.15 Specifically, the study finds that the real economic activity and exchange rate are the two significant positive determinants of stock prices in India while money supply and inflation are the two most important negative determinants of stock returns.

5.2.16 The examination of long-run relationship between macroeconomic factors and sectoral indices indicate that all the sub-sectors of manufacturing sector under study (textile, chemical, telecom and food and beverage) get significantly affected largely by same set of macroeconomic variables and the direction of impact is also the same for stock prices in all the sub-sectors. However, there does exist a difference across sectors with respect to the impact of international oil prices which are found to have significant negative relationship with textile and food and beverage sector, although the impact is found to be much less. Further, stock prices in financial services sector are found to have significant long run

relationship with only real economic activity (positive) and inflation (negative).

5.2.17 FDI is found to have no significant long run relationship with Indian stock prices.

5.3 Suggestions

The findings of the study are useful in the context of international portfolio diversification across Asian emerging markets and also provide deeper insight into influence of macroeconomic factors on Indian stock prices. With respective to the above conclusions, the following important suggestions can be made:

5.3.1 The stock markets in emerging Asia provide significant portfolio diversification opportunities since they are largely driven by their own shocks. Therefore, international investors can focus on channalizing the portfolio funds to emerging Asian region to exploit these benefits particularly considering the fact that the region include the two most prominent BRICs economies viz. India and China and several other high growth economies.

5.3.2 In terms of asset allocation decisions, higher portfolio allocations may be made in stock markets of China and India as China is the most segmented market in the region while Indian stock market gets affected significantly only by select markets.

5.3.3 While investing in the Asian region, global investors need to focus on developments in South Korean market which has significant impact on all the other markets in the region (except China). On the other hand, the portfolio investors need to be extra cautious while investing in Thailand which is the most endogenous market in the region followed by Indonesia and Malaysia. Even a decade after Asian crisis, the tiger economies show significant comovement with each other. Therefore, the portfolio investments in these three markets need to be closely monitored particularly with reference to developments in Malaysian market and economy.

5.3.4 The developed market of US has significant impact on South Korean market followed by Malaysia, India and Indonesia. The asset allocation decision with respect to emerging Asian stock markets thus need to be taken in the light of not only their superior returns but also the degree of growing integration with other markets in the region and US.

5.3.5 In specific reference to Indian stock market, the existence of long run equilibrium relationship between Indian stock prices and macroeconomic variables calls for implementation of fundamental analysts approach to investing.

5.3.6 While stock prices in manufacturing sector and its sub sectors are largely influenced by the same set of macroeconomic variables, the investors can minimize their holdings in textile and food and beverage sector in time of

high international oil prices as the two sectors are found to have significant negative long run relationship with international oil prices.

The integration of Asian economies and therefore stock markets is still evolving. Countries like China and India which till recently had limited trade and investment interests in most of the Asian countries are expanding their economic ties with several countries in the region. The China-ASEAN free trade agreement (FTA) is expected to be fully implemented in 2010 and ASEAN is also negotiating a FTA with India. Another emerging bloc in the region is Asia-Pacific Trade Agreement which combines the leading economies of China, India and Republic of Korea together with other Asian countries. Recent years have also seen greater cross-border acquisitions within Asian region. These expanding trade ties and firm level effects are expected to have a direct effect on stock market linkages within the Asian region and subsequent research post these developments should give clear idea of portfolio diversification benefits in the Asian region.

5.4 Scope for Further Research

This section provides some insight into future research directions which may be explored in the context of emerging markets.

5.4.1 The dynamic interactions between markets of different emerging economy regions can be studied so as to enable the international fund

managers investing across multiple emerging market regions decide on asset allocation that will provide superior risk-adjusted returns.

5.4.2 Future research can focus on analyzing international stock market comovements in relation to comovement of underlying macroeconomic factors to examine if source of comovement is economic factors or speculative trading.

5.4.3 Dynamic linkages between other segments of financial markets such as derivatives market and bond market across emerging markets may be examined.

5.4.4 With respect to relationship between stock prices and macroeconomic factors, the study may be extended to include sector specific data and variables.

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APPENDIX - I

APPENDIX - I

Table I-1
Forecast Error Variance Decomposition of RSP500 (US Market)

Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.099738	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	1.110306	98.22165	1.061486	0.034028	0.023249	0.019974	0.376366	0.263248
3	1.111882	98.06034	1.073597	0.060061	0.089908	0.073139	0.379230	0.263730
4	1.113310	97.89296	1.102121	0.059964	0.122854	0.079343	0.378276	0.364480
5	1.114347	97.71926	1.100122	0.123685	0.143846	0.112733	0.395278	0.405078
6	1.115674	97.55304	1.115312	0.153673	0.166968	0.163539	0.414677	0.432790
7	1.118496	97.13346	1.151309	0.273885	0.167042	0.185309	0.574391	0.514601
8	1.118567	97.12338	1.152518	0.274713	0.169890	0.185539	0.576660	0.517303
9	1.118592	97.11950	1.152485	0.275825	0.169883	0.187606	0.576985	0.517713
10	1.118596	97.11916	1.152510	0.275843	0.169886	0.187604	0.577261	0.517732
11	1.118611	97.11667	1.152678	0.275898	0.170666	0.187605	0.578720	0.517760
12	1.118632	97.11332	1.153985	0.276144	0.171345	0.187841	0.579400	0.517964
13	1.118640	97.11207	1.154104	0.276653	0.171363	0.187868	0.579957	0.517985
14	1.118641	97.11197	1.154106	0.276667	0.171383	0.187868	0.580010	0.517998
15	1.118641	97.11189	1.154145	0.276692	0.171392	0.187875	0.580011	0.517998

