

Spill over effects of Developed Economies on Indian Stock market

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ABSTRACT

This article aims to find whether any spill over effects happen on Indian Stock market due to abnormal gains or abnormal losses generated by developed economies' indices. The period after economic reforms in India taken for study is between January 1, 1991 and October 31,2018. Developed economies are selected on the basis of higher FDI inflow into India. They are Singapore, Netherlands, US, Japan, Germany, Hong Kong, UK, France and Canada.

The spill over effects are studied on two phases. Phase I for the whole period. In phase II, only the months on which those indices generated abnormal gains or abnormal losses are selected for study. Rate of monthly return is calculated for the five months. The selected month, previous two months and next two months are selected for study. Correlation, unit root test, Granger causal test, Johansen Juselius co integration test are used to determine the spill over effects.

Keywords: Co-integration, unit root test, developed economies, spill over effects, Granger Causality test.

Introduction

United Nations Organization define developed economy as an economy whose per capita GNI income is more than \$37760. India whose GNI per capita income is \$1820 belongs to low- middle – income group. Developed economies invest more in India and India is also very keen in investing in developed economies. The following table summarizes the Foreign direct investment made by the top investing countries in India.

Main Investing Countries	2017, in %
Mauritius	37.3
Singapore	24.8
Netherlands	7.5
United States	5.0
Japan	4.0
Germany	2.7
Hong Kong	2.3
United Kingdom	2.1

Among the countries in the above list, Mauritius whose GNI per capita income is \$10140 belongs to upper-middle-income group. It can be noticed that except Mauritius, all other countries are developed economies. So it becomes vital to find the impact of spill over effects of these economies' stock markets on Indian stock

market. We would like to find the spill over effects after the respective stock market gains more than 10% return on any specific month or it loses more than 10% return on any month. Developed economies taken for the study are Singapore, Netherlands, United States, Japan, Germany, Hongkong and United Kingdom, France. Since Canada's FDI inflows has almost become three folds from 2016 to

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2017 (from \$105.85mn to \$285.60mn which is almost 0.66% of total FDI inflows), it is also included in this study. We have divided the total contents into five sections. Section I deals with Data which has been selected for this article. Section II details the major changes that includes more than 10% or less than 10% in any month in all the indexes during the 20 years taken for study. Section III elaborates correlation between the major change month data of developed economies and the subsequent month data of Indian stock market index. Section IV tests whether unit root exists in any of the indexes taken for study. Section V tests for co integration between the returns of major change month of developed economies' indexes and the returns of subsequent month of Indian stock market index.

Literature Review

Co-integration has become a core topic after globalization embraces almost the whole world. It is the area of interest of many researchers how various stock markets are co-integrated and how a major happening in one country affects the other countries and especially their stock markets. If the markets are not co-integrated and whether any chance for making arbitrage profit by making gain through the differences in the markets. Authors provide evidence on the evolution of contemporaneous and lead / lag relationships among eight national stock markets. (Koch and Koch, 1991). They suggest that regional interdependencies have grown over time. Assessing volatility of asset returns is an important prelude toward the proper evaluation of regulatory policy changes aiming at restricting (or enhancing) international capital flows. Volatility considerations also assume significance for determining the cost of capital and for implementing international diversification and hedging strategies [Bekaert and Harvey (1997)]. As far as co-integration of developing economies' stock markets are concerned, authors find no co-integration between the emerging markets of

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Malaysia, Thailand and Korea and the developed markets of United States, United Kingdom and Japan. (W.K.Wong, J.Penn, R.D.Terrell and K.Lim, 2004). On the other hand, the increase in financial links for open and semi-open markets in the 1990s suggests that the relaxation of foreign ownership restrictions might have enhanced links with world markets. (K.Phylaktis, F.Ravazzolo, 2005). Assessing volatility of asset returns is an important pre-requirement towards analysing the stock market performance and the spill over effects. After the economic reforms in 1992, India has been depending upon foreign investment for better stock market performance. Foreign investments will create spill over effects immediately in the stock market. [Bikash Mishra (2011)]. In their study "Modelling volatility spillover effects between developed stock markets and Asian emerging stock markets", authors examined the linkages of stock markets across the USA, Japan and six Asian developing countries between January 1993 and December 2012, they found significant unidirectional shock and volatility spill over between US Market to both Japanese and Asian emerging markets. (Yanan Li, David E, Giles, 2014). In "Volatility spillovers among the US and Asian stock markets: a comparison between the periods of Asian currency crisis and subprime period crisis" results reveal

that the markets in three major Asian financial hubs, i.e., Japan, Hong Kong and Singapore, are the markets to which volatility is spilled over uni-directionally from several other countries during the subprime credit crisis period, but not during the Asian currency crisis period. Authors attribute this difference to crisis-specific (currency or credit crisis), market-specific (credit derivatives market participation and foreign currency reserves), and time-specific (more integrated global market) factors. [Donald Lien, Geul Lee, Li Yang and Yuyin Zhang, (2018)]

