

STOCK RETURNS BEHAVIOR AND LINKAGES: AN EMPIRICAL INVESTIGATION

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Abstract

The primary objective of this study is to examine the behavior and linkages of stock price indices and stock returns of different sectors with each other as well as with the market rate of return on the Karachi stock Exchange. We compute descriptive statistics and the correlation coefficients for stock price indices and return indices over a span of about 10 years, which is divided into two sub periods. Our findings suggest that all the said industry indices are modestly volatile relative to the market index during both the examined periods. During the second sub period, the weekly average rates of return for nine out of the eighteen industry indices as well as for the KSE-100 index are significantly greater than zero. This finding implies that an investor can get a positive return on average by trading of stocks. In addition to this, our results provide evidence that the Pakistani stock market may go up gradually but goes down sharply. Finally, we found that there is weaker short-run co-movement among the rates of return of the examined industry indices relatively during the second sub period. This finding suggests that an investor may hedge his/her loss by investing in more than one industry stock.

1. Introduction

In Pakistan debt was the preferred source of finance for industrial enterprises in the past, however, today, equity and quasi-equity are attractive instruments of finance. A stable and well-regulated equity market is necessary for enhancing activities among financial investors. If equity markets are efficient then firms can easily raise funds by issuing securities.

Stock markets tend often to lead, and sometimes to follow, booms and slumps in business activity. The value of the stock market influences the wealth of households, either directly or through their pension funds. Thus stock prices can be expected to influence their consumption spending. Firms also use the stock market, when stock prices are higher, to issue new shares in order to finance investment spending. As a result, employment level increases. This raises the individuals' income, consumption and saving. When stock prices are low, firms find this an unattractive way to raise new money and hence choose to cancel or postpone investments.

This study presents the descriptive statistics and the correlation coefficient for stock price indices and stock indices returns on the Karachi Stock Exchange. The correlation coefficient between two indices is used to explore whether changes in stock price volatility in one industry affects the stock price volatility of the other industry. According to portfolio diversification models, if stock prices of two stocks move together then investing in these stocks will provide no long-term gains to portfolio diversification (see for details, Markowitz, 1952, Sharpe, 1964 and Lintner, 1965). In other words, if the correlation coefficient between the stock index returns of two industries is low (negative or close to zero) then investors can reduce portfolio risk by diversifying their portfolio, i. e., investing in stock of both industries rather than investing in one of these industries. Therefore, investors, business firms and households would be interested to know whether stock indices on different industries are interlinked or independent of each other.

Prior to observing the behavior of the market, it would be useful to consider the recent trend of the KSE.. The KSE-100 index has gone up by 74 per cent in 1993 as compared to the previous year, however, the index has gone down by 30.80 per cent in 1995, and further fell by 36.90 per cent in 1998. During 1998-2000 this trend changed and the index has gone up by 59.60 percent. The index increased from 1273.1 at the end of 2001 to 2701.4 (about 112.2 per cent) in 2002 ¹. This booming trend continued and the index has gone up by 130.19% at the end of 2004 (KSE-100 index value then was 6218.40). Based on this historical evidence, can we predict next year's index change?

This study is planned as follows. Section II describes the analytical framework and data. Section III presents results and analysis of correlation of stock price indices. The final section concludes the study.

11. Methodological Framework and Data

A very simple but useful procedure to analyze the behavior of the stock market is to study the pattern of descriptive statistics based on the given sample with the help of means, standard deviation, skewness, kurtosis, Jarque-Bera test statistics and correlation coefficients. Following this traditional path, this study presents the pattern of stock price returns and simple correlation coefficients.

A higher mean indicates higher index value on average across the industry. The smaller standard deviation implies lesser dispersion of the data around the respective mean. The high value of skewness points to a less symmetrical distribution. Kurtosis

measures the peakedness or flatness of the distribution of the series. The kurtosis of the mesokurtic distribution is 3. Mesokurtic distribution is a prime example of normal distribution. If the kurtosis exceeds 3, the distribution is peaked (leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (platykurtic)² relative to the normal. Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution³.

