

## RISK AND REWARDS IN ASIAN STOCK MARKETS AN EMPIRICAL EVIDENCE

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**T**HE growing liberalisation and development of capital markets in a number of countries have increased the opportunity for diversifying portfolios internationally. However, global diversification involves several aspects, which are unique and arise out of the need to compare return and risk in various countries. In present study, we have made risk-return analysis and correlation analysis for the select Asian stock markets. The study has brought out that the stock markets of Hong Kong and India have generated the highest return amongst select Asian countries, in terms of dollars and local currency respectively. Both returns as well as risk are found the lowest in case of Japan. Moreover, the Indian Stock market shows the highest potential for inclusion in the international portfolio of equity securities as the correlation coefficients of it with other Asian markets are found the lowest.

### Backdrop

Generally people invest with the motives of maximizing returns and minimizing risk. Constructing portfolios comprising of either several assets or a group of corporate securities could attain these motives. International diversification may also be used to achieve the objectives cited above. The rationale for international diversification of portfolios stems from the probability that stock returns within one country are highly correlated, but on account of inter-country variations in economic environments, industrial and business growth rates and inflationary conditions the correlations among the investment returns across countries is low (Madura, 1985).

The growing liberalisation and development of capital markets in a number of countries has increased the opportunity for diversifying portfolios internationally. The interest in country funds in recent years, especially in Asia's emerging markets testifies to this growing awareness on the part of portfolio managers. The attraction towards emerging markets may be attributed to the fact that many of these markets have increasingly moved towards open-market economic system, liberalised stock markets and foreign exchange markets, and adoption of liberal guidelines with respect to both foreign direct investments and foreign institutional investments. Though Asian markets are more volatile as compared to their counterparts in the west, the volatility of these markets should be balanced against the fact that these markets exhibit very low or negative correlations with the developed markets (Sudhakar, 1996). The portfolio comprising of stocks from developed and emerging markets provides a very high potential for risk diversification.

International portfolio construction involves several aspects, which are unique and arise out of the need to compare return and risk in various countries and the benefits of international portfolio diversification. Further, there arise a need to measure the impact of foreign exchange rate fluctuations on return and risk. Obviously, the investor who intends to allocate funds in an internationally diversified portfolio must estimate the riskiness and return of the stock markets of his interest. However, according to the modern portfolio theory, the benefits of international diversification could arise only when the international stock markets are less than perfectly correlated. So, the correlation in the movement of rates of return on groups of stocks from two different countries needs to be computed while constructing international portfolio of securities. The present paper is an attempt

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in this direction. More specifically, the paper strives to achieve the following objectives:

- (i) to make risk and return analysis of investment in Asian equity markets;
- (ii) to measure the impact of exchange rate fluctuations on stock returns; and
- (iii) to determine correlation between the stock market indices of select Asian countries.

The paper has been divided into four sections, besides introduction. While, the first section analyses the methodology used herein, the second section presents the risk and return analysis of the select Asian markets. The third section brings out the relationship between the returns of the sample countries. The final section presents the summary and conclusion of the study.

## Section-1

**Research Methodology:** The various stock markets considered in this study include three emerging economies (India, Taiwan and Singapore) and two developed markets (Japan and Hong Kong). Exhibit 1 shows the country-wise indices considered for the study.

**Exhibit 1**

Country	Exchange	Index
India	Mumbai Stock Exchange	BSE Sensex
Japan	Tokyo Stock Exchange	Nikkei 225
Taiwan	Taiwan Stock Exchange	TSEC Weighted Stock Price Index
Hong Kong	Stock Exchange of Hong Kong Ltd.	Hangseng
Singapore	Stock Exchange of Singapore Ltd.	SGX

The data used for the present study are month end values of stock market indices and currency exchange rates for the sample countries. The reference period is January 1992 to December 2002. Most of the data have been collected through internet. Monthly data are used to calculate the stock returns which are expressed as logarithmic price relatives, i.e.  $\ln(P_t/P_{t-1}) * 100$  where  $P_t$  and  $P_{t-1}$  are the stock indices at time 't' and time 't-1' respectively. As the study utilizes monthly data, the shortest investment horizon is one month.

Almost as important as risk and return in investment decision-making is time horizon. Madhusoodanan (1997) emphasised that time needs to be taken as an important variable in the investment decision process. According to him long-term investments could reduce risk significantly and increase return. But the time diversification theory has been criticised by many researchers (Samuelson, 1994; Bodie, et al., 1996). In the present study, we have also tried to analyse the risk and returns pertaining to various investment horizons. For this objective, the investment horizons of one, two, three, six, twelve and twenty-four months have been considered. Here, it is assumed that the investor would buy index fund in the end of a month and would realise returns by his exit from the fund at the end of subsequent month in case of one month holding period and would sell at the end of 2nd month in case of two month holding period, and so on. Moreover, to get a better answer to the question whether the time diversification affect return and risk of equity investments, the return and risk statistics obtained as per various holding periods are being transformed into annualised statistics. For doing so, an assumption that stock prices follow random walk is taken. While the annualised returns have been calculated from the monthly, bimonthly, trimonthly, and six monthly stock returns by multiplying them with 12, 6, 4 and 2 respectively, the annualised volatility is estimated from holding period wise volatility by multiplying them with the square root of the numbers of holding periods in the year. The results obtained from various holding period returns and volatility, by simply multiplying by  $n$  and square root of  $n$  respectively, are presented in Tables 5 and 6 (given at the end).

In calculating the return series for each holding period, non-overlapping periods are used. Obviously the number of observations decreases with every increase in the length of the holding period. Risk being the other side of investment coin, the local risk, exchange rate risk and total risk associated with the select Asian stock markets

have been worked out and these statistics are presented in Tables 2 (given at the end). The risk has been measured by standard deviation ( $\sigma$ ) of return series as well as exchange rate series for respective countries.

The Karl Pearson's Product-moment formula has been applied to determine relationship amongst the returns series of select countries. However, the correlation coefficients based on time series data are valid only under the assumption of non autocorrelation (i.e. lag correlation of a given series with itself) and stationarity. The hypothesis of no serial correlation in the return series is tested by the Q statistic developed by L Jung & Box (1978). The Q statistic is approximately (i.e., in large samples) distributed as the chi-square distribution with m degree of freedom. In an application, if the computed Q exceeds the critical Q value from the chi-square table at the chosen level of significance, one can reject the null hypothesis that all  $r_k$  are zero; at least some of them must be non zero (Note that for the present study  $\rho_k$  stands for autocorrelation function (ACF) at stock returns series, with one month holding period). These coefficients are obtained from Easy Rag- a software designed to solve econometric models. We have computed the coefficients up to 24 lags.