Note: (a) S.E. represents standard error.
(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market (in header row)

Table I-2

Forecast Error Variance Decomposition of RKOSPI (South Korean Market)

Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	2.215675	9.979414	90.02059	0.000000	0.000000	0.000000	0.000000	0.000000
2	2.240471	9.910958	88.25712	0.009543	0.695182	0.090929	0.967832	0.068434
3	2.249060	9.998036	87.75988	0.037387	0.934578	0.169750	1.018583	0.081781
4	2.253999	10.17211	87.42901	0.116660	0.931551	0.170895	1.086826	0.092953
5	2.260641	10.16656	86.91745	0.116997	0.956511	0.393994	1.355526	0.092960
6	2.269372	10.08853	86.33050	0.116120	1.241393	0.682036	1.401640	0.139774
7	2.278794	10.11254	85.64721	0.245268	1.599256	0.703574	1.528852	0.163306
8	2.279265	10.10929	85.63031	0.247532	1.603308	0.709163	1.529400	0.171002
9	2.279497	10.10737	85.61938	0.247994	1.612248	0.710975	1.530996	0.171032
10	2.279602	10.10648	85.61235	0.249616	1.614741	0.713442	1.532070	0.171303
11	2.279834	10.10446	85.59500	0.250699	1.619035	0.716321	1.542267	0.172221
12	2.279916	10.10373	85.58956	0.250817	1.621439	0.717003	1.544654	0.172798
13	2.279977	10.10403	85.58497	0.252437	1.622047	0.717263	1.546450	0.172803
14	2.279987	10.10399	85.58462	0.252496	1.622172	0.717396	1.546507	0.172821
15	2.279991	10.10407	85.58444	0.252511	1.622173	0.717406	1.546562	0.172840

Note: (a) S.E. represents standard error.

(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market (in header row)

Table I-3

Forecast Error Variance Decomposition of RSSEC (Chinese Market)

Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.442574	0.160096	0.145397	99.69451	0.000000	0.000000	0.000000	0.000000
2	1.445408	0.209433	0.228361	99.31524	0.092883	0.080550	0.030420	0.043115
3	1.448397	0.299336	0.234462	99.01689	0.092842	0.081054	0.105194	0.170219
4	1.454600	0.375291	0.350071	98.50731	0.200383	0.112072	0.107587	0.347287
5	1.456284	0.413027	0.349329	98.44095	0.204536	0.118155	0.112828	0.361175
6	1.460112	0.567437	0.367394	97.93998	0.356356	0.226920	0.119054	0.422858
7	1.461978	0.566263	0.418285	97.83949	0.356404	0.229117	0.119489	0.470952
8	1.462046	0.568535	0.418263	97.83055	0.359941	0.229683	0.120047	0.472983
9	1.462265	0.569950	0.418321	97.80311	0.376263	0.237780	0.120895	0.473682
10	1.462484	0.573643	0.418241	97.78119	0.382333	0.237889	0.130289	0.476413
11	1.462557	0.573911	0.418547	97.77378	0.383853	0.241213	0.131850	0.476847
12	1.462649	0.575893	0.420887	97.76203	0.387419	0.241355	0.131865	0.480550
13	1.462658	0.576037	0.420914	97.76128	0.387713	0.241353	0.131984	0.480722
14	1.462662	0.576165	0.420919	97.76078	0.387844	0.241425	0.132145	0.480724
15	1.462668	0.576304	0.421051	97.76011	0.388162	0.241470	0.132177	0.480721

Note: (a) S.E. represents standard error.
(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market (in header row)

Table I-4

Forecast Error Variance Decomposition of RKLSE (Malaysian Market)

Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.613604	4.152847	3.603289	0.197539	92.04632	0.000000	0.000000	0.000000
2	1.621815	4.113555	3.758782	0.239219	91.49296	0.104917	0.250297	0.040269
3	1.638998	4.073303	4.605696	0.251020	89.61705	0.973498	0.251193	0.228236
4	1.643116	4.077231	4.585026	0.252705	89.62134	0.969342	0.266493	0.227864
5	1.659236	4.084262	4.499779	0.293431	89.21144	0.970973	0.631279	0.308841
6	1.662905	4.094332	4.485299	0.292266	89.17882	0.969503	0.658004	0.321779
7	1.671446	4.313222	4.478333	0.418935	88.46268	1.050264	0.921587	0.354977
8	1.671889	4.313344	4.475972	0.418718	88.44971	1.051383	0.926199	0.364677
9	1.672066	4.318381	4.483679	0.421774	88.43307	1.052352	0.926129	0.364619
10	1.672597	4.316738	4.484481	0.421989	88.42762	1.051985	0.930076	0.367114
11	1.673002	4.320548	4.485826	0.421785	88.40806	1.051597	0.944527	0.367660
12	1.673108	4.323420	4.485260	0.421848	88.40469	1.052003	0.944933	0.367843
13	1.673145	4.323573	4.485167	0.422766	88.40105	1.052172	0.947394	0.367874
14	1.673167	4.323461	4.485066	0.422802	88.40093	1.052146	0.947723	0.367869
15	1.673179	4.323655	4.485016	0.422806	88.40055	1.052179	0.947918	0.367873

