Exogenity Of Asian Financial Markets And Possible Contagion: Some Empirical Evidence

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SECTION- I

INTRODUCTION

The growing proliferation of liberalized policies have not only facilitated financial and economic development, but also made the universe a small place by integrating different countries and markets and substantially furthered the extent of capital mobility and cross border transactions. **During the last decade, almost all the emerging economies have undertaken institutional and structural reforms with the objective of ensuring a conducive platform to international business communities and to peg the economy at par with developed economies.** Particularly, the process of reform combined with the advancement in information technology has altered the way transactions were executed in the financial market and redefined the market microstructure. Albeit, financial markets have been defined in all its facets, there also emerge serious issues in the investing community with the growing integration of economies and financial markets all over the world. Financial markets are getting more and more contagious as witnessed by **Asian Crisis (1987) and the recent Global financial crisis (2008)**.

Financial market players particularly, the institutional players adopt international diversification strategies in order to optimize the return on investment by ensuring a legitimate risk-return trade off. And, it is immensely sensitive to investors having diversified portfolio in different markets to ascertain whether they are able to alleviate the systematic risk as documented in different portfolio models **(Markowitz, 1952; Sharpe, 1964; Lintner, 1965)**. With the growing manifestation of cross-border investment on one hand and the probability of financial market contagions on the other hand, it becomes inevitable to explore the extent and magnitude of exogenity and integration among different financial markets. Further, the gradual dismantling of regulatory barriers and the introduction of more advanced technology, have called for new market structures and practices, keeping in mind the move to reach a global standardization. In particular, emerging equity markets have attracted the attention of international fund managers as an opportunity for portfolio diversification and have also provided the impetus to the academic community to unfold the issue of international market linkages.

The present paper is explicitly intended to explore the dynamic interactions among these emerging markets in Asia to study their level of integration. The objective of the paper is to understand the dynamic inter-linkages between four emerging equity markets in Asia viz. India, South Korea, Taiwan and Philippines and to understand whether the stock markets in these Asian are interlinked. If these markets are independent, then investors in these countries can invest in different markets of the region to diversify their portfolio and the authorities in the region need not worry about any contagious effects if one market experiences any turmoil. The present study will help in understanding portfolio diversification strategy of international investors who operate in these markets. The rest of the paper is as follows: Section two discusses the existing literature; Section three deals with the data used and methodological issues; Section four analyses the data and interprets the result of the analysis followed by Section five where conclusions and possible implications have been documented.

Section- II

REVIEW OF LITERATURE

- **Taylor and Tonks (1989)** studied the market integration concerning markets of U.S., Germany, Netherlands and

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Japan using monthly data on stock price indices for the sub-periods, April1973 - September 1979 and October 1979-June 1986 and employed is a bivariate cointegration technique (Engle and Granger, 1987). They found stock price index of the U.K. was cointegrated with the stock price index of the U.S., Germany, Netherlands and that of Japan for the later period, but not for the former period. Based on these results, they suggested that there is no long-term gain from diversification for the U.K investors after the abolition of exchange control.