To test whether the stock index series of various sample countries are stationary, a unit root test is performed using the Augmented Dickey-Fuller (1979) method. The augmented Dickey-Fuller (ADF) test has been applied to regression run in the following form:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_1 \sum_{i=1}^m \Delta Y_{t-i} + \mu_t$$

where,  $Y_t = \ln(P_t)$  is the natural logarithm of the value of each stock index at time t,  $\Delta$  is the difference operator, and t is for time.

In this model, the null hypothesis is that  $\delta = 0$ , that is, there is a unit root. The above model has been applied to log levels as well as at first difference i.e. return series for each sample country. The ADF test statistic has the same asymptotic distribution as the DF statistic, so the same critical values are used.

## Section-2

**Annual Return Pattern:** This section presents analysis of the performance of select Asian stock markets in terms of annual returns in home currency and US dollar terms. The annual exchange gain/loss has also been worked out as portrayed in Table 1 (given at the end) along with returns. Before making the performance analysis, it is to clarify that the returns shown by Table 1 are purely index year-on-year growth and they don't include dividend and bonus income. The annual return series have also been shown by graph 1.0 (given at the end).

Table 1 shows that the return in home currency as well as in dollars in case of Indian stock market was the maximum for the year 1999 (49.37 and 47.20% respectively) followed by the returns in 1993 (24.64%) and 1992 (29%). Contrarily, the years 1995, 1997, 2000 and 2001 brought more than 18 per cent negative returns (losses). After putting a dent in the investments of global investors to the magnitude of 30.44 and 22.11 per cent in 2000 and 2001 respectively, the BSE Sensex yielded a return of merely 1 per cent during 2002. The attractive returns for the year 1999 may be attributed to the Union Budget of the year and political stability, which brought some cheers to the market and to the investors also. But the trend got reversed during 2000-01 as the tapes of senior political officials taking bribes created panic selling in the market. Market darling *Infosys Technology*, for example, lost 31 per cent of its market capitalization in a horror week of trading (HT, 2001). On the whole, the average return for a global investor has turned negative (-3.83%) as against the positive return (2.23%) for a local investor. Thus, due to the adverse movement of local currency against dollar the attractive returns in the Indian market disappear totally. On an average, there has been 5.53 per cent annual depreciation in Indian rupee against US dollar. The study conducted by Obaidullah (1994) for the five year period (1987-1992) had also shown similar results.

Section B of the Table 1, presents both annual stock return yielded by Nikkei 225 of Japan and annual exchange gain/loss of Yen against US dollar. It is obvious from the table that Nikkei stock average showed an alarming decline in 1992 (30.8%). But in next two years Nikkei provided appreciable return. After 1995, the Japanese securities market experienced steady decline continuously for three years. The poor performance of Japanese financial institutions and banks, poor corporate results, lack of political stability, continued recession in its

economy are some of the factors responsible for negative returns from securities market. During 1999, Nikkei yielded a return of 31.32 per cent in home currency but thereafter the index suffered 31.74, 26.82 and 13.90 per cent losses in 2000, 2001 and 2002 respectively. On the whole, the Japanese investors have incurred a loss of 10.23 per cent per annum over the study period. Fortunately, the average annual dividend (cash) yield on stocks (All First Section Stocks) in Japan works at 11.26 per cent approximately (Tokyo Stock Exchange Fact Book, 2003). So, considering dividend into account, the investments in Japanese equity provide around one per cent net return (i.e. dividend yield minus index loss). For a global investor the yield has most of the time been worse than that for a local investor.

Part-C of the table shows that the Taiwan's stock market (TSEC Weighted Stock Price Index) yielded significantly high return during 1993, both in home currency (58.65%) and US dollars (53.30%). However, the index rose by around 16 per cent in 1994. The TSEC Weighted Stock Price Index fell considerably (31.997%) during 1995. The market showed signs of improvement in the subsequent two years as the returns in home currency are worked out at 29.28 and 16.62 per cent during 1996 and 1997, respectively. But, the Taiwanese currency came under a severe pressure in 1997 as it depreciated to the tune of 16.28 per cent. It is evident from the table that the crisis triggered in Asia, in 1997-98, did not exempt Taiwanese investors as the index lost 24.34 per cent value during 1998. While the index followed the international trend during 1999 and bestowed the investors with 27.48 and 29.61 per cent returns in home currency and dollar terms, respectively, the year 2000 saw the highest fall out in the TSEC in its life since 1992. But, contrary to the many other countries of Asia, the investors of Taiwan remained a bit lucky for the year 2001 and enjoyed 15 per cent return, in home currency terms. However, again the index was observed at 22 per cent lower level in 2002 compared to the previous year. On the whole, the market fetched negative annual returns of 6 per cent for a local investor and 9 per cent for a global investor. On an average, the Taiwanese currency has depreciated by 2.65 per cent every year in the reference period. It is worth mentioning that Taiwanese stocks have enjoyed annual dividend yield to the tune of 4.4 per cent approximately during the study period (Fact book Taiwan Stock Exchange, 2002).

The return performance of Hangseng index of Hong Kong may be glanced through part D of Table 1. It is obvious from the return statistics that Hong Kong stocks have outperformed the Asian markets during 1992 and 1993 as the cumulative return of this period works out more than 100 per cent both in home and foreign currency terms. After showing a negative return of above 37 per cent in 1994, the market offered positive returns of around 20 and 29 per cent during 1995 and 1996 respectively. Similar to other Asian tigers, Hong Kong stock index brought out heavy losses during 1997 and 1998. However, the Hong Kong investors zoomed during 1999 as they harvested a positive return of 52 per cent. The last three years came heavily on the fate of investors since they suffered a cumulative loss of around 60 per cent in this period. On the whole, the Hangseng provided the annual return of 1.71 and 1.665 per cent to local and global investors respectively. Moreover, the investors in equity stocks have enjoyed a dividend yield of 2.96 per cent per annum. Therefore, the overall return earned by Hong Kong investors turns the best amongst the five sample countries.

As indicated in Table 1-E, the pattern of occurrence of stock returns in Singapore seems in full consonance to that of Hong Kong (Hangseng). An inspection of the table shows that the investors earned the maximum return during 1999 followed, with small difference, by 1993. On the other hand, 1997 brought the highest loss (i.e. 27.84%) to the investors followed by 2000, 2002 and 2001, respectively. In other words, the period between 2000 and 2002 has been the worst for both local and the foreign investors in case of Singapore stock market.