Note: (a) S.E. represents standard error.
(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market (in header row)

Table I-5

Forecast Error Variance Decomposition of RJKSE (Indonesian Market)

Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	2.263612	2.383017	4.845400	0.033226	3.690474	89.04788	0.000000	0.000000
2	2.361860	2.250292	6.611996	0.031995	5.676326	84.78616	0.609784	0.033446
3	2.370596	2.261425	6.710494	0.065528	5.853038	84.20811	0.792230	0.109175
4	2.374749	2.413594	6.702425	0.074762	5.903602	83.92876	0.861855	0.114999
5	2.382871	2.404231	6.664271	0.080677	6.197936	83.63944	0.890528	0.122912
6	2.397520	2.397707	6.915330	0.089029	6.188074	83.10294	1.183207	0.123711
7	2.415811	2.388082	7.513314	0.097544	6.475220	81.94062	1.429206	0.156016
8	2.418106	2.384014	7.516298	0.109558	6.610735	81.79313	1.428613	0.157649
9	2.418623	2.383066	7.537370	0.109591	6.616548	81.76086	1.433645	0.158916
10	2.418972	2.397197	7.539016	0.111340	6.619750	81.73839	1.435085	0.159218
11	2.419476	2.396457	7.536091	0.111353	6.635857	81.70705	1.453822	0.159372
12	2.419746	2.401557	7.537933	0.115670	6.636845	81.69060	1.453731	0.163663
13	2.419934	2.402542	7.536859	0.116059	6.644219	81.67873	1.456896	0.164689
14	2.419989	2.402716	7.536619	0.116141	6.646782	81.67551	1.457540	0.164687
15	2.420000	2.402786	7.536828	0.116201	6.646864	81.67503	1.457592	0.164701

Note: (a) S.E. represents standard error.
(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market (in header row)

Table I-6

Forecast Error Variance Decomposition of RSET (Thailand Market)

Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.865977	3.553461	8.089973	0.195266	7.572580	2.393369	78.19535	0.000000
2	1.888211	3.715678	8.805619	0.211901	7.465186	3.403508	76.39158	0.006533
3	1.898873	3.968687	9.140050	0.345496	7.383840	3.553804	75.59802	0.010101
4	1.904112	4.137989	9.235214	0.360424	7.500970	3.543136	75.18747	0.034797
5	1.908930	4.121703	9.370386	0.364108	7.554952	3.740494	74.80967	0.038686
6	1.911562	4.126307	9.408287	0.368096	7.592237	3.820882	74.64412	0.040069
7	1.919606	4.091802	9.642684	0.510644	7.596068	3.945567	74.07357	0.139662
8	1.920573	4.089379	9.650474	0.511800	7.658494	3.947854	74.00043	0.141573
9	1.920722	4.093520	9.651804	0.512711	7.663519	3.947287	73.98907	0.142091
10	1.920897	4.101688	9.652620	0.513152	7.666064	3.947705	73.97619	0.142577
11	1.920990	4.101571	9.651702	0.514440	7.667317	3.948351	73.97306	0.143557
12	1.921068	4.103534	9.651448	0.514809	7.666804	3.948734	73.96846	0.146212
13	1.921117	4.103376	9.652138	0.515732	7.667217	3.948851	73.96640	0.146290
14	1.921142	4.103598	9.651925	0.515813	7.668550	3.948933	73.96488	0.146305
15	1.921147	4.103581	9.651881	0.515841	7.668876	3.949003	73.96450	0.146319

Note: (a) S.E. represents standard error.
(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market (in header row)

Table I-7

Forecast Error Variance Decomposition of RNIFTY (Indian Market)

Period	S.E.	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.617497	3.254848	4.950167	0.301568	0.722921	0.932529	0.581879	89.25609
2	1.623697	3.468770	5.222459	0.299618	0.745522	0.925661	0.615510	88.72246
3	1.630126	3.804609	5.207069	0.368487	0.818627	0.990674	0.611016	88.19952
4	1.631801	3.815777	5.208771	0.448203	0.878532	0.990517	0.621584	88.03662
5	1.636654	3.805079	5.564272	0.491775	0.936384	1.006496	0.642082	87.55391
6	1.640220	3.792475	5.541299	0.552369	0.995169	1.149524	0.771671	87.19749
7	1.646126	3.767779	5.566806	0.644737	1.254027	1.159755	0.801336	86.80556
8	1.646307	3.767102	5.565897	0.646147	1.258989	1.164314	0.801285	86.79627
9	1.646444	3.768011	5.575329	0.649004	1.259234	1.164326	0.802213	86.78188
10	1.646514	3.767913	5.574906	0.650085	1.259241	1.169072	0.802928	86.77586
11	1.646661	3.768991	5.574151	0.652850	1.267491	1.169207	0.806451	86.76086
12	1.646708	3.769005	5.574926	0.652963	1.267739	1.169289	0.807817	86.75826
13	1.646737	3.769737	5.575559	0.652976	1.269215	1.169545	0.807793	86.75517
14	1.646738	3.769732	5.575565	0.652983	1.269214	1.169589	0.807798	86.75512
15	1.646739	3.769732	5.575635	0.652994	1.269228	1.169594	0.807827	86.75499

