



UGC Approved Journal Number: 44278

Shanlax International Journal of Management

A Peer-reviewed - Refereed Scholarly Quarterly Journal
with Impact Factor

VOLUME 5 | SPECIAL ISSUE 1 | September 2017



International Conference on

Interdisciplinary Research for Sustainable Development

(SIJ) Bombay

ISSN 2321 - 4643

Effectiveness of Stock Market Regulators: Comparative Study of India with Developed Nations

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Abstract: The development of an economy is largely influenced by financial markets—they competitively allocate financial resources that are mobilized from savers and investors among users in the economy. The Indian stock market is one of the earliest market in Asia, which is operational since 1875. However, it remained largely outside the global integration process until 1991. There has been a conscious effort by the RBI and the Government of India to develop and integrate various financial market segments in a phased manner. Both have proactively shaped the development of financial markets in India through its series of economic policy reforms— market-determined interest and exchange rates, current account convertibility, monetary policy dealing with price-based instruments, auction-based allocation in the government securities market (GSM), and phased capital account. As a consequence, India too has become a part of the world-wide integrated financial system. In this context, this paper seeks to examine whether reform in the Indian stock market has led to integration with the developed stock markets in the world. The study finds that Indian stock market is not co-integrated with the developed market as yet. Only some short-term impact exists. The integration is unidirectional in majority of countries. That is to say, the developed stock markets, viz., Canada, France, Germany, Japan, Norway, Sweden, UK and USA Granger cause the India stock market but not vice versa. Its only with Australia that India have bi-directional causality. It is derived from the study that although some positive steps have been taken up, which are responsible for the substantial improvement of the Indian stock market. However, these are not sufficient enough to make Indian stock market as a matured one and hence not integrated with the developed stock markets so far. From a policy perspective, no co-integration between Indian financial market with developed countries leads to policy formation aiming to level co-integration so as to achieve financial stability.

Keywords: Unit Roots Test, Cointegration, Variance Decomposition, Granger Causality.

I. INTRODUCTION

One of the most important national policy decisions during the late twentieth century and forepart of this century has been the financial liberalization of equity markets across the world. Equity market liberalization gives foreign investors the opportunity to invest in domestic equity markets and domestic investors the right to transact in foreign equity market. However, it is important to distinguish between the concepts of liberalization and integration. For example, a country might pass a law that seemingly drops all barriers to foreign participation in domestic capital markets. This is liberalization, but it may not be an effective liberalization that results in market integration.

The Indian stock market is one of the earliest in Asia being in operation since 1875, but remained largely outside the global integration process until the late 1980s. A number of developing countries with the initiative of International Finance Corporation and the World Bank started the reform process in the stock markets in order to mobilize finance in an effective way. In line with the global trend, Indian stock market also initiated the reform process in the financial market in general and stock market in particular. However, the critics argue that the stock market reform of the 1990s in India is an offshoot of the crisis erupted in 1992 owing to the infamous stock market scam (Shah and Thomas 2001). Thus, it is claimed that although reform process in India started with the establishment of Securities and Exchange Board of India in 1988 to frame rules and guidelines for various operations of the stock exchange in India it was not that active as it became after the post-scam period. Over the decade of 1990s, a series of measures in the stock markets were taken. The stock markets introduced the best possible systems practiced in advanced stock markets, viz., electronic trading system, dematerialisation of shares, replacement of the Indian carry forward trading system called '*badla*' by the index-based and scrip-based futures and options; rolling settlement in place of the account period settlement; adoption of risk management through 'novation' at the clearing corporation etc. With the introduction of these advanced practices transparency has also increased in the stock market. Further, among the significant measures of opening up of capital market, portfolio investment by foreign institutional investors (FIIs) such as pension funds, mutual funds, investments trusts, asset management companies, nominee companies and incorporated portfolio managers allowed since September 1992 have made the turning point for the Indian stock markets. As of now, India is allowed to invest in all categories of securities traded in the primary and secondary segments and in the derivative segment. On the other hand, the ceiling on aggregate equity of FIIs including NRIs (non-resident Indians) and OCBs (overseas corporate bodies) in a company engaged in activities other than agriculture and plantation has been enhanced in phases. Further, with the financial sector reforms initiated in 1991, not only FIIs and NRIs are allowed to invest in Indian stock markets, Indian corporate have also been allowed to tap the global market with global depository receipts (GDR), American depository receipts (ADR) and foreign currency convertible bonds (FCCB) since 1993. However, the company with good track record is required to obtain prior permission

from the Government of India in order to issue GDR/ADR/FCCB1.