Inter-country comparison of returns at the overall level, shows that the highest level of average return (home currency) has accrued in Indian stock market followed by Hong Kong. But from the point of view of a global investor, the Hong Kong market outperformed the other Asian countries. The Japanese markets have yielded the highest losses followed by Singapore and Taiwan where the negative return is minimum. The above pattern is also true for return in US dollars except the case of India.

**Risk Analysis:** Any rational investor, before investing his or her investible wealth in the stocks, analyses the risk associated with them. The risk is expressed in terms of variability of return and therefore, the statistical tool often used to measure risk is the standard deviation. We have measured the risk in Asian stock markets by computing standard deviation of index based monthly returns. The exchange rate risk has also been computed on the same pattern. The net result is termed as total risk. The risk statistics so obtained are presented in Table 2 (given at the end).

It is clear from the table that both local risk and total risk are the highest in India amongst the sample countries during 1992. This may be attributed to the stock market scam in India, which came to light in April 1992. Even currency fluctuations in this year was the maximum in India followed by Japan and Taiwan. Taiwan's stock market faced the highest level of fluctuations in 1993. It is interesting to see that the stock markets in Asia remained relatively more stable between 1994 and 1996 as the standard deviation of returns in this duration is lower than other years for all countries except Japan in 1995. In the above duration, the exchange rate risk is found the maximum for Japan followed by India, Taiwan, Singapore and Hong Kong. During 1997, the Hong Kong turned as the most volatile market followed, with wide margin, by Taiwan, Singapore, India and Japan. However, Singapore experienced the highest risk in 1998 followed, closely, by Hong Kong. The risk ranged between 9.021 and 4.011 in 1999 and 8.97 and 6.86 in 2000. The total as well as local risk during 2001 is found lower than that of the year 2000 and 2002, irrespective of the country involved. At the overall level, Taiwan turned as the most risky whereas Japan experienced the lowest level of risk. On looking index based returns and risk (Table 1 & 2) at a glance, we find that the hypothesis *higher the risk, higher the returns* stands accepted in all the countries except Taiwan where the risk is the maximum but the rewards are not in that proportion.

**Risk and Return Under Different Investment Horizons:** Almost as important as risk and return in investment decision-making is time horizon. This is the investment-planning period for individuals. It is highly variable from individual to individual. Investors may adopt passive or active approaches to the management of their portfolios. A passive or buy-and-hold strategy essentially means purchasing and holding a security to maturity and then reinvesting cash proceeds in similar securities. One technique for a passive strategy is an index fund. Index fund basically provide diversification along with minimum transaction costs. On the other, the active strategy aims at periodic realisation of returns. In this strategy portfolios typically have a shorter time horizons, varying from a few days to a year or so. Major emphasis is focused upon price appreciation.

In the present study, the investment horizons of one, two, three, six, twelve and twenty-four months have been considered. The descriptive statistics including mean return, standard deviation, coefficient of variation, minimum and maximum returns and skewness are calculated for each time horizon of investments and the same are exhibited in Tables 3 and 4 (given at the end) in terms of home currency and US dollar respectively.

It is evident from the aforesaid table that the average returns are the highest in case of Hong Kong followed by India, Singapore, Taiwan and Japan. Interestingly, this phenomenon holds good irrespective of nature of average as well as holding period. The table further pinpoints that the average returns have a tendency to rise with the rise in holding period. However, the position emerging about those stock markets, which resulted into negative return, for instance Japan and Taiwan, is different from the markets showing positive returns. In their case, the losses increased significantly with the increase in holding period.

The table shows very interesting results about the risk statistics, i.e. standard deviation and coefficient of variation (c.v.). While the standard deviation for various Asian markets exhibit rising trend with widening of holding period, the coefficient of variation, which is a relative measure of dispersion implies a decreasing trend. Considering the supremacy of coefficient of variation over standard deviation, it concludes that the risk reduces with the increase in holding period. The table further indicates that the longer holding period offers the opportunity to earn a return higher than that is available in the shorter holding periods. Regarding nature of distribution of stock returns, it may be captured from the table that the returns are *positively skewed* in case of India and Singapore, irrespective of holding period. Vijaya and Vedpuriswal (2002), in their study also found that there is significant positive skewness in Indian stock returns. Studies in the US and Australian markets have also revealed that there is positive skewness in the distribution of stock returns (Beedles, 1986). But there appears no set pattern of distribution of returns in case of Japan, Taiwan and Hong Kong.

An attempt has also been made to test a null hypothesis that there is no difference in returns offered by Indian stock market and the other selected Asian stock markets. The results of t-test applied for the purpose under various holding periods led to the acceptance of the above hypothesis at 5 per cent and 1 per cent level of significance. The above is valid for both home currency and dollar form returns.

To get a better answer to the question whether the time diversification affect return and risk of equity investments, the return and risk statistics obtained as per various holding periods are being transformed into annualized

statistics. The results obtained from various holding period returns and volatility are presented in tables 5 and 6 respectively (given at the end). It is worth noting from the said tables that both annualised returns and risks are more or less same in case of each of the holding period under study. The above finding is true for each of the five Asian countries. Thus, the claim made by Kritzman (1994) that time diversification surely reduces risk, stands invalid in Asian countries. But in case one considers the coefficient of variation as a measure of volatility, the findings of Kritzman as well as Madhusoodanan (1997) are found to get the approval from present study too.

### **Section-3**

**Correlation Among Asian Stock Markets :** Numerous studies have documented the potential portfolio diversification benefits of global investing (Levi and Sarnad, 1970; Baily and Stulz, 1990; Hunter and Coggin, 1990). The logic of the benefits of global diversification stems from the fact that international stock markets are less than perfectly correlated. However, there is a school of those analysts, who argue that the global stock markets have started showing signs of co-integration due to the more openness of the capital markets resulting from ongoing process of liberalisation and hence, potential for international diversification exists no longer. In view of the above debate, we have made an attempt to examine the correlation among the select Asian stock markets so as to comment whether these markets still have potential for global diversification.

However, the correlation coefficients based on time series data are valid only under the assumption of non autocorrelation (i.e. lag correlation of a given series with itself) and stationarity. The hypothesis of no serial correlation in the return series is tested by the Q statistic developed by L Jung & Box (1978). The results show that the null hypothesis of no autocorrelation cannot be rejected at the 5 per cent level for all return series. It is also found that the stock returns are random walk in each and every country. Thus, all the selected markets are efficient markets.