- **Kasa (1992)** also explored common stochastic trends in the stock markets of the U.S., the U.K., Japan, Germany and Canada using monthly and quarterly data from 1974 to 1990 and found that a single common stochastic trend driving these countries' stock markets.
- **Kanas (1998)** explored the linkages between the U.S. and European stock markets using the daily data and found that the U.S. stock market was not pair-wise cointegrated with any of the six European stock markets.
- **Rocca (1999)** investigated the price linkages between the equity markets of Australia and that of the U.S., U.K., Japan, Hong Kong, Singapore, Taiwan and Korea using weekly stock market and found that no cointegration existed between Australia and other markets. But he found that the Granger causality tests revealed that Australia is significantly linked with the U.S. and the U.K.
- **Li (2002)** employed techniques of nonlinear cointegration analysis to study international stock market integration. The stock price indexes of Japan, Australia, New Zealand, UK and the US are used in both linear and nonlinear cointegration tests on bivariate and multivariate models. Much more evidence of market integration emerges from nonlinear cointegration analysis than linear analysis.
- **Brooks and Negro (2003)** explore the link between international stock market comovement and the degree to which firms operate globally. Using stock returns and balance sheet data for companies in 20 countries, they estimate a factor model that decomposes stock returns into global, country-specific and industry-specific shocks. They find a large and highly significant link: on average, a firm raising its international sales by 10 percent raises the exposure of its stock return to global shocks by 2 percent and reduces its exposure to country-specific shocks by 1.5 percent. This link has grown stronger since the mid-1980s.
- **Jansen and Berben (2003)** investigates shifts in correlation patterns among international equity returns at the market level as well as the industry level. They develop a novel bivariate GARCH model for equity returns with a smoothly time-varying correlation and then derive a LM statistic to test the constant-correlation hypothesis directly. Applying the test to weekly data from Germany, Japan, the US and the UK in the period 1980-2000, they find that correlations among the German, UK and US stock markets have doubled, whereas Japanese correlations have remained the same.
- **Bose and Mukherjee (2005)** examine the comovement of the Indian stock market with developed markets like US, Japan and other Asian markets, using daily data for the period January, 1999 to June, 2004, and tools like pairwise & groupwise cointegration and Granger-causality tests. They find that the US market may not be playing a unique role in integration of Asian markets; thus, their study yields an interesting result that, excluding the Indian market from the set of the Asian markets leads to no or fewer cointegrating relations. This indicates a unique role of India in the degree of linkages of these markets during the recent period of more open capital markets, where FII investments play a key role in synthesizing markets across a region. The degree of integration that is found to be not very high implies that the nature of integration with emerging Asian markets does not yet warranty any immediate concern for India regarding possible contagion and also shows that there is still much scope for reaping benefits of portfolio diversification, by investing in the Indian market.
- **Phylaktis and Xia (2006)**, the equity market comovement and contagion at the sector level during the period 1990-2004 across the regions of Europe, Asia and Latin America. They examine whether unexpected shocks from a particular market, or group of markets, are propagated to the sectors in other countries. The results confirm the sector heterogeneity of contagion. This implies that there are sectors which can still provide a channel for achieving the benefits of international diversification during crisis, despite the prevailing contagion at the market level. In addition, the results lend support to the importance of financial links in the propagation of contagion.
- **Seshaiah (2006)** analyses the long-run equilibrium relationship and short-run dynamic linkage between the Indian stock market indices and the stock markets of seven developed and developing countries. Using the cointegration approach and Granger causality on daily data of stock market indices for the period 1997-2005, it is found that the Asian stock markets have a long term relationship with the Indian stock market whereas, the Indian stock market

exhibits certain short term unidirectional as well as bidirectional causal relationship with the different capital markets chosen for the analysis.

❁ **Majid. *et., al.* (2007)** examines market integration among five selected ASEAN emerging markets (Malaysia, Thailand, Indonesia, Philippines and Singapore) and their interdependencies from the US and Japan based on a two-step estimation, cointegration and Generalized Method of Moments (GMM). Closing daily stock indices starting from January 1988 to December 2006 are used. The study reveals that the ASEAN stock markets are going towards a greater integration either among themselves or with the US and Japan, particularly in the aftermath of the post 1997 financial turmoil. This implies that the long-run diversification benefits that can be gained by investors across the ASEAN markets tend to diminish.

❁ **Kozluk (2008)** applies the approximate factor model in a search for common global and regional driving forces in stock market returns and volatility. The study particularly focuses on two emerging stock markets- Russia and China. The result of the study indicates that while the Russian market, like CEEC region, substantially increased their cointegration with global stock markets, the Chinese market continued to move largely independently from global movements and only slightly increased in comovement with regional forces.

Section-III

DATA

The data employed in this paper comprises of daily close prices of CNX Nifty (India), SE (Philippines), TAIEX (Taiwan) and KOPSI200 (South Korea). The countries under study are located in the same time zone. The data spans from April 01, 1998 to March 31, 2008 excluding holidays when there were no transactions. All the data has been collected from the websites of respective stock exchanges. The cointegration analysis has been carried out for the entire period under study. Further, to study the causal relationship, Granger causality test has been employed for the entire period under study, taking all the return series representing sample countries.