Research Design and Methodology 4

Research Objectives

The following are the objectives of the study:

1. To find any co integration exists between Developed economies and Indian Stock market
2. To find correlation between sensex and developed economies indices of the world.
3. To find whether any of the indices cause Sensex and to find whether sensex cause any of the indices.

Research Design and Methodology

This study is to focus on the co integration between indexes of selected developed economies which invest more on Indian stock market and Indian stock market's index. The period of study is 27 years after economic reforms. That is between 1 January 1991 and 30 June 2018. The indexes of developed economies taken for study are

1. Singapore – FTSE Straits Times Singapore Index
2. Netherlands – Amsterdam Exchange Index
3. United States – S&P 500 Index
4. Japan – Nikkei 225 Index
5. Germany – DAX Performance Index
6. Hongkong – Hang seng Index
7. United Kingdom – FTSE 100 Index
8. France – CAC 40 Index
9. Canada- S&P TSX Composite Index

The months on which the indexes generated abnormal income that includes more than 10% monthly return or less than 10% monthly return.

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Augemented Dickey Fueller Test and Philips Perron Test are the tests used to find whether any unit root exists in the data series selected for Study. Pearson Correlation Test is used to find any correlation exists between Sensex and any of the developed economies' index. For testing co integration, Johansen and Juselius co integration test is used. Granger Causality test is used to find whether any of the developed economy indices cause Sensex and to find whether Sensex cause any developed economy index.

Data Analysis

We have divided the total contents into five sections. Section I deals with Data which has been selected for this article. Section II details the major changes that includes more than 10% or less than 10% in any month in all the indexes during the 20 years taken for study. Section III elaborates correlation between the major change month data of developed economies and the subsequent month data of Indian stock market index. Section IV tests whether unit root exists in any of the indexes taken for study. Section V tests the co integration between the data of major change month of developed economies' indexes and the data of subsequent month of Indian stock market index.

1. Section I – Data Used

Table 1: The list of indices & the respective months on which those indices generated abnormal return.

Sl No	Index	More than 15% gained months	More than 15% lost months
1	FTSE Straits Times Singapore Index	May 2009, Feb 2010, Jun 2016, Dec 2016, Oct 2017, Jun 2018	Oct 2008
2	Amsterdam Exchange Index	Sep 2002	Aug 1998, Jun 2002, Aug 2002, Dec 2007, Aug 2008, Sep 2008
3	Global S&P 500 Composite Index	-	Aug 1998, Oct 2008
4	Nikkei 225 Index	Jul 2008, Aug 2008	Sep 1993
5	DAX Performance Index	Jun 1997, Nov 1999, Mar 2003, Mar 2009	Jul 1998, Aug 2001, Jun 2002, Aug 2002, Dec 2007, Sep 2008, Jul 2011
6	Hangseng Index	May 2009, Oct 2007, Nov 1999, Apr 1999, Oct 1998, Feb 1998, Dec 1993, Oct 1993	Sep 2011, Oct 2008, Sep 2008, Jan 2008, Mar 2001, May 1998, Jan 1998, Oct 1997, Aug 1997, Mar 1994
7	FTSE 100 Index*	-	Sep 2002, Sep 2008, Oct 2008
8	CAC 40 Index	-	Sep 2002, Jan 2008, Oct 2008
9	S&P TSX Composite Index	-	Aug 1998, Feb 2001, Sep 2008, Oct 2008

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The above table lists the months on which abnormal return was generated during the period under study. 14% is the benchmark return. The months on which an index generated more

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than 14% or less than 14% monthly returns are taken for the study. Since FTSE 100 Index of UK has not generated the monthly return above 14% or below 14% in any month during the period of study, we have taken the months which generated monthly return above 10% or below 10%.