With the automation and liberalization of the Indian stock markets there has been a perceptible change in the Indian stock market towards the later part of the 1990s and fore part of the current decade. Trading system in BSE and NSE has no doubt reached a global standard. It has created a nationwide trading system that provides equal access to all investors irrespective of their geographical location. In that sense, technology has brought about equality among the investors across the country. This has resulted in phenomenal growth of Indian stock market during the post liberalization period. The number of shareholders and investors in mutual funds rose from 2 million in 1980 to 40 million in 1993 (Biswal and Kamaiah 2001). This makes the Indian investors' population the second largest in the world next to US and largest in terms of companies listed, with nearly 7,985 companies listed by the end of 1995 (Misra 1995).

Equity market liberalization gives foreign investors the opportunity to invest in domestic equity markets and domestic investors the right to transact in foreign equity market. However, it is important to distinguish between the concepts of liberalization and integration. For example, a country might pass a law that seemingly drops all barriers to foreign participation in domestic capital markets. This is liberalization, but it may not be an effective liberalization that results in market integration.

From the above analysis, it is evident that the stock market in India has witnessed a phenomenal but uneven growth during the post liberalization period. In other words, the deregulation and market liberalization measures and the increasing activities of multinational companies have accelerated the growth of Indian stock market. Thus, given the newfound interest in the Indian stock markets during the liberalization period, an intriguing question may obviously arise in one's mind as to how far India has gone down the road towards international stock market integration, and whether any linkages have taken place among the stock indices of India and world's major stock indices. To answer these questions, we examine the interrelationship between Indian stock markets and major developed stock markets and study the underlying mechanism through which the Indian stock indices interact with international stock indices by analyzing empirically the long-run pair-wise, and multiple cointegration relationship and short-run dynamic Granger causality linkages between the Indian stock market and the major developed markets, viz., Australia, Canada, France, Germany, Japan, Norway, Sweden, UK and USA in the post liberalization period.

To diagnose and minimize the negative implications of financial interdependence among economies and regional integration, several researches were conducted to evaluate the interdependence across regional integration of national stock markets of several developed nations. In several literatures, bi-directional causality is tested among India and other countries, yet it is in scarce. Hence there is a need to examine these interdependence, as international interdependence of emerging markets has great implications for both in case of developed

and developing economies. If the interdependence is sufficiently strong, then domestic market may get insulated from global shock while a weak interdependence facilitates gains from international divergences.

II. REVIEW OF LITERATURE

Among studies on international markets, most of the studies have focused on the developed markets specially US, Japan & major European countries. In some interdependence between developed Asian and emerging markets with developed equity markets have been studied.

Grubel (1968), in the paper examined the gains of international diversification through co-movement and correlation between different markets and US perspective. Hamao et al (1990) used univariate GARCH model to study return and volatility spillover between New York, Tokyo and London stock markets. Same stock markets analyzed by Koutmos and Booth (1995) using EGARCH model to find return and volatility between the markets.

The multi-variate GARCH model is applied by Engle, Ito and Lin (1990), to investigate the intraday volatility spillover between US and Japanese foreign exchange market. The same model was further applied by various authors on different capital markets (Bekaert and Harvey (1997), Ng (2000), Baele (2002), Christiansen (2003), & Worthington & Higgs (2004)).

The effects of introduction of EURO on European and US markets, have been examined by many authors. Yet the linkage between European and US market are not conclusive, most of studies claimed that these linkages increased after EURO. Bartram (2007), uses general time varying copula dependence model to study linkage among Euro and non-European countries. They concluded that, due to increased European integration, dependence within the Euro area increased only for some countries and not for the whole Europe and non-European countries.