The study covers the 420-week time span from January 1, 1995 to July 31, 2004 for the KSE-100 index and 18 sartorial indices⁴. However, we divide this period into two sub periods: January 1995 to December 1998 and January 1999 to July 2004. In the first sub period, the Karachi Stock Exchange has as over all declining trend on average. For example, as was mentioned above, the KSE–100 indexes has gone down by about 37% during 1995 to 1998. Contrary to this, the market performance has considerably changed during the second sub period and the index has gone up by about 355% during 1999-04. Some external factors are also responsible for this positive trend in the equity market. For instance, after the event of September 11, 2001, the capital flow (particularly, home remittances) has increased and a significant part of this might have been invested in the equity market. Therefore, the higher capital flow may be a cause of this upward trend on the KSE.

The main objective of this study is to examine stock return behavior and to explore the linkages, however, we are also interested in investigating whether this behavior and linkages have changed during the period in which the market has up ward trend as compared to the declining trend period.

Calculation of Returns

The weekly returns are derived from daily stock price indexes. The weekly return of each index is computed as the return from Wednesday's closing index value to the following Wednesday's close⁵. Formally, we calculated the weekly returns for stock price indices using the following formula developed by Rogalski (1984). For week ,

where r_t is weekly return while I_t is Wednesday's closing value of the index in question. If the following Wednesday's index value is missing, then Thursday's index value is used. If Thursday's index point is also missing the return for that week is reported as missing. The data on KSE-100 index and all the said sect oral indices are obtained from Vital Information Services (Vies) databases.

III. Empirical Results

Table 1 presents the basic descriptive statistics of weekly stock price indices. Each row corresponds to a particular index. The sample size, mean, median, maximum, minimum, standard deviation, skew ness, kurtosis and Jarque-Bera statistics are given in columns 2-8, respectively, for the said industry indices as well as for the KSE-100 index over the period from January 1995 to December 1998.

Industry	Obser.	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Banks & Inv. Companies	206	421.22	378.24	980.81	210.60	166.29	1.08	3.79	45.61
Textile Spinning	206	667.18	639.58	999.61	493.50	115.17	0.66	2.70	15.70
Textile Weaving	206	588.48	544.90	974.61	356.10	134.20	0.74	2.96	18.83
Textile Composite	206	529.99	470.83	986.54	344.94	158.07	0.86	2.78	25.91
Sugar & Allied	206	297.38	202.55	973.62	66.92	226.06	1.10	3.16	41.98
Petroleum & Oilfields	206	536.03	504.34	1013.45	220.99	181.27	0.41	2.58	7.22
Natural Gas & LPG	206	524.70	454.16	1043.68	215.37	229.85	0.64	2.27	18.74
Energy	206	582.45	561.35	991.62	364.702	166.84	0.55	2.26	15.04
Engineering & Metals	206	608.32	591.68	999.22	417.94	134.52	0.86	3.00	25.18
Automotive & Assembler	206	485.51	450.00	947.04	313.98	154.58	0.92	2.89	29.05
Auto Parts & Batteries	206	536.52	477.10	993.86	232.85	226.85	0.33	1.82	15.57
Transport & Comm.	206	729.30	748.52	998.32	335.60	147.15	-0.71	3.09	17.20
Fertilizers	206	637.93	602.85	1006.27	372.68	183.96	0.25	1.73	16.02
Pharmaceuticals	206	524.42	449.05	999.69	245.14	232.78	0.55	1.87	21.25
Chemicals	206	564.33	484.50	1032.68	326.49	208.31	0.95	2.56	32.91
Paper & Board	206	707.63	681.17	999.20	465.02	150.19	0.13	1.95	10.12
Paper & Forest Products	206	705.16	636.00	1014.79	559.87	140.09	0.92	2.21	34.23
Vanaspoti & Allied	206	726.21	693.15	1023.60	549.93	116.58	0.91	3.16	28.48
KSE-100	206	1526.90	1575.17	2077.38	789.15	287.09	-0.87	3.23	26.45

The table shows that the highest magnitude of mean is 729.30 for the Transport and Communication sector index across the industry indices. It is interesting to note that the standard deviation of the Textile Spinning index is lowest across industry indices. The Nature Gas and LPG index has the highest maximum value (1043.68) across industry indices and the minimum index is 66.92 for Sugar and Allied industry over the first sub period period. The stock index of Pharmaceutical sector has the highest standard deviation (232.78) across all the industries examined. However, all industry indices are less volatile relative to the KSE-100 index, i.e., the standard deviation of the KSE-100 Index (287.09) is higher than the examined industry indices.