The regression results concerning Augmented-Dickey-Fuller Test applied with the aim of examining stationarity of the index series and return series are presented in Table 8 (given at the end). All ADF statistics based on log levels provide support to the null hypothesis of a unit root at 5 per cent level of significance. But these statistics reject the null hypothesis of a unit root for the return series at 5 per cent level of significance. Hence, the stock price index series for each country have the element of non-stationarity but stock-return series have stationarity. That is, the first difference of a random walk time series have stationarity. Now, after evaluating the data for its stationarity and no serial can dare to proceed towards the analysis of correlation coefficients between sample countries.

Table 9 (given at the end) depicts the correlation coefficients for the monthly returns of each pair of the indices of five Asian markets measured in local currency terms (Panel A) and dollar terms (Panel B). The table reveals some interesting points. First, these Asian stock markets behave quite differently from one another, that is the correlations of their returns tend to be substantially less than unity. Although the highest coefficients are 0.764 and 0.762 in home currency and dollar terms respectively between the Hong Kong and Singapore, rest all values are below 0.50. Thus, investors can diversify their holdings by spreading their portfolio across the various markets of Asia. The second notable point is that stock prices in Hong Kong and Singapore move more closely ( $r = 0.764$ ) than do either the stock prices in Japan and Hong Kong ( $r = 0.286$  in home currency) or the prices in India and Hong Kong ( $r = 0.286$  in home currency). Consequently, investors seeking diversification must choose carefully from amongst the various markets.

The third point emerging from the table is that all the correlations are positive and well above zero. Moreover, the majority correlation coefficients of Taiwan and two coefficients of Singapore are significant at 0.01 level. This implies the absence of complete dissimilarity in the movement of stock prices. The positive values indicate that the world's stock prices are, like their economies, somewhat integrated. Thus, the benefit of international diversification has limits. In other words, the markets of the world are members of a somewhat loosely connected system of economies, and allocating funds among the various economies provides some, but not complete, reduction of variability in returns on securities. Fourth, it is worth noting that the correlation coefficients of Indian stock prices are the lowest amongst the five Asian stock markets. On an average, the coefficients for Singapore are the highest followed, very closely, by Hong Kong and Taiwan. In contrast, average coefficients for India is the lowest (0.132) followed, in upside, by that of Japan (0.229). Thus, the Indian stock market offers

extra ordinary benefits of risk reduction through diversification since it is a well established proposition that the lower the correlation between return of assets, the greater are the benefits of diversification in terms of risk reduction. While the Hong Kong market provided higher return (next to India), the opportunities for risk reduction are not significant because of its relatively high correlations with all of the sample countries (average correlation 0.414 in home currency terms).

Finally, it is interesting to note that the results pertaining to each of the above mentioned four points turn absolutely similar when correlation coefficients examined in US dollar terms. That is, for a global investor too India turns as the most favourable market for risk reduction through international portfolio diversification. Obaidullah (1994) in his study titled "Internationalisation of Equity Portfolios : Risk and Return in South Asian Security Markets" also found that the Indian stock market was the very promising one from the stand point of the global investor with its high returns and extremely low correlation with other markets. But he argued that the low correlations may be due to the fact that the Indian market remained independent from global influence for a long time due to artificial restrictions imposed by the government.

But, despite the continuing process of economic reforms since 1991, the Indian stock prices show a tendency to move quite independently. Interestingly, Japanese market (Fabozzi, et. al., 2002) has a relatively low level of correlation with developed markets such as US, France, UK, Canada and Australia. Another recent study on Stock Performance of Emerging Markets by Cohen (2001) also supports the above mentioned feature of Japanese stock market. Sudhakar (1996) in his study also showed that Japanese market has a low degree of co-variability with emerging Asian Markets including Hong Kong, Thailand, Taiwan and Korea. The study also highlights that there is no significant divergence in the correlation for Taiwan and Japan.

## Section-4

**Summary and Conclusions :** The study finds that the highest level of average return for a local investor has accrued in Indian stock markets followed closely by Hong Kong. But for a global investor, Hong Kong stock markets proved the best and the Indian stock markets shifted to the second rank. This is attributed to the depreciation rate of Indian rupee against dollar, which is significantly higher as compared to that of Hong Kong and other Asian markets. Surprisingly, we find no attraction towards the Japanese stock markets for the global as well as local investors because it has shown the maximum loss since 1992. The period of last three years (2000 to 2002) has been most unlucky for the equity investors in Asia since the Index of every country underwent more than 50 per cent depreciation in the said period.

Further, no significant difference is observed between different investment horizons insofar as annualized returns are concerned. In other words, both active and passive investment strategies have yielded the similar level of return/risk irrespective of the country under consideration. Although the stock markets of Hong Kong and Singapore move more closely, the correlation between the returns of Asian countries is substantially less than unity. It implies that the Asian market offers a good opportunity for equity portfolio diversification. Further, the Indian stock market is judged as the most beneficial case for inclusion in the equity portfolio of a global investor. Two important reasons may be assigned to the above conclusion. One, stock returns in India have shown the lowest level of correlation with various countries in Asia. Second, the rewards of investment in equity securities are the highest for a local investor and the second highest for a global investor. At the overall level, Taiwanese market turned as the most volatile (risky), whereas, Japanese stocks experienced the lowest level of volatility. Interestingly, the general belief 'Higher the risk, higher the return' stands approved in all the countries except Taiwan where the risk is the maximum but the rewards are not in that proportion.

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**Table 1 : Annual Return of Select Asian Stock Markets****A) India**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Returns in Home Currency	28.982	24.638	16.007	-23.307	-0.816	17.057	-18.027	49.369	-23.130	-19.686	1.483	2.225
Exchange Gain/Loss	-17.101	-2.159	-0.056	-10.769	-2.482	-9.017	-8.165	-2.167	-7.314	-2.428	-0.449	-5.528
Returns in US Dollars	11.881	22.479	15.951	-34.076	-3.298	8.039	-26.192	47.202	-30.444	-22.114	1.034	-3.830

**B) Japan**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Returns in Home Currency	-30.805	2.865	12.434	0.732	-2.585	-23.809	-9.745	31.326	-31.735	-26.821	-13.900	-10.232
Exchange Gain/Loss	0.360	10.976	11.394	-3.632	-11.622	-11.376	13.551	10.635	-11.310	-13.595	10.101	1.062
Returns in US Dollars	-30.445	13.842	23.828	-2.900	-14.207	-35.185	3.806	41.961	-43.044	-40.416	-3.799	-11.691

**C) Taiwan**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Returns in Home Currency	-27.335	58.645	16.011	-31.997	29.283	16.615	-24.341	27.486	-57.818	15.818	-22.057	-6.046
Exchange Gain/Loss	0.936	-5.343	2.141	-3.799	-0.656	-16.283	0.031	2.121	-4.198	-4.261	-1.123	-2.652
Returns in US Dollars	-26.398	53.302	18.152	-35.796	28.628	0.332	-24.310	29.607	-62.017	11.557	-23.180	-9.038