METHODOLOGICAL ISSUES

Over the decades, various techniques have been used for the transformation of the data and for judging the statistical properties of the time series. Natural logarithm transformation is a commonly used transformation technique where as ADF, PP and LM tests are applied for observing the characteristics of the data series under study.

Under the study, each price series (index as well as individual) is transformed into its natural logarithm price series. In view of the inherent heteroscedasticity of price changes, it is considered advisable to transform it into log price changes. Log transformation is likely to render the price changes to be homoscedastic and thereby make the series stationary. To smooth the price changes, this transformation is done as it depicts the rate of change rather than actual change. The first difference of log prices referred to as log returns have been used throughout the study. The logarithmic return has been applied in all the empirical tests in the study. Unless otherwise specified, the returns used from now are logarithmic returns.

The return (R) is measured as:

$$R_t = \log {}^{p_t}\!/_{p_{t-1}} \text{ where, } t = 1, 2, 3 \ldots \ldots \ldots . n$$

Where R_t is the rate of return for the period t, and p_{t-1} and p_t are the prices for the two successive periods t-1 and t.

Further, the computation of descriptive statistics such as skewness, Kurtosis and Jarque-Bera provides basic albeit, elementary evidence about changes in the time series behavior and explains the fact that returns distribution of equity shares are not normally distributed which is a well documented fact in financial literature. Given the fact that the presence of a stochastic trend or deterministic trend in a financial time series or its stationary or non-stationary in levels is a prerequisite for conducting any test, the study begins with the testing of return series for a unit root using Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. A stationary time series is one for which the mean and variance are constant over time; they depend only on the distance or lag between the two time periods and not on the actual time at which they are computed. The presence of a unit root indicates that the given series has become unstable or non-stationary; showing an uneven movement. The time series variables considered in this paper are daily stock indices prices of sample countries and the ADF unit root test is performed by using the following equations:

$$\Delta Y_t = \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 1}$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 2}$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 t + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 3}$$

Further, the test of cointegration has been applied in order to study the integration/linkage between stock market indices. The test of cointegration identifies the long-run structural relationship among the variables under consideration. In other words, it tries to establish whether the variables move in the same direction in the long-run. **The current study envisages to study whether the indexes under consideration move in the same direction in the long-run. To unfold the aforesaid issue, Johansen's methodology has been applied. Finally, the causal relationship among different stock indexes representing countries under study has been explored by applying Granger-Causality test.** The equations to test the relationship are as follows:

$$Y_t = \alpha_0 + \sum_{j=1}^{p} \alpha_j Y_{t-j} + \sum_{j=1}^{p} \beta_j X_{t-j} + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 4}$$

$$X_t = \gamma_0 + \sum_{j=1}^{p} \gamma_j Y_{t-j} + \sum_{j=1}^{p} \lambda_j X_{t-j} + v_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 5}$$

However, the aforementioned equations of testing the causal relationship are based on the assumption of stationery time series data. And, the different time series data used in the study are showing non-stationery behavior as sufficed by the results of ADF and PP tests. Hence, the causality equations are required to be transformed into a differenced series by taking the first order differencing where there is the presence of unit root in time series data. Further, if the variables are cointegrated, the specifications are required to be modified by inserting an error correction term as an additional endogenous variable in the equations. Accordingly, the new equations to study the causal relationship are as follows:

$$\Delta Y_t = \alpha_0 + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \sum_{j=1}^{p} \beta_j \Delta X_{t-j} + \delta ECT_{t-1} + u_t \ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 6}$$

$$\Delta X_t = \gamma_0 + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \sum_{j=1}^{p} \lambda_j \Delta X_{t-j} + \eta ECT_{t-1} + v_t \ldots\ldots\ldots\ldots\ldots\ldots \text{ Equation 7}$$