2. Section II – Selected developed economies' indices abnormal return more than or less than 15% monthly return.

The spill-over effects are studied by directly comparing the return of Sensex during the month, and next two months. For example, FTSE Straits Times Singapore Index generated abnormal return which is more than 14% in May 2009 (27.36%). So returns of Sensex during May 2009, June 2009, and July 2009 are compared.

Table 2: Abnormal return generated months of developed economies' indices and return generated by Sensex during that period.

Index	Abnormal return	Abnormal return generated month	Sensex Return during the month	Sensex return during the next month	Sensex return during the next second month
FTSE Straits Times Singapore Index	May 2009	27.36%	17.72%	23.70%	-1.64%
	Feb 2010	15.04%	-6.71%	0.60%	6.57%
	Jun 2016	18.65%	4.28%	1.41%	3.70%
	Dec 2016	16.21%	4.42%	0.17%	3.52%
	Oct 2017	15.43%	0.73%	5.57%	0.29%
	Oct 2008	-19.30%	10.27%	24.22%	10.81%
Amsterdam Exchange Index	Sep 2002	14.57%	6.72%	7.47%	0.64%
	Aug 1998	-15.12%	1.62%	9.87%	5.90%
	Jun 2002	-18.99%	6.10%	2.63%	7.95%
	Aug 2002	-22.62%	7.95%	6.72%	7.47%
	Dec 2007	-15.59%	2.94%	3.90%	13.15%
	Aug 2008	-21.96%	4.24%	2.45%	10.27%
	Sep 2008	-21.36%	2.45%	10.27%	2.42%
Global S&P 500 Composite Index	Aug 1998	-15.76%	1.62%	9.87%	5.90%
	Oct 2008	-18.56%	10.27%	24.22%	10.81%
Nikkei 225 Index	Jul 2008,	14.93%	-20.77%	4.24%	2.45%
	Aug 2008	27.21%	4.24%	2.45%	10.27%
	Sep 1993	-14.96%	10.94%	3.20%	2.40%
DAX Performance Index	Jun 1997	15.66%	2.11%	12.60%	1.38%
	Nov 1999	16.56%	6.85%	2.63%	12.23%
	Mar 2003	19.37%	1.27%	-8.34%	-2.96%
	Mar 2009	15.49%	-6.63%	10.63%	17.72%
	Jul 1998	-19.74%	-15.19%	-1.62%	-9.87%
	Aug 2001	-18.58%	-4.26%	-2.71%	-14.14%
	Jun 2002	-16.92%	-6.10%	2.63%	-7.95%
	Aug 2002	-29.33%	-7.95%	6.72%	-7.47%
	Dec 2007	-16.33%	-2.94%	3.90%	-13.15%
	Sep 2008	-15.61%	2.45%	-10.27%	-24.22%
	Jul 2011	-21.31%	2.39%	-3.34%	-7.87%

Index	Abnormal return	Abnormal return generated month	Sensex Return during the month	Sensex return during the next month	Sensex return during the next second month
Hang seng Index	May 2009	15.76%	17.72%	23.70%	-1.64%
	Oct 2007	14.42%	11.95%	14.82%	-2.94%
	Nov 1999	14.83%	-6.85%	2.63%	12.23%
	Apr 1999	19.76%	8.42%	-10.38%	15.67%
	Oct 1998	25.32%	5.90%	-7.38%	-0.59%
	Feb 1998	21.58%	-10.65%	10.63%	6.45%
	Dec 1993	26.42%	21.11%	4.95%	13.64%
	Oct 1993	19.50%	3.20%	-2.40%	21.11%
	Sep 2011	-15.46%	-7.87%	-4.26%	-7.61%
	Oct 2008	-25.44%	-10.27%	-24.22%	-10.81%
	Sep 2008	-16.56%	2.45%	-10.27%	-24.22%
	Jan 2008	-15.67%	3.90%	-13.15%	-3.38%
	Mar 2001	-14.74%	-0.35%	-20.56%	2.10%
	May 1998	-15.03%	3.95%	-8.25%	-15.19%
	Jan 1998	-14.75%	3.40%	-10.65%	10.63%
	Oct 1997	-34.82%	0.26%	-1.84%	-7.59%
Aug 1997	-14.65%	1.38%	-10.91%	0.26%	
Mar 1994	-14.22%	8.15%	-12.62%	-1.02%	
FTSE 100 Index*	Sep 2002	-12.74%	6.72%	-7.47%	-0.64%
	Sep 2008	-13.95%	2.45%	-10.27%	24.22%
	Oct 2008	-11.33%	-10.27%	-24.22%	-10.81%
CAC 40 Index	Sep 2002	-19.22%	6.72%	-7.47%	-0.64%
	Jan 2008	-14.22%	3.90%	-13.15%	-3.38%
	Oct 2008	-14.52%	10.27%	-24.22%	-10.81%
S&P TSX Composite Index	Aug 1998	-22.57%	-1.62%	-9.87%	5.90%
	Feb 2001	-14.31%	7.54%	-0.35%	-20.56%
	Sep 2008	-15.85%	2.45%	-10.27%	-24.22%
	Oct 2008	-18.55%	-10.27%	24.22%	-10.81%