**D) Hongkong**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Returns in Home Currency	24.901	76.860	-37.249	20.682	28.927	-22.674	-6.492	52.350	-11.655	-28.108	-20.108	1.714
Exchange Gain/Loss	0.501	0.206	-0.166	0.075	-0.032	-0.168	0.014	-0.317	-0.362	0.031	-0.031	-0.022
Returns in US Dollars	25.402	77.066	-37.415	20.757	28.895	-22.842	-6.478	52.033	-12.017	-28.077	-20.139	1.665

**E) Singapore**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Returns in Home Currency	2.102	52.021	-11.826	3.352	3.813	-27.843	-7.928	57.682	-25.221	-17.123	-19.118	-2.336
Exchange Gain/Loss	-1.027	2.269	9.608	3.228	1.031	-17.978	0.899	-0.331	-3.856	-6.674	6.385	-0.356
Returns in US Dollars	1.075	54.290	-2.219	6.580	4.843	-45.821	-7.029	57.352	-29.078	-23.797	-12.732	-4.018

*Note:* As the returns are based on stock indices, they don't include dividends income and bonus issues.

**Table 2 : Annual Risk (Standard Deviation of Monthly Returns) of Select Asian Stock Markets****A) India**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Local Risk	18.160	8.549	8.097	5.899	7.849	7.968	8.719	7.996	7.052	8.025	5.802	8.556
Exchange Rate Risk	3.971	1.989	0.019	1.744	2.301	1.660	1.438	0.329	0.662	0.419	0.498	1.366
Total Risk	16.471	8.255	8.100	5.734	8.138	8.365	9.507	8.050	6.792	8.227	5.788	8.49

**B) Japan**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Local Risk	7.515	7.808	5.645	7.400	5.316	5.475	6.760	4.011	6.868	5.910	5.752	6.224
Exchange Rate Risk	2.574	2.477	2.510	4.780	2.273	3.780	6.197	2.566	2.735	3.591	2.311	3.254
Total Risk	8.859	8.927	5.982	6.496	5.087	7.585	7.919	4.502	8.501	5.713	6.475	6.913

**C ) Taiwan**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Local Risk	8.245	12.810	7.389	6.148	7.518	8.752	7.736	8.604	8.974	13.280	6.723	8.744
Exchange Rate Risk	1.058	0.730	0.931	1.578	0.606	2.391	2.083	0.926	1.345	1.269	1.273	1.290
Total Risk	8.541	12.855	7.415	6.089	7.633	8.583	8.374	8.248	9.636	13.659	6.377	8.855

**D ) Hongkong**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Local Risk	6.817	9.003	7.365	6.406	4.640	12.526	13.099	9.021	7.609	7.877	5.491	8.169
Exchange Rate Risk	0.148	0.126	0.042	0.051	0.037	0.107	0.072	0.024	0.034	0.010	0.030	0.062
Total Risk	6.828	9.051	7.386	6.432	4.639	12.523	13.067	9.030	7.611	7.884	5.486	8.176

**E ) Singapore**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Average
Local Risk	4.194	6.218	5.742	4.525	4.897	8.240	14.577	7.588	7.842	8.839	5.127	7.072
Exchange Rate Risk	0.924	0.851	0.303	1.050	0.308	1.934	4.082	1.455	1.074	1.850	0.971	1.346
Total Risk	4.072	6.516	5.812	4.618	4.978	9.639	17.766	8.459	8.576	9.243	5.411	7.735

**Note:**

1 Local risk refers to the standard deviation of monthly returns in home currency.

2 Exchange rate risk refers to the standard deviation of exchange rates of domestic currency against US Dollar.

3 Total risk is the net effect of 1 and 2 above on the global investor.

**Table 3: Summary Statistics for Stock Returns in Select Asian Stock Markets in Home Currency Terms (1992-2002)****a ) Holding Period: 1 month**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	0.0039	0.3982	8.9845	2255.996	35.0600	-25.7200		0.429
2	Japan	NIKKEI 225	-0.8956	-0.6973	6.2748	-899.889	14.9700	-18.3100	0.2519	-0.081
3	Taiwan	TSEC Weighted Stock Price Index	-0.3982	0.0023	9.0930	386938.660	33.2400	-21.5000	0.7223	0.622
4	Hong kong	Hangseng Index	0.2038	0.5866	8.7163	1485.817	26.4500	-34.8200	0.8629	-0.056
5	Singapore	SGX	-0.2195	0.0751	7.6702	10216.779	24.8400	-21.0700	0.7535	0.030

**b ) Holding Period: 2 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	0.0357	0.7965	12.6395	1586.887	43.2900	-23.2700		0.579
2	Japan	NIKKEI 225	-1.7914	-1.3946	8.9604	-642.522	22.1500	-20.4600	0.2529	0.340
3	Taiwan	TSEC Weighted Stock Price Index	-0.8393	0.0047	13.2055	280970.798	38.4800	-31.7600	0.7255	0.500
4	Hong kong	Hangseng Index	0.4987	1.1733	11.8102	1006.609	33.3500	-28.5500	0.8598	0.335
5	Singapore	SGX	-0.3914	0.1501	10.5666	7037.434	34.1100	-29.4000	0.7505	0.504

**c ) Holding Period: 3 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	-0.1302	1.1950	17.5535	1468.912	78.3500	-33.0000		1.810
2	Japan	NIKKEI 225	-2.7371	-2.0920	11.2049	-535.597	21.0200	-28.2800	0.2986	-0.244
3	Taiwan	TSEC Weighted Stock Price Index	-1.5866	0.0070	18.3388	260292.132	45.9900	-29.4700	0.7571	0.547
4	Hong kong	Hangseng Index	0.5364	1.7593	15.6169	887.667	43.7400	-33.8900	0.8736	-0.087
5	Singapore	SGX	-0.8676	0.2248	14.8545	6608.660	39.3500	-38.5900	0.7804	0.240

**d ) Holding Period: 6 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	0.5225	2.3886	20.7864	870.220	45.3500	-21.1700		0.822
2	Japan	NIKKEI 225	-5.8901	-4.1836	18.2852	-437.064	31.3800	-36.7300	0.2719	0.053
3	Taiwan	TSEC Weighted Stock Price Index	-2.6184	0.0145	21.8284	150070.006	41.8300	-55.6200	0.7135	-0.438
4	Hong kong	Hangseng Index	1.2455	3.5191	22.1041	628.119	51.5600	-34.8700	0.8621	0.241
5	Singapore	SGX	-1.3868	0.4500	19.8092	4402.050	44.2400	-40.1400	0.7530	0.565