Bekaert & Harvey (1997), claimed the influence of integrated global market factors on validity and local factors influence on segmented markets. Worthington and Higgs (2007), analyzed nine Asian Stock market and concludes the existence of volatility spillover and positive mean. Chuang et al (2007) uses VAR-BEKK framework to investigate volatility spillover among six East Asian markets. The study concludes the influential nature of Japanese market in transmitting volatility.

Hansda & Ray (2002), examine the interdependence between the Nasdaq/NYSE and BSE/ NSE. They analyzed technology shocks and conclude unidirectional causality between the sample. Nair & Ramanathan (2002), used Engle Granger residual based test of co-integration, between the US and Indian stock market indices. Causal results were found positive and flowed from Nasdaq to NSE.

Mukherjee & Mishra (2006), examined Indian stock market with 12 other developed Asian countries with reference to return and volatility. Results obtained through GARCH concludes that Indian open-to-close returns are more related to foreign market than close-to-open return.

Tripathi & Sethi (2010), examines the integration of the Indian stock market with the stock market of Japan, UK, US and China over the period 1st January 1998 to 31st October 2008 using Engle - Granger cointegration test and Granger's causality Test. The results show that the Indian stock market is not integrated with any of these markets except US. However, unidirectional causality was found in most cases.

Srinivasa Rao, C.A. Yoonus (2012), using the daily returns of the indices of US (S&P 500) and the Indian stock markets (CNX S&P Nifty), examines the impact of the global financial crisis on the level of financial integration between the US and Indian stock markets from March 2005 to November 2010. The article also analyses the existence of cointegration and dynamic relationship between the two indices during the pre-crisis, crisis and post-crisis periods, and in the last five years, using the Johansen Cointegration analysis and the Vector Auto Regression (VAR) Model. The article finds no cointegration between the two indices in all the four periods.

Deepak R. & Sandeep M. (2013), tries to understand the intensity of the stock market integration for diversification motives of both retail and institutional investors. The study was conducted considering five major indices of the world namely BSE 30, NSE CNX NIFTY, HANG SANG index, S&P 500, and KLSE COMPOSITE for the period 2002-13. It was observed that correlation among the returns of the indices has increased over the period of time. It may be seen as first indication for the increasing interdependency and integration of the markets. All the indices considered were found to be co-integrated emphasizing the existence of long term relationship. Granger causality test show one-way and two-way integration between the indices which have considerably changed over the time period.

Rafay & Farid (2017), investigate the extent of financial integration between the four major money markets (Pakistan, India, Sri Lanka, and Bangladesh) in the SAARC region. To determine the association between these money markets, this study deployed variety of robust time series techniques such as JJ Co-integration Test, Granger Causality Test, Impulse Response Functions (IRF), and Variance Decomposition Analysis (VDC). Monthly data for the period 2007-2015 was utilized for the data analysis whereas Call Money rates and Interbank rates were used as proxies of money markets. The empirical findings confirmed the presence of long term relationship between the nominal interest rates in SAARC region.

III. OBJECTIVE OF THE STUDY

The main objective of this paper is to investigate the issue of stock market integration in India in the light of financial liberalization. The relaxation of all types of economic barriers and developments in information technologies are, among others, expected to induce stronger stock market integration as opposed to stock market fragmentation. As well-developed and large financial markets contribute significantly to economic growth [see Arestis, Demetriades and Lunitel (2001) and Beck, Levee and Loeyssa (2000)], the development and integration of

Indian financial markets is of particular importance. Further, the nature and extent of equity market integration is of importance for corporate managers as it influences the cost of capital, and for investors as it influences international asset allocation and diversification benefits (e.g. Sentana (2000)). Since the work of Grubel (1968) on expounding the benefits from international portfolio diversification, the relationship among national stock markets has been widely studied. Hence the relationship among different stock markets has great influence on investment because diversification theory assumes that prices of different stock markets do not move together so that investors could buy shares in foreign as well as domestic markets and seek to reduce risk through global diversification. Under this backdrop, it is worth examining whether Indian stock market has really integrated with the world markets.