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Whole world faced recession during Aug 2008, September 2008, and October 2008. So we can find almost all the indices faced a fall during that period. Otherwise there is no much spill-over effects on Indian stock markets by the developed economies due to the hike in their indices. Since FTSE 100 Index of UK has not generated the monthly return above 14% or

below 14% in any month during the period of study, we have taken the months which generated monthly return above 10% or below 10%.

3. Section III – correlation between Sensex and other developed economies' indices

Table 3: Correlation between Indian stock market index and developed economies index during the period of study:

<u>Index</u>	<u>Sense</u>	<u>AE</u>	<u>CA</u>	<u>DA</u>	<u>FTSE1</u>	<u>FTS</u>	<u>HS</u>	<u>NIKKEI2</u>	<u>GSP</u>	<u>TS</u>
<u>Sensex</u>	1	0.03	0.01	0.03	-0.03	0.19	0.0	0.01	0.06	-
<u>AEX</u>	0.03	1	0.13	-	0.12	0.07	7	0.62	0.16	0.0
<u>CAC</u>	0.01	0.13	1	0.15	0.85	0.04	0.6	0.22	0.83	0.7
<u>DAX</u>	0.03	-	-	0.11	-0.09	-0.00	0.0	0.03	-0.10	0.2
<u>FTSE100</u>	-0.03	0.12	0.83	-	1	0.07	3	0.19	0.82	0
<u>FTSE</u>	0.19	0.07	0.04	0.09	0.07	1	0.0	0.04	0.08	0.2
<u>HSI</u>	-0.08	-	-	0.06	-0.09	-0.05	0.0	-0.59	-0.08	0.6
<u>NIKKEI2</u>	0.01	0.63	0.22	0.03	0.19	0.04	5	1	0.18	9
<u>GSPC</u>	0.06	0.16	0.83	-	0.82	0.07	0.5	0.18	1	0.5
<u>TSX</u>	-0.05	-	-	0.10	-0.25	-0.05	0.0	-0.58	-0.26	0.2

0.72 0.27

0

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The above tables explain the correlation between any two indices for the whole period under study which is between Jan 1, 1991 and June 30, 2018.

The following information shows the correlation between the selected index and Sensex when the selected indices make abnormal return.

Sensex vs. FTSE Straits Times Singapore Index – correlation is 0.007

Sensex vs. Amsterdam Exchange Index – correlation is 0.03144

Sensex vs. Global S&P 500 index – correlation is 0.161052

Sensex vs. Nikkei 225 index – correlation is -0.285301

Sensex vs. DAX Performance index – correlation is -0.053132

Sensex vs. Hang seng Index – correlation is -0.010917

Sensex vs. FTSE 100 Index – correlation is -0.237807

Sensex vs. CAC 40 Index – correlation is -0.169869

Sensex vs. S&PTSX Composite Index – correlation is 0.114738

From the above correlation numbers, it has become clear that there is no spill over effects created by all the indices when the indices of developed economies earn abnormal return or abnormal loss.

4. Section IV: Granger Causality Test Results

Granger causality test is used to how far the movement in the developed economies indices going to Cause the movement in the sense. In this section we will also verify whether the developed economies indices' abnormal movement causes the Sensex.

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The following table lists the result of Granger causality test of developed economies indices during the complete 25 years of study. The second table lists the result of Granger Causality test of verifying whether developed economies indices cause Sensex during the period as listed in Table 1.

Table 4: Results of Granger Causality Test during the complete period.