Note: (a) S.E. represents standard error.
(b) Entry in each cell under each variable is the percentage contribution of forecast error variance of given market explained by that variable or market (in header row)

APPENDIX - II

APPENDIX - II

Table II-1

Impulse Response of RSP500 (US Market) to One Standard Error Shock in Given Market

Period	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	1.099738	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.01525)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	-0.037840	0.114393	-0.020481	0.016930	-0.015692	0.068116	0.056967
	(0.02188)	(0.02178)	(0.02179)	(0.02174)	(0.02164)	(0.02174)	(0.02166)
3	-0.038022	0.013671	0.017973	0.028721	0.025651	0.006971	0.003896
	(0.02190)	(0.02179)	(0.02187)	(0.02172)	(0.02120)	(0.02189)	(0.02180)
4	-0.032259	-0.019689	0.000840	0.020279	-0.008901	0.000477	0.035456
	(0.02191)	(0.02175)	(0.02187)	(0.02159)	(0.02108)	(0.02187)	(0.02175)
5	-0.010226	-0.000796	-0.028154	0.016233	-0.020407	0.014828	-0.022640
	(0.02188)	(0.02168)	(0.02182)	(0.02139)	(0.02106)	(0.02185)	(0.02172)
6	-0.028711	0.014888	-0.019414	0.017090	-0.025214	0.015911	-0.018893
	(0.02188)	(0.02158)	(0.02179)	(0.02109)	(0.02103)	(0.02182)	(0.02164)
7	-0.030010	-0.022818	-0.038905	0.003384	-0.016813	0.044991	-0.032415
	(0.02178)	(0.02146)	(0.02182)	(0.02099)	(0.02034)	(0.02174)	(0.02162)
8	0.005417	-0.004119	-0.003287	-0.005991	0.001782	-0.005413	-0.005885
	(0.00618)	(0.00728)	(0.00509)	(0.00726)	(0.00627)	(0.00580)	(0.00529)
9	0.002074	-0.000468	-0.003750	-9.41E-05	0.005095	-0.002093	0.002327
	(0.00488)	(0.00571)	(0.00418)	(0.00589)	(0.00465)	(0.00418)	(0.00429)
10	-0.002158	-0.000647	-0.000502	0.000226	1.29E-05	-0.001872	0.000533
	(0.00396)	(0.00479)	(0.00361)	(0.00553)	(0.00388)	(0.00394)	(0.00367)
11	-0.001666	0.001581	0.000881	-0.003135	-0.000271	-0.004296	-0.000728
	(0.00330)	(0.00437)	(0.00320)	(0.00517)	(0.00366)	(0.00362)	(0.00318)
12	-0.001836	0.004110	0.001790	-0.002929	0.001745	-0.002964	-0.001670
	(0.00297)	(0.00383)	(0.00279)	(0.00403)	(0.00330)	(0.00291)	(0.00288)
13	0.001306	0.001302	0.002534	0.000497	-0.000612	-0.002660	-0.000598
	(0.00245)	(0.00305)	(0.00240)	(0.00327)	(0.00211)	(0.00232)	(0.00253)
14	-0.000149	-0.000216	0.000426	-0.000501	-3.83E-05	0.000820	0.000410
	(0.00105)	(0.00098)	(0.00075)	(0.00166)	(0.00087)	(0.00097)	(0.00073)
15	0.000326	-0.000705	0.000559	-0.000348	0.000300	0.000129	-0.000129
	(0.00084)	(0.00078)	(0.00060)	(0.00127)	(0.00070)	(0.00081)	(0.00054)

Note: Figures in parenthesis represents standard error.

Table II-2

Impulse Response of RSP500 (South Korian Market) to One Standard Error Shock in Given Market