The purpose of this study is to explore the: -

- analyzing interlinkages of India with Australia, Canada, France, Germany, Japan, Norway, Sweden, UK and USA,
- evaluating lead-lag relationship of the co-integrated indices of countries, and
- tracing the impact of regional and global stock market on Indian market both in the short-run and long-run.

IV. DATA

The sample used in the study consists of most liquid and actively traded indices in nine countries namely, Australia, Canada, France, Germany, India, Japan, Norway, Sweden, UK and USA. The period of study ranges from April 2011 to March 2017, however the data period varies across countries. The data comprises of daily closing stock prices of sample countries. The natural logarithm of daily prices is taken to minimize the heteroscedasticity in data. These aggregate indices are applied to examine the aggregate behavior of regional integrations with regards to price discovery.

V. METHODOLOGY

Given the nature of the problem and the quantum of data, we first study the data properties from an econometric perspective. We find whether co-integration exist, and then error correction models are applied to establish the equilibrium relationship between the markets. The concept of co-integration becomes relevant only when the time series being analyzed are non-stationary. Therefore, ADF and Phillip Perron tests are applied on the relevant data to check the stationarity. Subsequently, long-run cointegration is analysed through Johansen Co-integration test, while Vector Error Correction Model is used for estimating short-run adjustments. To test the causality Granger Causality block exogeneity test is performed and the findings are provided in detail in results section.

VI. RESULTS

The time series stationarity of sample price series has been

tested using Augmented Dickey Fuller (ADF) 1981. The ADF test uses the existence of a unit root as the null hypothesis. To double check the robustness of the results, Phillips and Perron (1988) test of stationarity has also been performed for the series. The results of stationarity tests are given in Table 1. It confirms non-stationarity of data; hence we repeat stationarity tests on return series (estimated as first difference of log prices) which are also provided in Table 1. The sample return series exhibit stationarity thus conforming that prices are integrated to the first order.

The price linkage between pairs of indices of countries is examined using co-integration (Johansen, 1991) analysis that has several advantages. First, co-integration analysis reveals the extent to which two markets move together towards long run equilibrium. Secondly, it allows for divergence of respective markets from long-run equilibrium in the short run. The co-integrating vector identifies the existence of long run equilibrium, while error correction dynamics describes the price discovery process that helps the markets to achieve equilibrium. Co-integrating methodology fundamentally proceeds with non-stationary nature of level series and minimizes the discrepancy that arises from the deviation of long-run equilibrium. The observed deviations from long-run equilibrium are not only guided by the stochastic process and random shocks in the system but also by other forces like arbitrage process. As a result, the process of arbitrage possesses dominant power in the commodity future market to minimize the very likelihood of the short run disequilibrium. Moreover, it is theoretically claimed that if pairs of indices are co-integrated, then it implies presence of causality at least in one direction. On the other hand, if some level series are integrated of the same order, it does not mean that both level series are co-integrated. Co-integration implies linear combinations of both level series cancelling the stochastic trend, thereby producing a stationary series.

Table 1: Stationarity Test for Countries

Countries	Stock Price Series		Interface on Return Series Integraion I(I)	
	ADF-Test	Phillip-Perron Test	ADF-Test	Phillip-Perron Test
	t-statistics	t-statistics	t-statistics	t-statistics
	Australia	-1.36	-1.15	-47.25
Canada	-1.48	-1.35	-44.17	-44.32
France	-0.92	-0.72	-47.32	-47.71
Germany	-0.85	-0.78	-46.82	-46.90
India	-0.49	-0.49	-45.89	-45.89
Japan	0.39	0.32	-45.38	-45.42
Norway	-0.91	-0.70	-47.95	-48.47
Sweden	-1.13	-0.94	-50.38	-51.51
UK	-1.99	-1.70	-47.03	-47.73
USA	-0.56	-0.41	-49.32	-49.74