Null Hypothesis	P value	Result at 95% confidence level
GSPC does not granger cause Sensex	0.0000	Null Hypothesis is rejected
FTSE 100 does not granger cause Sensex	0.0000	Null Hypothesis is rejected
FTSE Straits does not granger cause Sensex	0.0451	Null Hypothesis is accepted
DAX does not granger cause Sensex	0.8113	Null Hypothesis is accepted
AEX does not granger cause Sensex	0.0000	Null Hypothesis is rejected
S&P TSX does not granger cause Sensex	0.0000	Null Hypothesis is rejected
Nikkei 225 does not granger cause Sensex	0.0000	Null Hypothesis is rejected
CAC 40 does not granger cause Sensex	0.0000	Null Hypothesis is rejected
Hang seng Index does not granger cause Sensex	0.0000	Null Hypothesis is rejected
Sensex does not granger cause GSPC	0.8329	Null Hypothesis is accepted
Sensex does not granger cause FTSE 100	0.2728	Null Hypothesis is accepted
Sensex does not granger cause FTSE Straits	0.7190	Null Hypothesis is accepted
Sensex does not granger cause DAX	0.9723	Null Hypothesis is accepted
Sensex does not granger cause AEX	0.5924	Null Hypothesis is accepted
Sensex does not granger cause S&P TSX	0.6882	Null Hypothesis is accepted
Sensex does not granger cause Nikkei 225	0.6337	Null Hypothesis is accepted
Sensex does not granger cause CAC 40	0.3386	Null Hypothesis is accepted
Sensex does not granger cause Hang seng Index	0.5543	Null Hypothesis is accepted

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The above table shows that Sensex is caused by many indices. Indices like GSPC, FTSE 100, AEX, S&P TSX, Nikkei 225, CAC 40, and Hang sang Index influence Sensex. Spill over effects are created by stock market indices of developed economies like US, UK, Netherlands, Canada, France and Hong Kong. But spill over effects are not created by indices FTSE Straits index and Dax index of developed economies Singapore and Germany.

Granger Causality test is also conducted on the months listed in Table 1 which includes the months on which the selected indices generated abnormal return. So it is essential to verify any spill over effects created on Sensex by those indices during those months of abnormal return.

Table 5 – Results of Granger Causality test during those months on which those respective indices made abnormal gain.

Null Hypothesis	P value	Result at 95% confidence level
GSPC does not granger cause Sensex	0.0317	Null Hypothesis is rejected
FTSE 100 does not granger cause Sensex	0.7494	Null Hypothesis is accepted
FTSE Straits does not granger cause Sensex	0.0058	Null Hypothesis is rejected
DAX does not granger cause Sensex	0.5227	Null Hypothesis is accepted
AEX does not granger cause Sensex	0.2053	Null Hypothesis is accepted
S&P TSX does not granger cause Sensex	0.1125	Null Hypothesis is accepted
Nikkei 225 does not granger cause Sensex	0.6706	Null Hypothesis is accepted
CAC 40 does not granger cause Sensex	0.0052	Null Hypothesis is rejected
Hang seng Index does not granger cause Sensex	0.0093	Null Hypothesis is rejected
Sensex does not granger cause GSPC	0.1152	Null Hypothesis is accepted
Sensex does not granger cause FTSE 100	0.7376	Null Hypothesis is accepted
Sensex does not granger cause FTSE Straits	0.6464	Null Hypothesis is accepted
Sensex does not granger cause DAX	0.9567	Null Hypothesis is accepted
Sensex does not granger cause AEX	0.8996	Null Hypothesis is accepted
Sensex does not granger cause S&P TSX	0.8671	Null Hypothesis is accepted
Sensex does not granger cause Nikkei 225	0.1158	Null Hypothesis is accepted
Sensex does not granger cause CAC 40	0.6355	Null Hypothesis is accepted
Sensex does not granger cause Hang seng Index	0.5023	Null Hypothesis is accepted

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Spill over effects are created by GSPC, FTSE Straits index, CAC 40 and Hang Seng Index on Sensex during the months when the indices made abnormal gain as listed in Table 1. But spill over effects are not created by FTSE 100, DAX, AEX, S&P TSX, Nikkei 225. Moreover, Sensex does not create spill over effects on the indices of developed economies during the months in which those developed economies' indices generated abnormal gain or loss as listed in Table 1.

5. Section V: Unit root test Results

In this section we will do unit root test to check whether unit root exists in the data we selected for the indices.