Section-IV

EMPIRICAL RESULTS

The descriptive statistics in Table 1 indicate the typical characteristics of time series data with respect to all the return series representing the sample markets under study. The Jarque-Bera test statistics for Nifty, SE, TAIEX and KOPSI200 returns as shown in Table 1 are 1898.371, 32499.39, 2950.234 and 446.6263 respectively and statistically significant. Further, the descriptive statistics also shows excess kurtosis in case of all the return series under study. The computation of descriptive statistics such as skewness, Kurtosis and Jarque-Bera provides basic albeit, elementary evidence about changes in the time series behavior and explains the fact that returns distribution of indexes are not normally distributed which is a well documented fact in financial literature.Owing to the aforesaid fact, it is imperative to further study the time series properties such as the presence of unit root in all the return series. The ADF and PP tests have been conducted for each of the four index return series and the results are documented in Table 2. The ADF coefficients of Nifty, SE, TAIEX and KOPSI200 return series are 26.1347, 57.9473, 41.7701 and 146.615 respectively and statistically significant. The coefficients of PP test are also statistically significant and indicate the presence of unit root in daily return of different Index representing sample countries under study.

Table 1: Descriptive Statistics Of All Return Series

Statistics	Nifty (India)	SE (Philippines)	TAIEX (Taiwan)	KOPSI200 (South Korea)
Mean	9.96E-05	-8.90E-05	4.39E-05	9.23E-05
Median	0.000534	-0.000156	5.98E-05	0.000501
Std. Dev.	0.007377	0.007336	0.007974	0.009744
Skewness	-0.526111	1.006776	-0.062936	-0.112928
Kurtosis	7.58716	22.36831	8.865658	5.271561
Jarque-Bera	1898.371	32499.39	2950.234	446.6263
Probability	0	0	0	0
Observations	2057	2057	2057	2057

Table 2: Results Of Unit Root Test For Daily Return Of Index Series

Country/Index	ADF Statistics	Probability	PP Statistics	Probability
India/Nifty	26.1347	0	26.4801	0
Philippines/SE	57.9473	0	53.9721	0
Taiwan/TAIEX	41.7701	0	31.6593	0
South Korea/KOPSI200	146.615	0	25.4838	0

After obtaining satisfactory results of unit root, the researchers employed the cointegration test - group-wise and pair-wise in order to study the extent of cointegration between different market indices representing the sample countries. The results of the analysis have been documented in Table 3 and Table 4. There is no cointegrating relation between the return series under study as evidenced by the outputs of cointegration test. The null hypotheses of having cointegrating relation have been rejected at 5% level of significance. And, the Indian stock market has a long term relationship with other stock markets under study.

Table 3: Results of Cointegration Test

Null Hypotheses	Eigenvalue	Trace Statistics	Critical Value at 5%
None *	0.20936	1627.22	54.07904
At most 1 *	0.201847	1145.181	35.19275
At most 2 *	0.175341	682.5462	20.26184
At most 3 *	0.130502	286.9504	9.164546

* denotes rejection of the hypothesis at the 0.05 level

Again, the researchers conducted pair-wise cointegration test and the results are in consonance with the group-wise test and there seems to be no cointegration between different markets under study and there exists long run equilibrium between these markets.

Finally, the Granger causality test has been employed to explore whether there exists any causal relationship between the return series representing different markets and the results are documented in Table 5. The researchers have used a lag of 5 days with the belief that it is a reasonable time period for the dissemination of sensitive information from one market to the other. The outputs of the causality test imply that there exists some short term unidirectional as well as bidirectional causal relationship between the return series under study.