Period	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	0.699936	2.102214	0.000000	0.000000	0.000000	0.000000	0.000000
	(0.04235)	(0.02915)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.087124	0.104632	-0.021887	0.186805	0.067560	0.220414	0.058611
	(0.04416)	(0.04404)	(0.04414)	(0.04398)	(0.04369)	(0.04382)	(0.04362)
3	0.090698	-0.094224	-0.037578	-0.111253	0.063419	0.054224	-0.026486
	(0.04428)	(0.04403)	(0.04419)	(0.04390)	(0.04286)	(0.04418)	(0.04399)
4	0.105201	-0.052037	0.063528	0.007352	0.009795	-0.060775	0.024203
	(0.04432)	(0.04397)	(0.04424)	(0.04372)	(0.04263)	(0.04422)	(0.04397)
5	-0.052600	0.008605	-0.007225	-0.039432	-0.107017	0.118566	-0.005317
	(0.04437)	(0.04394)	(0.04426)	(0.04349)	(0.04266)	(0.04425)	(0.04394)
6	0.001688	-0.064419	0.001049	-0.122678	-0.122434	0.053954	0.049474
	(0.04449)	(0.04386)	(0.04433)	(0.04294)	(0.04266)	(0.04428)	(0.04389)
7	-0.074628	-0.038875	-0.082197	-0.138258	-0.037559	0.084892	-0.035804
	(0.04434)	(0.04370)	(0.04446)	(0.04272)	(0.04139)	(0.04418)	(0.04395)
8	-0.006974	-0.031016	-0.011084	-0.015649	-0.017478	-0.007830	-0.020082
	(0.01357)	(0.01608)	(0.01258)	(0.01640)	(0.01575)	(0.01295)	(0.01280)
9	0.002680	-0.018344	-0.005162	0.021942	-0.010082	-0.009953	0.001834
	(0.01175)	(0.01297)	(0.01066)	(0.01336)	(0.01114)	(0.01053)	(0.01044)
10	-0.001564	-0.006901	-0.009246	0.011718	0.011474	-0.007949	0.003861
	(0.00968)	(0.01097)	(0.00941)	(0.01249)	(0.00952)	(0.00959)	(0.00909)
11	-0.001248	0.000863	-0.007676	0.015499	0.012535	-0.023370	-0.007037
	(0.00850)	(0.01019)	(0.00831)	(0.01139)	(0.00890)	(0.00891)	(0.00818)
12	-8.49E-05	0.006226	0.002656	0.011449	0.006177	-0.011396	-0.005537
	(0.00742)	(0.00886)	(0.00706)	(0.00922)	(0.00812)	(0.00728)	(0.00725)
13	0.006614	-0.000527	0.009216	0.006010	0.003936	-0.009883	0.000870
	(0.00574)	(0.00680)	(0.00565)	(0.00722)	(0.00541)	(0.00552)	(0.00593)
14	-0.001509	0.004261	0.001779	0.002674	0.002695	-0.001909	0.000996
	(0.00260)	(0.00305)	(0.00211)	(0.00413)	(0.00272)	(0.00241)	(0.00228)
15	-0.002488	0.003094	0.000922	0.000664	0.000793	0.001787	-0.001020
	(0.00227)	(0.00229)	(0.00172)	(0.00297)	(0.00214)	(0.00206)	(0.00165)

Note: Figures in parenthesis represents standard error.

Table II-3

Impulse Response of RSP500 (Chinese Market) to One Standard Error Shock in Given Market

Period	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	0.057720	0.055007	1.440368	0.000000	0.000000	0.000000	0.000000
	(0.02827)	(0.02825)	(0.01997)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.032309	0.041776	0.015357	0.044051	0.041022	0.025210	0.030013
	(0.02850)	(0.02844)	(0.02851)	(0.02845)	(0.02831)	(0.02846)	(0.02840)
3	-0.043637	-0.012155	-0.048310	0.002680	-0.004190	0.039639	0.051674
	(0.02852)	(0.02838)	(0.02849)	(0.02830)	(0.02763)	(0.02852)	(0.02839)
4	0.040755	0.049883	0.083943	0.047876	0.025902	-0.008342	-0.061459
	(0.02862)	(0.02840)	(0.02854)	(0.02816)	(0.02747)	(0.02850)	(0.02833)
5	0.028613	-0.001195	0.058509	0.009894	0.011597	0.010790	0.017651
	(0.02859)	(0.02833)	(0.02851)	(0.02798)	(0.02749)	(0.02853)	(0.02836)
6	0.057775	-0.020594	-0.017530	0.057092	-0.048291	0.012055	0.036815
	(0.02862)	(0.02820)	(0.02851)	(0.02757)	(0.02746)	(0.02852)	(0.02827)
7	-0.002421	-0.033283	-0.056524	-0.004523	0.007702	-0.003975	0.032420
	(0.02845)	(0.02804)	(0.02854)	(0.02741)	(0.02657)	(0.02841)	(0.02828)
8	-0.007048	0.000587	0.001525	-0.008736	0.003543	0.003487	-0.006659
	(0.00706)	(0.00907)	(0.00719)	(0.00935)	(0.00820)	(0.00694)	(0.00663)
9	0.005823	0.001978	0.006233	0.018743	-0.013214	-0.004348	-0.004239
	(0.00639)	(0.00760)	(0.00694)	(0.00815)	(0.00593)	(0.00595)	(0.00608)
10	-0.009090	-0.000993	-0.012637	-0.011499	-0.001962	0.014202	0.007840
	(0.00524)	(0.00645)	(0.00631)	(0.00763)	(0.00492)	(0.00562)	(0.00531)
11	-0.002639	-0.002728	-0.007036	0.005774	0.008463	-0.005803	-0.003208
	(0.00442)	(0.00589)	(0.00472)	(0.00625)	(0.00450)	(0.00476)	(0.00463)
12	-0.006630	0.007154	-0.003463	0.008792	0.001921	0.000831	-0.008971
	(0.00411)	(0.00524)	(0.00382)	(0.00559)	(0.00415)	(0.00406)	(0.00410)
13	0.001791	0.000823	0.002983	0.002531	8.26E-05	0.001601	-0.001954
	(0.00314)	(0.00382)	(0.00309)	(0.00422)	(0.00252)	(0.00293)	(0.00330)
14	0.001679	0.000410	-0.001104	0.001687	0.001255	-0.001863	0.000319
	(0.00144)	(0.00158)	(0.00145)	(0.00246)	(0.00135)	(0.00146)	(0.00128)
15	-0.001747	0.001700	-0.001090	-0.002620	0.000999	0.000844	0.000118
	(0.00131)	(0.00129)	(0.00134)	(0.00182)	(0.00117)	(0.00130)	(0.00112)