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**Table 3: Summary Statistics for Stock Returns in Select Asian Stock Markets  
in Home Currency Terms (1992-2002)**

**e ) Holding Period: 12 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	2.2250	4.7782	24.4413	511.520	49.3700	-23.3100		0.363
2	Japan	NIKKEI 225	-10.2317	-8.3655	19.7778	-236.422	31.3300	-31.7300	0.1814	0.627
3	Taiwan	TSEC Weighted Stock Price Index	-6.0458	0.0282	34.6810	123061.436	58.6400	-57.8200	0.7147	-0.036
4	Hong kong	Hangseng Index	1.7140	7.0400	36.4163	517.277	76.8600	-37.2500	0.8662	0.675
5	Singapore	SGX	-2.3357	0.9000	28.8574	3206.373	57.6800	-27.8400	0.7374	1.315

**f ) Holding Period: 2 years**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	0.2805	5.4800	35.0965	640.447	53.6202	-42.8160		0.014
2	Japan	NIKKEI 225	-24.9079	-19.8100	31.1400	-157.194	21.5808	-58.5551	0.2166	0.384
3	Taiwan	TSEC Weighted Stock Price Index	-1.6897	2.6867	31.9752	1190.144	45.8987	-42.0008	0.8883	0.070
4	Hong kong	Hangseng Index	-3.3760	8.2200	57.0478	694.012	101.7612	-48.2160	0.9225	0.915
5	Singapore	SGX	-8.4197	-1.2017	42.7826	-3560.275	54.1228	-42.3443	0.7737	0.677

**Note:** *t*-test has been applied to test the significance of difference between average return of India and other Asian countries.

**Table 4: Risk and Return Statistics of Select Asian Stock Markets  
in US Dollar Terms (1992-2002)****a ) Holding Period: 1 month**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skew-ness
			G.M.	A.M.						
1	India	BSE Sensex	-0.4575	-0.0722	8.8159	-12202.077	27.3771	-23.81014		0.199
2	Japan	NIKKEI 225	-0.9101	-0.6558	7.1448	-1089.552	17.3201	-18.72896	0.5552	0.174
3	Taiwan	TSEC Weighted Stock Price Index	-0.6393	-0.2282	9.2108	-4036.133	33.3122	-21.3011	0.8883	0.646
4	Hong kong	Hangseng Index	0.2014	0.5847	8.7229	1491.743	26.4576	-34.75238	0.5433	-0.052
5	Singapore	SGX	-0.3487	0.0262	8.6122	32817.463	28.6518	-24.85285	0.9269	-0.052

**b ) Holding Period: 2 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skew-ness
			G.M.	A.M.						
1	India	BSE Sensex	-0.9073	-0.1445	12.6162	-8731.092	43.1984	-27.2278		0.622
2	Japan	NIKKEI 225	-1.8606	-1.3115	10.5811	-806.790	27.7952	-23.6349	0.5658	0.416
3	Taiwan	TSEC Weighted Stock Price Index	-1.3449	-0.4564	13.5310	-2964.609	38.5138	-32.4992	0.8913	0.521
4	Hong kong	Hangseng Index	0.4933	1.1695	11.8287	1011.441	33.3587	-28.351	0.5382	0.342
5	Singapore	SGX	-0.6623	0.0525	12.0009	22865.198	43.4100	-36.8182	0.9269	0.350

**c ) Holding Period: 3 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skew-ness
			G.M.	A.M.						
1	India	BSE Sensex	-1.5756	-0.2167	17.1228	-7899.927	65.3938	-35.6185		1.057
2	Japan	NIKKEI 225	-2.8239	-1.9673	13.0118	-661.416	21.3774	-24.0117	0.5907	-0.032
3	Taiwan	TSEC Weighted Stock Price Index	-2.4643	-0.6846	19.2147	-2806.581	46.3223	-32.6419	0.9043	0.456
4	Hong kong	Hangseng Index	0.5252	1.7542	15.6531	892.302	43.8918	-34.0147	0.5745	-0.083
5	Singapore	SGX	-1.1942	0.0787	15.7564	20013.720	40.8160	-44.6727	0.9331	0.017

**d ) Holding Period: 6 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skew-ness
			G.M.	A.M.						
1	India	BSE Sensex	-2.4235	-0.4335	20.9855	-4841.027	40.8045	-24.2058		0.649
2	Japan	NIKKEI 225	-6.2172	-3.9345	20.8699	-530.431	30.3335	-42.9385	0.5819	-0.099
3	Taiwan	TSEC Weighted Stock Price Index	-4.5112	-1.3693	22.9760	-1677.992	39.1541	-62.534	0.8885	-0.646
4	Hong kong	Hangseng Index	1.2223	3.5085	22.1777	632.118	51.8522	-34.8836	0.5481	0.254
5	Singapore	SGX	-2.1467	0.1575	21.5155	13664.428	41.8127	-41.9904	0.9270	0.148

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**Table 4: Risk and Return Statistics of Select Asian Stock Markets  
in US Dollar Terms (1992-2002)**

**e ) Holding Period: 12 months**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	-3.8300	-0.8670	25.4170	-2931.658	47.2022	-34.0757		0.320
2	Japan	NIKKEI 225	-11.6914	-7.8690	27.8015	-353.302	41.9605	-43.0443	0.5446	0.327
3	Taiwan	TSEC Weighted Stock Price Index	-9.0383	-2.7385	34.4535	-1258.108	53.3018	-62.0165	0.8863	-0.070
4	Hong kong	Hangseng Index	1.6653	7.0169	36.4937	520.080	77.0658	-37.4149	0.5639	0.672
5	Singapore	SGX	-4.0175	0.3149	31.6722	10057.446	57.3517	-45.8212	0.9241	0.781

**f ) Holding Period: 2 years**

Sr. No.	Country	Index	Average Return		Std. Dev.	C.V.	Max.	Min.	T-Test Sig.level	Skewness
			G.M.	A.M.						
1	India	BSE Sensex	-10.2670	-5.2752	31.6633	-600.232	34.3603	-52.5579		-0.287
2	Japan	NIKKEI 225	-36.0117	-21.1625	47.9192	-226.434	45.7664	-83.4601	0.5157	0.267
3	Taiwan	TSEC Weighted Stock Price Index	-7.6248	-3.0945	30.0856	-972.225	28.9602	-50.4599	0.9051	-0.545
4	Hong kong	Hangseng Index	-3.4898	8.1848	57.3053	700.139	102.4680	-48.216	0.6285	0.929
5	Singapore	SGX	-13.1119	-3.3888	47.6593	-1406.377	55.3650	-52.8744	0.9375	0.409

**Note:** *t*-test has been applied to test the significance of difference between average return of India and other Asian countries.