Table 6: Test of stationarity – unit root test of all Indices –Augmented Dickey Fueller test and Philips Perron test results

	ADF Test value (Variable in Levels)	ADF Test value (variable in first differences)	PP Test value (Variable in levels)	PP Test value (Variable in first differences)
Sensex (India)	-16.48**	-15.23**	-16.49**	-108.39**
FTSE Straits (Singapore)	-11.51**	-13.50**	-11.72**	-30.69**
AEX (Netherlands)	-16.33**	-11.85**	-16.50**	-108.42**
GSPC (US)	-17.37**	-11.64**	-17.43**	-82.48**
Nikkei225 (Japan)	-16.80**	-15.30**	-16.71**	-80.09**
DAX (Germany)	-14.84**	-11.83**	-17.14**	-122.40**
Hang Seng (Hong kong)	-17.33**	-12.41**	-17.32**	-147.72**
FTSE 100 (UK)	-14.41**	-12.35**	-14.43**	-62.67**
CAC 40 (France)	-16.95**	-12.13**	-16.96**	-118.60**
TSX (Canada)	15.32**	-11.99**	-15.35**	-137.84**

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An ** indicates rejection of null hypothesis of non-stationarity even at 1 percent level of significance. Table displays the results of ADF test and Philips Perron Test at levels and at first difference. Table clarifies that there is no existence of unit root in the series of the selected indices in the period between January 1, 1991 and December 31, 2016. The results

clearly indicate null hypothesis of existence of stationarity can be rejected for all stock indices expressed in levels itself. Therefore we may conclude that all ten stock indices are integrated of order zero.

Data analysis 16**1. Section VI. Co-integration Test Results**

For testing co integration, testing the existence of Unit root is the first step. We have already tested all the ten indices for existence of Unit root. Both ADF test and PP Test confirm the absence of Unit root in all the ten indices data series. Unit root test suggest that they are all differenced at zero. So now Co integration test can be applied to check whether all these developed economies' stock markets are co integrated or not. For testing co integration, Johansen and Juselius co integration test is used. If test confirms that these markets are co integrated, there will be less chance for arbitrage.

Table 7: The Johansen Juselius co-integration test results

(Co-integrating vector: IN,SI,NE, US,JA,GE,HO,UK,FR,CA)

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	551.92	239.23	107.68	64.50
At most 1*	444.24	197.37	100.51	58.43
At most 2*	343.73	159.52	74.53	52.36
At most 3*	269.19	125.61	62.82	46.23
At most 4*	206.37	95.75	51.42	40.08
At most 5*	154.95	69.82	45.42	33.87
At most 6*	109.52	47.85	34.11	27.58
At most 7*	75.41	29.79	30.38	21.13
At most 8*	45.02	15.49	23.53	14.26
At most 9*	21.49	3.84	21.49	3.84

An * indicate rejection of null hypothesis of no co-integration at the 95% level of significance.

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From the table, JJ Test results it can be inferred that there is a co integrating relationship between India and nine developed economies' selected markets viz., Singapore, Netherlands, US, Japan, Germany, Hongkong, UK, France and Canada. This inference is supported by both the trace and the maximal Eigen value statistics of JJ approach. Both of these statistics are more than enough to reject the null hypothesis of no co integration ($r=0$) among India,

Singapore, Netherlands, US, Japan, Germany, Hongkong, UK, France and Canada stock markets at 95 percent level of confidence.

It is become vital to test for co integration during the months on which abnormal gains are generated by the developed economies indices. Data consists of the months on which developed economies' indices generated abnormal return, previous two months and next two months. We applied Johansen Juselius co integration test and the results are as follows:

6.1 India and Singapore

Table 8: The Johansen Juselius co-integration test results between India and Singapore stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	64.74	15.49	37.83	14.26
At most 1*	26.90	3.84	26.90	3.84

An * indicate rejection of null hypothesis of no co-integration between India and Singapore at the 95% level of significance.

6.2 India and Netherland

Table 9: The Johansen Juselius co-integration test results between India & Netherlands stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	19.98	15.49	15.32	14.26
At most 1*	4.66	3.84	4.66	3.84

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An * indicate rejection of null hypothesis of no co-integration between India and Netherlands at the 95% level of significance.