Section-V

CONCLUSION

The growing magnitude of capital mobility across countries have created a serious concern for policymakers as to how and to what extent their domestic economies move in step with the economies of the rest of the world. Essentially, the extent of market integration and comovement is there to determine the influence of policy makers

Table 4: Pair-wise Cointegration Test Outputs

Pairs	Null Hypotheses	Eigenvalue	Trace Statistics	Critical Value at 5%
Nifty-SE				
	None *	0.176555	398.6181	11.2248
	At most 1 *	0.146858	325.9175	4.129906
Nifty-TAIEX				
	None *	0.191603	436.4653	11.2248
	At most 1 *	0.138744	306.4945	4.129906
Nifty-KOPSI200				
	None *	0.194236	797.322	12.3209
	At most 1 *	0.158521	354.1642	4.129906
SE-TAIEX				
	None *	0.203874	772.3007	12.3209
	At most 1 *	0.137885	304.4491	4.129906
SE-KOPSI200				
	None *	0.200941	805.3583	12.3209
	At most 1 *	0.154776	345.0514	4.129906
TAIEX-KOPSI200				
	None *	0.202364	804.59	12.3209
	At most 1 *	0.152952	340.6267	4.129906

* denotes rejection of the hypothesis at the 0.05 level

Table 5: Pair-wise Granger Causality Test

Results of Causality Test		
Null Hypotheses	**F-Statistic**	**Probability**
RET_P does not Granger Cause RET_N	1.83038	0.10368
RET_N does not Granger Cause RET_P	2.69729	0.01949*
RET_T does not Granger Cause RET_N	3.87256	0.0017*
RET_N does not Granger Cause RET_T	1.77181	0.11535
RET_K does not Granger Cause RET_N	1.32663	0.24987
RET_N does not Granger Cause RET_K	0.75191	0.58463
RET_T does not Granger Cause RET_P	13.8398	2.50E-13*
RET_P does not Granger Cause RET_T	2.22394	0.04948
RET_K does not Granger Cause RET_P	3.93995	0.00147*
RET_P does not Granger Cause RET_K	1.90157	0.09095
RET_K does not Granger Cause RET_T	0.78443	0.56081
RET_T does not Granger Cause RET_K	4.97694	0.00016*

*Indicates significant at .01 level.

on their own economies. Proliferation of globalization followed by institutional and structural reforms in financial markets all over the world, the extent of market integration and possible contagion is a polemic issue that needs to be analyzed empirically.

The main objective of the present paper is to determine the extent of integration between the capital markets of four emerging Asian economies viz. India, Philippines, Taiwan and South Korea. To explore the objective, the researchers have used daily close prices of indices of the aforesaid countries for the sample period April 01, 1998 to March 31, 2008. To test the hypothesis, we have employed Johansen's cointegration test and Granger causality test.

The results of the analysis indicate that there is no cointegration between the capital markets of India, Philippines, Taiwan and South Korea and there exist long run equilibrium between these markets though the results exhibit certain mild and short term unidirectional as well as bidirectional causal relationship between the capital markets chosen for analysis. The implication of the result is that these markets do not yet warrant any immediate concern for any possible contagion and the market participants can reap the benefit of portfolio diversification by investing in these markets.