**Table 5: Annualised Return and Risk for Various Investment Horizons (Home Currency)**

Country	Index	Based on One Month H.P.			Based on Two Months H.P.		
		G.M.	A.M	Std. Dev.	G.M.	A.M	Std. Dev.
India	BSE Sensex	0.047	4.779	31.123	0.214	4.779	30.960
Japan	NIKKEI 225	-10.747	-8.367	21.737	-10.748	-8.367	21.948
Taiwan	TSEC Weighted Stock Price Index	-4.778	0.028	31.499	-5.036	0.028	32.347
Hong kong	Hangseng Index	2.446	7.040	30.194	2.992	7.040	28.929
Singapore	SGX	-2.633	0.901	26.570	-2.349	0.901	25.883
Country	Index	Based on One Month H.P.			Based on Two Months H.P.		
		G.M.	A.M	Std. Dev.	G.M.	A.M	Std. Dev.
India	BSE Sensex	-0.521	4.780	35.107	1.045	4.777	29.396
Japan	NIKKEI 225	-10.948	-8.368	22.410	-11.780	-8.367	25.859
Taiwan	TSEC Weighted Stock Price Index	-6.347	0.028	36.678	-5.237	0.029	30.870
Hong kong	Hangseng Index	2.145	7.037	31.234	2.491	7.038	31.260
Singapore	SGX	-3.470	0.899	29.709	-2.774	0.900	28.014

**Table 6: Annualised Return and Risk for Various Investment Horizons (Dollar Terms)**

Country	Index	Based on One Month H.P.			Based on Two Months H.P.		
		G.M.	A.M	Std. Dev.	G.M.	A.M	Std. Dev.
India	BSE Sensex	-5.490	-0.867	30.539	-5.444	-0.867	30.903
Japan	NIKKEI 225	-10.921	-7.869	24.750	-11.163	-7.869	25.918
Taiwan	TSEC Weighted Stock Price Index	-7.672	-2.739	31.907	-8.069	-2.739	33.144
Hong kong	Hangseng Index	2.417	7.017	30.217	2.960	7.017	28.974
Singapore	SGX	-4.184	0.315	29.834	-3.974	0.315	29.396
Country	Index	Based on One Month H.P.			Based on Two Months H.P.		
		G.M.	A.M	Std. Dev.	G.M.	A.M	Std. Dev.
India	BSE Sensex	-6.302	-0.867	34.246	-4.847	-0.867	29.678
Japan	NIKKEI 225	-11.295	-7.869	26.024	-12.434	-7.869	29.515
Taiwan	TSEC Weighted Stock Price Index	-9.857	-2.739	38.429	-9.022	-2.739	32.493
Hong kong	Hangseng Index	2.101	7.017	31.306	2.445	7.017	31.364
Singapore	SGX	-4.777	0.315	31.513	-4.293	0.315	30.428

**Table 7: Autocorrelation Coefficients of Stock Indices (Holding Period = month)**

<b>Lag</b>	<b>India</b>	<b>Japan</b>	<b>Taiwan</b>	<b>Hongkong</b>	<b>Singapore</b>
1	0.0982	0.0099	0.0615	0.0087	0.0153
2	0.0269	-0.096	0.0417	-0.0163	0.0876
3	-0.1496	0.0362	-0.099	-0.0941	-0.0843
4	-0.144	0.0265	-0.0305	-0.0659	-0.0116
5	0.089	0.051	-0.0034	-0.031	-0.0049
6	0.1818	-0.0931	-0.2016	-0.0187	-0.004
7	-0.1668	-0.123	0.0923	0.2119	0.126
8	-0.1644	0.0663	-0.0829	0.1292	0.1146
9	-0.0694	0.0373	0.1045	0.0182	-0.0605
10	0.043	-0.0144	0.0792	0.0893	-0.0431
11	0.0959	-0.0407	-0.0175	-0.1592	-0.1796
12	0.0156	-0.0076	-0.0317	-0.1129	0.0069
13	-0.2073	-0.137	-0.0827	-0.1524	-0.0537
14	-0.1878	0.0951	0.0674	0.0372	0.0381
15	-0.1107	-0.0934	-0.0314	-0.039	-0.1457
16	-0.1482	-0.0254	-0.165	0.1334	0.0215
17	0.0723	0.0516	-0.1055	0.0311	-0.0017
18	-0.0295	-0.1482	-0.2494	-0.0978	-0.1037
19	-0.1483	0.0264	-0.0741	-0.0813	-0.0658
20	0.0774	0.052	-0.1407	-0.0788	-0.0522
21	0.0406	0.0115	0.1086	0.0902	0.0767
22	0.1745	-0.1003	0.0839	-0.0573	-0.1342
23	0.2647	-0.0618	0.1541	-0.0629	-0.0376
24	0.0324	0.0013	0.1066	0.0239	-0.0025
Q(1)	1.24	0.01	0.48	0.01	0.03
p-value	0.2652	0.9098	0.4878	0.9211	0.8609
Q(6)	9.60	2.81	7.03	1.91	2.00
p-value	0.1426	0.8329	0.3182	0.9281	0.9201
Q(12)	15.91	5.40	11.06	15.16	10.42
p-value	0.1952	0.9432	0.5240	0.2330	0.5788
Q(24)	34.79	13.23	28.72	24.66	18.22
p-value	0.0715	0.9622	0.2309	0.4245	0.7923



Table 8. : Augmented-Dicky Fuller Unit Root Test

Country	D.F. Statistic at level $In (P_t)$			Unit Root of D.F. Statistics at 1st difference $R_t = In (P_t) - In (P_{t-1})$		
	D.F.	t	r <sup>2</sup>	D.F.	t	r <sup>2</sup>
India	-0.2155	-2.8239	0.2994	-0.8129*	-3.7987	0.55172
Japan	-0.0949	-1.4527	0.1243	-1.1118*	-6.0289	0.5261
Taiwan	-0.0622	-1.2417	0.1836	-1.0172*	-5.9293	0.4877
Hong Kong	-0.1263	-1.8023	0.23352	-1.2757*	-6.7277	0.51622
Singapore	-800	-0.7568	0.1755	-1.0218*	-5.818	0.5051

\* $H_0$  Rejected at 5% significance level.