Note: Figures in parenthesis represents standard error.

Table II-4

Impulse Response of RSP500 (Malaysian Market) to One Standard Error Shock in Given Market

Period	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	0.328829	0.306300	0.071717	1.548104	0.000000	0.000000	0.000000
	(0.03131)	(0.03068)	(0.03037)	(0.02146)	(0.00000)	(0.00000)	(0.00000)
2	0.008353	0.071043	-0.033894	0.099490	0.052532	0.081139	0.032545
	(0.03198)	(0.03191)	(0.03198)	(0.03188)	(0.03170)	(0.03185)	(0.03177)
3	0.034980	0.157661	-0.021237	0.029522	0.152943	0.012819	-0.071218
	(0.03227)	(0.03204)	(0.03210)	(0.03191)	(0.03110)	(0.03201)	(0.03186)
4	0.025624	0.008028	-0.008913	0.110583	-0.004399	0.021143	-0.004562
	(0.03231)	(0.03207)	(0.03230)	(0.03189)	(0.03107)	(0.03223)	(0.03204)
5	-0.048621	0.009688	0.035436	-0.190850	-0.023684	0.100919	0.048483
	(0.03255)	(0.03224)	(0.03249)	(0.03179)	(0.03108)	(0.03228)	(0.03202)
6	0.027864	0.012172	0.001888	0.099869	-0.008816	-0.028565	-0.019885
	(0.03258)	(0.03214)	(0.03252)	(0.03143)	(0.03125)	(0.03248)	(0.03222)
7	-0.085330	0.032904	-0.060183	-0.073408	-0.050322	0.086898	-0.031923
	(0.03250)	(0.03204)	(0.03261)	(0.03132)	(0.03046)	(0.03239)	(0.03220)
8	0.008204	0.000594	0.000378	-0.030790	-0.006843	0.011940	-0.016625
	(0.01003)	(0.01158)	(0.00979)	(0.01424)	(0.01188)	(0.01052)	(0.00973)
9	0.012895	-0.015553	-0.009375	0.007526	-0.005771	-0.001874	0.000731
	(0.00942)	(0.00984)	(0.00914)	(0.01293)	(0.00935)	(0.00974)	(0.00885)
10	-0.005546	-0.010106	-0.003678	-0.037674	-0.002905	0.011264	0.008734
	(0.00791)	(0.00828)	(0.00777)	(0.01201)	(0.00783)	(0.00851)	(0.00740)
11	0.012852	-0.009923	-2.31E-05	0.025527	-0.001844	-0.020422	-0.004502
	(0.00732)	(0.00791)	(0.00632)	(0.01099)	(0.00722)	(0.00808)	(0.00701)
12	-0.009785	0.000267	-0.001807	-0.014815	-0.003886	0.003839	0.002536
	(0.00517)	(0.00578)	(0.00503)	(0.00807)	(0.00504)	(0.00568)	(0.00557)
13	0.003104	0.001721	0.005121	-0.002767	0.002458	-0.008369	-0.001146
	(0.00477)	(0.00497)	(0.00461)	(0.00633)	(0.00403)	(0.00483)	(0.00478)
14	-9.59E-05	-0.000672	-0.001142	0.007827	-0.000196	-0.003149	-0.000375
	(0.00218)	(0.00244)	(0.00213)	(0.00436)	(0.00225)	(0.00234)	(0.00212)
15	-0.002683	-0.000651	0.000539	-0.005048	0.001156	0.002416	0.000493
	(0.00198)	(0.00198)	(0.00179)	(0.00366)	(0.00168)	(0.00214)	(0.00171)

Note: Figures in parenthesis represents standard error.