BIBLIOGRAPHY

1) Baig, T. and Goldfajn, I. (1999), "Financial Market Contagion in the Asian Crisis", IMF Staff Papers, Vol.46, No.2, International Monetary Fund, Washington.
2) Barberis, N., Shleifer, A. and Wurgler, J. (2005), "Comovement", Journal of Financial Economics, Vol. 75: 283-317.
3) Bose, S. and Mukherjee, P. (2005), "A Study of Inter-linkages between Indian Stock Market and some other Emerging and Developed Markets", 9th Capital Markets Conference Paper, Indian Institute of Capital Markets, Mumbai.
4) Brooks, R. and Negro, M.D. (2003), "Firm-Level Evidence on International Stock Market Comovement", IMF Working Paper No. 03/55, International Monetary Fund, Washington.
5) Campbell, J.Y., Lo, A.W. and Mackinlay, A.C. (1997), "The Econometrics of Financial Markets", Princton University Press, Princton, NJ.
6) Granger, C.W. (1988), "Some Recent Developments in the Concept of Causality", Journal of Econometrics, Vol. 39: 199-211.
7) Jansen, W.J. and Berben, R.P. (2003), "Comovement in International Equity Markets: A Sectoral View", Bank of the Netherlands, Monetary and Economic Policy Department, Netherland.
8) Johansen, S. (1991), "Estimation and Hypothesis testing of cointegrating vectors in Gaussian vector Autoregressive models", Econometrica, Vol. 59: 1551-1580.
9) Kanas, A. (1998), "Linkage between the US and European equity markets: Further evidence from Cointegration tests", Applied Financial Economics, Vol. 8: 607-614.
10) Kasa, K. (1992), "Common Stochastic trends in International Stock markets", Journal of Monetary Economics, Vol. 29: 95-124.
11) Kozluk, T.J. (2008), "Global and Regional Links between Stock Markets": The Case of Russia and China, BOFIT Discussion Paper No. 4/2008.
12) Li, Xiaoming. (2002), "International Stock Market Integration: Evidence from Nonlinear Cointegration Analysis", Working Paper Series, Department of Commerce, Massey University.
13) Majid, M.S.A., Meera, A.K. and Omar, M.A. (2007), "Interdependence of ASEAN-5 Stock Markets from the US and Japan", 20th Astralasian Finance and Banking Conference Paper. Australia.
14) Phylaktis, K. and Xia, L. (2006), "Equity Market Comovement and Contagion: A Sectoral Perspective", EFA 2006 Meeting paper, Zurich.
15) Rocca, E.D. (1999), "Short-term and Long-term price linkages between the equity markets of Australia and its major trading partners", Applied Financial Economics, Vol. 9: 501-511.
16) Seshaiah, S.V. (2006), "Indian Capital Market Integration with selected Developed and Developing Countries, 1997-2006", Applied Econometrics and International Development, Vol. 6: (2).
17) Taylor, M.P. and Tonks, I. (1989), "The Internationalization of stock markets and abolition of UK exchange control", The Review of Economics and Statistics, Vol. 71: 332-336.

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35. Rahman, Shofiqur and Hossain, Mohammad Farhad (2006), "Weak-form Efficiency: Testimony of Dhaka Stock Exchange", electronic copy provided by SSRN (http//ssrn.com/abstract=940811).
36. Ramachandran, J. (1985), "Behaviour of Stock Market Prices, Trading Rules, Information & Market Efficiency", Doctoral Dissertation, Indian Institute of Management, Ahmadabad.
37. Ranganatham M. and Subramanian V (1993), "Weak Form of Efficient Markets Hypothesis: A Spectral Analytic Investigation", Vikalapa Vol. 18, No. 2, pp 25-30.
38. Rao, K.N. and Mukherjee, K (1971), "Random-Walk Hypothesis: An Empirical Study", *Arthaniti*, Vol.14, No.142.
39. Ray, Dhirendra Pratap and Sharma, Rahul (2008), "Analysis of Market Efficiency for Indian Capital Market", Available at SSRN.
40. Samanta, G P (2004), "Evolving Weak Form Informational Efficiency of Indian Stock Market", *Journal of Quantitative Economics*, New Series 2.
41. Seiler, Michael J and Walter Rom (1997), "A Historical Analysis of Market Efficiency: Do Historical Returns Follow a Random Walk", *Journal of Financial and Strategic Decisions*, 10.
42. Sharma, J.L. (1983), "Efficient Capital Markets and Random Character of Stock Prices Behaviour in a Developing Economy," The Indian Economic Journal, Vol.31, No. 2, pp 53-70.
43. Sharma, J.L. and Kennedy, Robert E, (1977), "A Comparative Analysis of Stock Price Behavior on the Bombay", London and New York Stock Exchanges", Journal of Financial and Quantitative Analysis, September, pp 391-413.
44. Verma, Ashutosh and Rao, Nageshwar (2007)," An Examination of Weak Form Efficiency of BSE 100 Index Companies", *ICFAI Journal of Financial Economics*, December, Vol. 5, No. 4, pp. 81-93. (Available at SSRN:http//ssrn.com/abstract1079607).
45. Yalawar, Y.B. (1988), "Bombay Stock Exchange: Rate of Return and Efficiency," *Indian Economic Journal*, Vol.35, No. 4, pp 68-121.