Note : Table value for t-test at 5% level of significance is 2.89.

Table 9 : Correlation Coefficients of Selected Asian Stock Markets

## A) Home Currency Terms

	Hongkong	India	Japan	Singapore	Taiwan
Hongkong	1.000				
India	0.137	1.000			
Japan	0.286**	0.038	1.000		
Singapore	0.764**	0.163	0.335**	1.000	
Taiwan	0.470**	0.191*	0.257**	0.430**	1.000
Average "R"	0.414	0.132	0.229	0.423	0.337

## B) Us Dollar Terms

	Hongkong	India	Japan	Singapore	Taiwan
Hongkong	1.000				
India	0.139	1.000			
Japan	0.316**	0.078	1.000		
Singapore	0.762**	0.190*	0.367**	1.000	
Taiwan	0.481**	0.229**	0.189*	0.417**	1.000
Average "r"	0.424	0.159	0.238	0.434	0.329

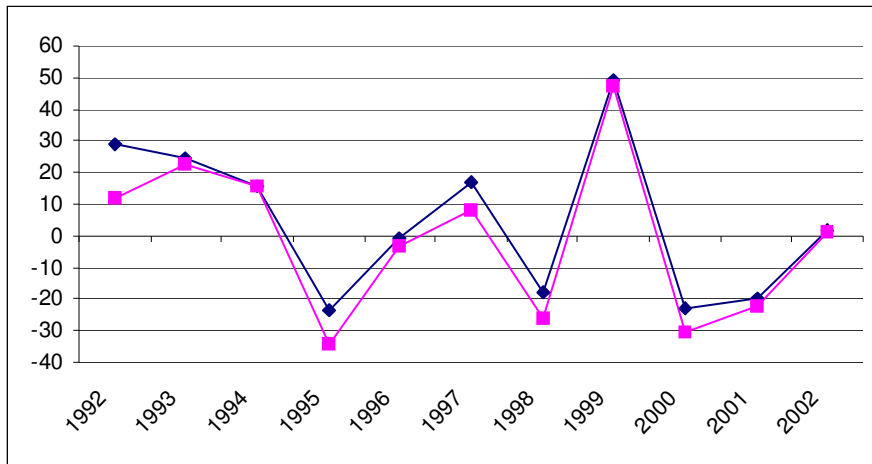
\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

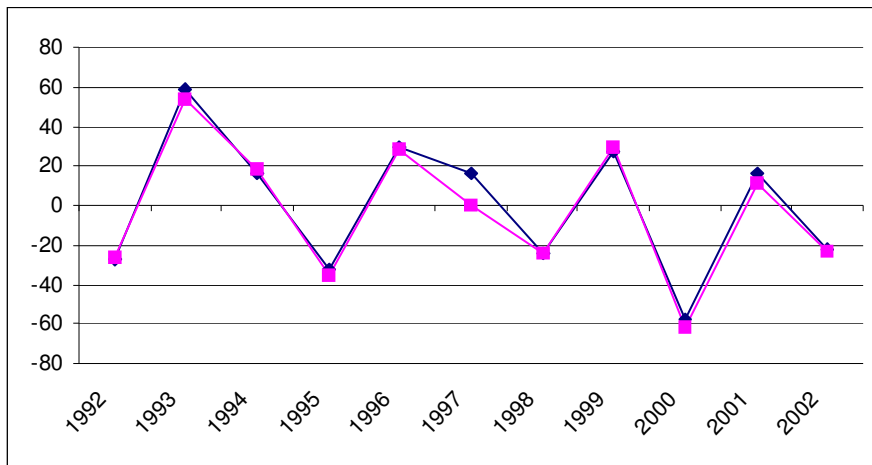
Note: All the above correlation coefficients are based on monthly returns for the period January 1992 to December 2002.

Chart 1: Annual Stock Returns

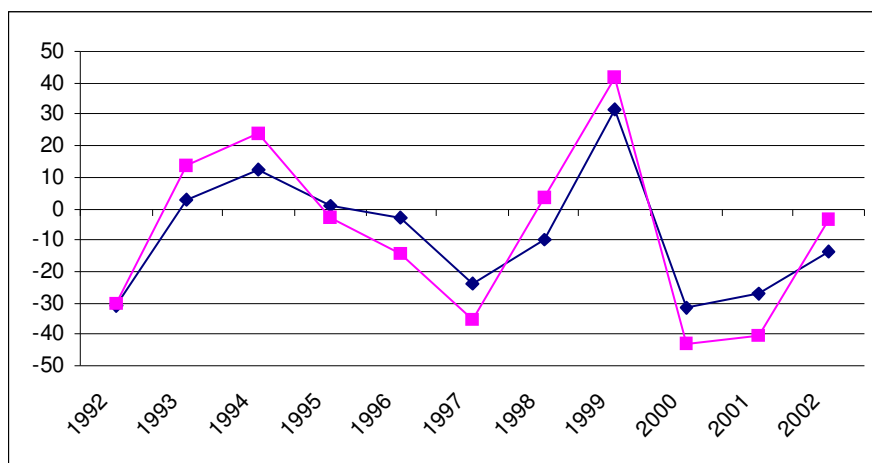
India



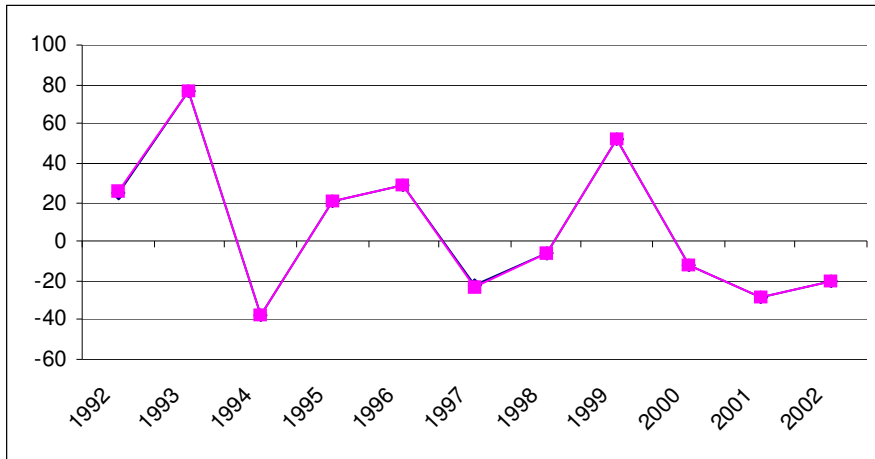
Taiwan



Japan



### Hongkong



### Singapore