Table II-5

Impulse Response of RSP500 (Indonesian Market) to One Standard Error Shock in Given Market

Period	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	0.349434	0.498272	0.041261	0.434854	2.136062	0.000000	0.000000
	(0.04412)	(0.04330)	(0.04275)	(0.04232)	(0.02962)	(0.00000)	(0.00000)
2	0.058528	0.347228	-0.009074	0.357141	0.408576	0.184434	0.043194
	(0.04654)	(0.04621)	(0.04608)	(0.04573)	(0.04491)	(0.04472)	(0.04456)
3	0.039447	0.090934	0.043562	-0.110804	0.050690	0.102494	-0.065342
	(0.04667)	(0.04643)	(0.04662)	(0.04637)	(0.04539)	(0.04662)	(0.04639)
4	0.095011	0.029450	-0.023101	-0.063284	-0.028984	0.063895	0.018706
	(0.04665)	(0.04627)	(0.04664)	(0.04622)	(0.04491)	(0.04662)	(0.04635)
5	0.020026	-0.020581	-0.019098	-0.137818	-0.126511	-0.044284	0.022221
	(0.04673)	(0.04626)	(0.04665)	(0.04596)	(0.04480)	(0.04661)	(0.04625)
6	0.036174	0.138195	-0.023164	0.061428	-0.166529	0.132087	-0.011488
	(0.04694)	(0.04623)	(0.04679)	(0.04543)	(0.04493)	(0.04669)	(0.04624)
7	0.039360	-0.202454	-0.023986	-0.149018	-0.073004	0.124091	0.044658
	(0.04698)	(0.04623)	(0.04702)	(0.04517)	(0.04387)	(0.04668)	(0.04639)
8	-0.005201	-0.031748	-0.026708	-0.092963	-0.021576	0.011130	-0.010620
	(0.01828)	(0.02061)	(0.01801)	(0.02186)	(0.02241)	(0.01772)	(0.01840)
9	0.002046	-0.037692	-0.002163	0.022482	-0.012616	-0.018169	0.008835
	(0.01420)	(0.01470)	(0.01193)	(0.01535)	(0.01393)	(0.01264)	(0.01198)
10	-0.029447	-0.014954	-0.010207	-0.017295	-0.008108	0.010416	0.004512
	(0.01256)	(0.01298)	(0.01100)	(0.01452)	(0.01239)	(0.01163)	(0.01107)
11	0.003895	0.003559	-0.001859	0.033232	0.012599	-0.033642	-0.003594
	(0.01122)	(0.01222)	(0.01030)	(0.01353)	(0.01188)	(0.01105)	(0.01034)
12	-0.018163	0.014363	-0.015946	0.012024	0.010234	-0.003700	-0.015916
	(0.00997)	(0.01074)	(0.00982)	(0.01087)	(0.01070)	(0.00941)	(0.00960)
13	0.008919	-0.002373	0.004881	0.022184	0.006893	-0.014092	-0.007847
	(0.00802)	(0.00856)	(0.00805)	(0.00927)	(0.00756)	(0.00760)	(0.00802)
14	0.004066	0.002433	0.002259	0.012950	0.005283	-0.006445	-0.000550
	(0.00378)	(0.00461)	(0.00375)	(0.00571)	(0.00420)	(0.00357)	(0.00384)
15	-0.002323	0.004040	0.001889	-0.002896	0.003957	0.001967	0.000947
	(0.00301)	(0.00316)	(0.00238)	(0.00402)	(0.00291)	(0.00287)	(0.00234)

Note: Figures in parenthesis represents standard error.

Table II-6

Impulse Response of RSP500 (Thailand Market) to One Standard Error Shock in Given Market

Period	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	0.351748	0.530738	0.082456	0.513486	0.288676	1.650049	0.000000
	(0.03626)	(0.03517)	(0.03437)	(0.03361)	(0.03260)	(0.02288)	(0.00000)
2	0.093540	0.179633	-0.027497	0.049920	0.194968	0.030989	0.015262
	(0.03720)	(0.03703)	(0.03705)	(0.03697)	(0.03670)	(0.03680)	(0.03673)
3	0.103068	0.124956	-0.070019	0.009009	0.082423	0.047241	-0.011457
	(0.03737)	(0.03713)	(0.03723)	(0.03700)	(0.03614)	(0.03723)	(0.03707)
4	0.083241	-0.072605	-0.024700	0.075617	-0.017925	0.013328	0.029957
	(0.03743)	(0.03712)	(0.03737)	(0.03692)	(0.03599)	(0.03734)	(0.03712)
5	-0.012908	0.081376	-0.014158	-0.057836	-0.088558	0.006606	0.012171
	(0.03745)	(0.03707)	(0.03736)	(0.03666)	(0.03594)	(0.03736)	(0.03710)
6	0.024140	0.048241	-0.013503	0.046067	-0.057564	0.038391	0.007377
	(0.03745)	(0.03690)	(0.03735)	(0.03615)	(0.03592)	(0.03738)	(0.03704)
7	0.000370	-0.107408	-0.073254	-0.049808	-0.075973	0.044482	-0.060681
	(0.03733)	(0.03677)	(0.03742)	(0.03590)	(0.03485)	(0.03723)	(0.03702)
8	-0.007915	-0.025409	-0.007849	-0.050842	-0.015197	0.007354	-0.008698
	(0.01058)	(0.01286)	(0.01037)	(0.01437)	(0.01285)	(0.01084)	(0.01034)
9	-0.013271	-0.010207	-0.006042	0.015136	-0.001280	0.001897	-0.004463
	(0.00901)	(0.01013)	(0.00862)	(0.01190)	(0.00917)	(0.00891)	(0.00829)
10	-0.018137	-0.009751	-0.004443	-0.012062	-0.006480	0.004795	0.004348
	(0.00768)	(0.00857)	(0.00752)	(0.01089)	(0.00730)	(0.00782)	(0.00715)
11	-0.003213	-0.000775	-0.007026	0.008582	0.006158	-0.012193	-0.006055
	(0.00643)	(0.00779)	(0.00621)	(0.00987)	(0.00665)	(0.00710)	(0.00630)
12	-0.009205	0.004422	-0.003894	0.002012	0.005098	-0.007194	-0.009920
	(0.00551)	(0.00667)	(0.00520)	(0.00815)	(0.00589)	(0.00578)	(0.00555)
13	0.001401	0.006619	0.005918	0.005458	0.003434	-0.008028	-0.001777
	(0.00497)	(0.00557)	(0.00473)	(0.00620)	(0.00440)	(0.00491)	(0.00479)
14	0.003473	0.001107	0.001868	0.007512	0.002597	-0.003672	0.000839
	(0.00211)	(0.00262)	(0.00211)	(0.00355)	(0.00241)	(0.00215)	(0.00214)
15	-0.000425	0.000463	0.001070	-0.003674	0.001832	0.000340	0.000735
	(0.00167)	(0.00186)	(0.00145)	(0.00259)	(0.00151)	(0.00171)	(0.00134)