6.3 India and US

Table 10: The Johansen Juselius co-integration test results between India & US stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	33.35	15.49	22.03	14.26
At most 1*	11.32	3.84	11.32	3.84

An * indicate rejection of null hypothesis of no co-integration between India and US at the 95% level of significance.

6.4 India and Japan

Table 11: The Johansen Juselius co-integration test results between India & Japan stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	15.56	15.49	13.81	14.26
At most 1	1.75	3.84	1.75	3.84

Null hypothesis of no co integration between India and Japan is accepted at 95% level of significance

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6.5 India and Germany

Table 12: The Johansen Juselius co-integration test results between India and Germany stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	45.25	15.49	23.88	14.26
At most 1*	21.37	3.84	21.37	3.84

An * indicate rejection of null hypothesis of no co-integration between India and Germany at the 95% level of significance.

6.6 India and Hong kong

Table 13: The Johansen Juselius co-integration test results between India and Hong Kong stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	55.23	15.49	37.71	14.26
At most 1*	17.52	3.84	17.52	3.84

An * indicate rejection of null hypothesis of no co-integration between India and Hongkong at the 95% level of significance.

6.7 India and UK

Table 14: The Johansen Juselius co-integration test results between India & UK stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None	7.19	15.49	4.12	14.26
At most 1	3.07	3.84	3.07	3.84

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Null hypothesis of no co integration between India and UK is accepted at 95% level of significance

6.8 India and France

Table 15: The Johansen Juselius co-integration test results between India & France stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	23.92	15.49	15.23	14.26
At most 1*	8.68	3.84	8.68	3.84

6.9 India vs Canada

Table 16: The Johansen Juselius co-integration test results between India and Canada stock market indices

Hypothesized no of CEs	The Trace value		The Maximal Eigen value	
	Test Statistics	CV (95%)	Test Statistics	C.V.(95%)
None *	22.27	12.32	17.14	11.22
At most 1*	5.12	4.13	5.13	4.13

Results and Findings

1. ADF Test and Philips Perron Test clarifies that there is no existence of unit root in the series of the selected indices in the period between January 1, 1991 and June 30, 2018.

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2. From the correlation coefficients, it has become clear that there is no correlation created by all the indices when the indices of developed economies earn abnormal return or abnormal loss.
3. Through Granger Causality Test, it is observed that spill over effects are created by GSPC, FTSE Straits index, CAC 40 and Hang Seng Index on Sensex during the months when the indices made abnormal gain. But spill over effects are not created by FTSE 100, DAX, AEX, S&P TSX, Nikkei 225. Moreover, Sensex does not create spill over effects on the indices of developed economies during the months in which those developed economies' indices generated abnormal gain or loss
4. JJ Test results it can be inferred that there is a co integrating relationship between India and nine developed economies' stock markets viz., Singapore, Netherlands, US, Japan, Germany, Hongkong, UK, France and Canada.
5. There is no co integration between India and UK and India and Japan. Co integration exists between India and each of the remaining developed economies viz., Singapore, Netherland, US, Germany, Hong Kong, France and Canada.

Conclusion

So spill over effects on Indian stock market happen when indices FTSE Straits Index of Singapore, Amsterdam Exchange Index of Netherland, Global S&P Composite Index, Dax of Germany, Hang Seng Index of Hong Kong, CAC 40 of France and S&P TSX Index of Canada generate abnormal gain or abnormal loss. Surprisingly when Nikkei 225 of Japan and FTSE 100 of UK generated abnormal gain or abnormal loss, spill over effects do not happen on Indian stock market. During normal circumstances, there is no co integration between India and developed economies' stock markets. When abnormal gains are made or abnormal loss is generated, there is no co integration between India and UK and India and Japan. But

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co integration exists between India and each of the remaining developed economies viz., Singapore, Netherland, US, Germany, Hong Kong, France and Canada during those circumstances. Through Granger Causality test, it is observed that Sensex does not create spill over effects on the indices of developed economies during the months in which those developed economies' indices generated abnormal gain or loss.

Suggestions:

1. Since there is no correlation exists among Indian stock market and developed economies' stock markets taken for study when these stock markets generate abnormal gain or abnormal loss, Investors in Indian stock market need not be very anxious when these stock markets exhibit abnormal movement.
2. Since GSPC (US), FTSE Straits index (UK), CAC 40 (France) and Hang Seng Index (Hong Kong) granger causes on Sensex, Investors on Indian stock market follow these US, UK, France and Hong Kong markets before making their investment.

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