*The table describes the sample price series that have been tested using Augmented Dickey Fuller Test (ADF) 1981. The ADF test uses the existence of unit root test as a null hypothesis. To double-check the robustness of the results, Phillip and Perron (1988) test of stationarity has also been performed for the price series and both the test are performed on return series also as shown in table. Unit root test is applied to data at level and at I^1 difference I(1). All test are performed using 5% level of significance (**).*

Johansen's Co-integration test is more sensitive to the lag length employed. Besides, inappropriate lag length may give rise to problems of either over parameterization or under parametrization. The objective of the estimation is to ensure that there is no serial correlation in the residuals. Here, Akaike information criterion (AIC) is used to select the optimal lag length and all related calculations have been done embedding that lag length. The co-integration results are reported in Table 2.

Maximal Eigen value and trace test statistics are used to interpret whether null hypothesis of $r=0$ is rejected at 5% level and not rejected when $r=1$. Rejection of the null hypothesis implies there exists at least one co-integrating

Table 2: Johansen's C0-Integration Test

Countries	Leg Length	Max Eigen Value	Trace Statistics	Critical Value**
India & Australia	2	0.004005	9.009804	15.49471
India & Canada	4	0.005341	11.78847	15.49471
India & France	8	0.003155	6.952096	15.49471
India & Germany	4	0.003776	8.351436	15.49471
India & Japan	2	0.004288	9.624213	15.49471
India & Norway	3	0.005688	12.63634	15.49471
India & Sweden	8	0.003788	8.330684	15.49471
India & UK	7	0.003477	7.713842	15.49471
India & USA	8	0.00459	10.03906	15.49471

This table provides the Johansen's o-Integration test, Maximal Eigen Value and Trace Statistics are used to interpret whether null hypothesis if of $r=0$ is rejected at 5% level and not rejected where $r=1$. Rejection of null hypothesis implies that there exists at least one cointegrating vector which confirms a long run equilibrium relationship between the two variables, stock indices of two countries in our case. The null hypothesis is accepted in all nine combinations of developed countries with India which reveals that no cointegration relationship exists among these combinations.

vector which confirms a long run equilibrium relationship between the two variables under consideration are combinations of countries. The null hypothesis is accepted in case of all combinations, which reveals that no co-integration relationship exists between combinations of countries. Thus, these countries indices do not share common long-run information.

Our co-integration result confirms that in general there is no price discovery process in the concerned sample. Despite determining a co-integrating vector for each country, it is customary to produce the diagnostic checking criterions before estimating the ECM model. Diagnostic tests are performed for those sample indices for which long run relationship between countries is confirmed based on Johnson Co-integration test. Vector Auto Regression (VAR) estimated with various lags selected by AIC is used to check whether the model satisfies the stability, normality test as well as no serial correlation criterion among the variables in the VAR Adequacy model. Testing the VAR adequacy of the sample series, it was revealed that all the sample indices are satisfying the stability test. In normality test, all the sample commodities are found to be non-normal. In verifying the VAR Residual Serial Correlation LM Tests it was found that in all sample series no serial correlation was present. Therefore, it leads to take the position that our model fulfils the adequacy criterion for majorly almost all countries.

The error correction model takes into account the lag terms in the technical equation that invites the short run adjustment towards the long run. This is the advantage of the error correction model in evaluating price discovery. The presence of error correction dynamics in a particular system confirms the price discovery process that enables the market to converge towards equilibrium. In addition, the model shows not only the degree of disequilibrium from one period that is corrected in the next, but also the relative magnitude of adjustment that occurs in both markets in achieving equilibrium. Moreover, co-integration analysis indicates how two markets reveal pricing information identified through the price difference between the respective markets. The implication of co-integration is that the prices in two separate markets respond disproportionately to the pricing information in the short run, but they converge to equilibrium in the long run under the condition that both markets are innovative and efficient. In other words, the root cause of disproportionate response to the market information is that a particular market is not dynamic in terms of accessing the new flow of information and adopting better technology. Therefore, there is a consensus that price changes in one market generates price changes in the other market with a view to bring a long run equilibrium relation.