Note: Figures in parenthesis represents standard error.

Table II-7

Impulse Response of RSP500 (Indian Market) to One Standard Error Shock in Given Market

Period	RSP500	RKOSPI	RSSEC	RKLSE	RJKSE	RSET	RNIFTY
1	0.291816	0.359876	0.088825	0.137527	0.156198	0.123384	1.528137
	(0.03146)	(0.03079)	(0.03036)	(0.03028)	(0.03014)	(0.03001)	(0.02119)
2	0.079335	0.090408	-0.003030	0.027224	-0.002522	0.031679	0.062209
	(0.03200)	(0.03190)	(0.03196)	(0.03190)	(0.03175)	(0.03193)	(0.03185)
3	0.098234	-0.026143	0.043506	-0.045810	-0.043832	0.003054	-0.068283
	(0.03208)	(0.03189)	(0.03202)	(0.03182)	(0.03106)	(0.03204)	(0.03189)
4	0.022477	0.018160	-0.046290	0.040495	0.007066	0.017742	-0.021918
	(0.03210)	(0.03186)	(0.03207)	(0.03169)	(0.03088)	(0.03205)	(0.03187)
5	0.017854	0.101729	0.035189	0.041098	0.024190	0.025449	0.032187
	(0.03212)	(0.03179)	(0.03198)	(0.03142)	(0.03083)	(0.03202)	(0.03181)
6	-0.010274	-0.005673	-0.041081	0.041121	0.062972	0.059677	0.025347
	(0.03215)	(0.03169)	(0.03204)	(0.03105)	(0.03088)	(0.03206)	(0.03177)
7	0.008179	-0.042032	-0.051089	0.084897	-0.022369	0.030881	-0.079397
	(0.03203)	(0.03157)	(0.03212)	(0.03087)	(0.02991)	(0.03195)	(0.03178)
8	-0.002010	-0.002908	-0.006485	-0.011914	-0.011421	0.001842	-0.016250
	(0.00854)	(0.01075)	(0.00823)	(0.01104)	(0.01035)	(0.00818)	(0.00840)
9	-0.006450	0.016755	-0.008965	0.003506	0.002361	0.005361	0.000825
	(0.00786)	(0.00891)	(0.00767)	(0.00919)	(0.00711)	(0.00711)	(0.00745)
10	-0.002462	-0.001195	-0.005549	-0.001765	-0.011461	0.004610	0.006114
	(0.00623)	(0.00734)	(0.00662)	(0.00852)	(0.00574)	(0.00640)	(0.00641)
11	-0.006893	-0.002564	-0.008840	-0.015159	-0.003058	0.009971	-0.003750
	(0.00550)	(0.00683)	(0.00600)	(0.00782)	(0.00550)	(0.00600)	(0.00594)
12	0.002484	-0.005438	0.002014	0.002946	-0.001999	-0.006188	-0.007923
	(0.00483)	(0.00591)	(0.00471)	(0.00680)	(0.00480)	(0.00500)	(0.00515)
13	-0.004846	0.004748	0.000994	-0.006423	-0.002845	0.000338	-0.000382
	(0.00412)	(0.00465)	(0.00423)	(0.00517)	(0.00347)	(0.00398)	(0.00437)
14	2.10E-06	0.000585	0.000476	-0.000115	0.001111	-0.000390	0.001185
	(0.00157)	(0.00197)	(0.00143)	(0.00279)	(0.00153)	(0.00162)	(0.00158)
15	-0.000397	-0.001460	-0.000554	-0.000662	0.000432	-0.000908	-0.000311
	(0.00141)	(0.00145)	(0.00129)	(0.00198)	(0.00115)	(0.00141)	(0.00121)

Note: Figures in parenthesis represents standard error.