Table 3: Lead-Lag Relationship of VECM

Countries	Dominant Role	Direction
India & Australia	Australia	Bi-directional
India & Canada	Canada	Uni-directional
India & France	France	Uni-directional
India & Germany	Germany	Uni-directional

India & Japan	Japan	Uni-directional
India & Norway	Norway	Uni-directional
India & Sweden	Sweden	Uni-directional
India & UK	UK	Uni-directional
India & USA	USA	Uni-directional

Out of 9 combinations of countries, bi-directional interlinkages are found in 1 such combination that is only between India & Australia while in rest 8 we have only uni-directional relation.

The Vector Error Correction Model (VECM) results shows, short run dynamics in the price series and price movements in the two markets. The lag length of the series is selected in Vector Error Correction Model (VECM) on the basis of Akaike's Information Criteria. The residual diagnostics tests; indicate existence of Heteroscedasticity, in most of the sample commodities and indices which exhibit cointegration. Thus, t-statistics are adjusted, as well as the Wald test statistics which are employed to test for Granger causality.

The Variance Decomposition Analysis measures the percentage of the forecast error of a variable that is explained by another variable. It indicates the relative impact that one variable has upon another variable within the VECM system. In addition, the empirical results of between combinations of index prices of countries were examined to check the direction of causality. The results display a mix of bidirectional and uni-directional linkages among various combinations of regional integration and countries. These empirical results are consistent with the VECM results of short-term adjustments. A summary of lead-lag relationship and dual and singular causal aspects, based on the combined results of VECM and VEC Granger Causality/Bloc Exogeneity Wald test, are depicted in Table 3.

VII. EMPIRICAL FINDINGS

We cover time series stock indices of ten countries namely Australia, Canada, France, Germany, India, Japan, Norway, Sweden, UK and USA. The study period ranges from 1st April, 2011 to 31st March, 2017. We find that sample indices are non-stationary. Long run equilibrium relationship is not confirmed for all combinations of countries with India using Johansen's Co-integration procedure. Despite of having no co-integration we check short-run movement of stock prices to decide about the dominant country. Short term dynamics of the markets are examined using VECM. Results exhibits that India is not playing dominant role in any of the concerned combinations. The results of VEC Granger causality test show both uni-directional and bi-directional Granger lead relationships between combination of countries. Out of the nine combinations of countries, bi-directional interlinkages are found in 1 such combination that is only between India & Australia while in rest 8 we have only uni-directional relation.

VIII. CONCLUSION

India is one of the emerging economies, which have witnessed significant development in the stock markets during the recent periods due to the liberalization policy initiated by the government. It is generally believed that due to liberalization policy and the consequent development of Indian stock markets, the latter might have integrated with the developed markets. One may argue that due to this integration, which appears to have taken place after liberalization, Indian stock market will mainly be governed by a common factor as in the case of the developed markets. However, our study does not support this view. Rather, it finds that Indian stock market is not at all integrated with the world markets. Of course, the study finds that barring Australia there is a unidirectional causality from the developed market. Hence, we may conclude that Indian stock market is not influenced by other markets. Of course, some short-term sentiment in the world market does have impact but this is short-lived. That means the pre-requisites, which are required for long-run relationship has not been achieved by India so far.

IX. POLICY IMPLICATIONS

The empirical analysis provides various applied finance perspective on co-integration among stock markets of various countries. Empirical evidence doesn't support the international integration of India's stock market in terms of stock prices. There is evidence of the differential impact of regional and global stock market on the Indian market in the long run as well as in the short run. From a policy perspective, no co-integration between Indian financial market with developed countries leads to policy formation aiming to level co-integration so as to achieve financial stability. From the standpoint of their portfolio diversification objective, investors can benefit from arbitrage activities in the long run. Likewise, in the short run also markets would continue to be influenced by the portfolio diversification objective of foreign investors. The lack of evidence of integration of stock markets in terms of local currency gives rise to a concern that India's stock market integration may not be complete, a finding attributable to the inadequate role of domestic investors and policy makers.

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