The table reveals that there is a positive skewness of stock prices for all the industry indices apart from the Transport and Communication sector index during the first sub period. However, skewness of stock prices for 16 out of the 18 industries is less than one. This is pointing to a more symmetric distribution of stock prices for these sixteen industries. Interestingly, the KSE-100 index is negatively skewed with a magnitude of -0.87. This suggests that the stock prices (at aggregate level) in Pakistan contain a more symmetric distribution. It implies that the Pakistani stock market may go up gradually but goes down sharply.

As we mentioned earlier, kurtosis measures the peakedness or flatness of the distribution of the series. The results reported in the table indicate that the magnitude of kurtosis is greater than 3 for 5 out of the 18 industry indices. This means that the distribution of stock prices for these industries is leptokurtic. Leptokurtic distribution has higher peak with fatter tails relative to normal distribution. This suggests that the frequent trading of stocks of these industries may be an important factor in the departure of observed distribution from normality. In other words, this means that movements of stock prices for these industries occur with greater frequency than is predicted by the normal distribution. The magnitude of kurtosis for the KSE-100 index is also greater than 3. This implies that the distribution of stock prices in Pakistan is peaked relative to normal distribution.

On the other hand the magnitude of kurtosis for the remaining industries is less than 3, implying that there is a platykurtic distribution (fat or short-tailed relative to normal distribution) for stock prices in these industries. Finally, it can be seen from the table that the estimated Jarque-Bera test statistics are significant at any common level of

significance not only for all the industry indices but also for the KSE-100 index. Thus, there is strong evidence to reject

Industry	Obser.	Mean	Median	Maximum	Minimum	Std. Dev.	Skew ness	Kurtosis	Jarque-Bera
Banks & Inv. Companies	214	198.19	198.73	312.97	124.61	46.12	0.30	2.18	7.57
Textile Spinning	214	622.45	647.92	714.49	508.05	63.08	-0.64	1.87	21.66
Textile Weaving	214	480.71	494.17	800.47	320.11	101.26	0.60	3.13	10.60
Textile Composite	214	452.51	454.15	608.97	342.43	69.11	0.12	2.12	6.12*
Sugar & Allied	214	99.83	95.97	151.52	64.67	18.27	0.50	2.87	7.54
Petroleum & Oilfields	214	268.32	255.17	410.06	201.01	40.68	1.34	4.42	67.84
Natural Gas & LPG	214	282.19	281.44	404.51	184.78	57.52	0.31	1.95	10.95
Energy	214	341.10	344.54	441.19	246.65	36.71	-0.28	3.26	2.85*
Engineering & Metals	214	457.56	458.17	686.12	327.87	81.15	0.50	2.30	10.94
Automotive & Assembler	214	375.06	373.07	460.18	324.80	32.33	0.52	2.84	8.22
Auto Parts & Batteries	214	223.92	224.15	327.12	157.82	39.69	0.44	2.71	6.33*
Transport & Comm.	214	450.50	439.03	644.60	313.61	78.24	0.68	2.59	14.92
Fertilizers	214	387.87	381.03	477.61	349.67	27.61	1.16	3.75	43.93
Pharmaceuticals	214	259.17	250.52	334.07	211.51	30.23	0.44	2.25	9.84
Chemicals	214	399.06	395.87	453.35	352.42	27.48	0.34	2.23	7.87
Paper & Board	214	560.23	562.85	668.49	458.50	55.96	0.05	1.99	7.64
Paper & Forest Products	214	493.76	483.79	666.17	325.27	110.11	0.14	1.50	17.12
Vanaspati & Allied	214	546.40	551.63	596.00	449.57	26.39	-1.03	3.84	36.25
KSE-100	214	1430.04	1380.27	2054.43	874.36	280.38	0.26	2.31	5.49*

It can be observed from the table that all the examined industry indices are less volatile during the second sub period as compared to the first sub period. Again, the Textile Spinning sector index is highest on average and the Vanaspati & Allied sector index has the lowest standard deviation across the industry indices. The standard deviation of the KSE-100 index (with a magnitude of 280.38) is lower relative to the first sub period. This implies that the KSE-100 index is less volatile during the second sub period. Over the second sub period, it is interesting to note that the KSE-100 index is positively skewed while it was negative during the first sub period. Similarly, the Transport and Communication sector's index has changed from negative skewed to positive skewed during the second sub period. However, the Textile Spinning sector's index, the Energy sector's index, and the Vanaspati and Allied sector's index are negative skewed which were positive skewed over the first sub period.

Furthermore, quite contrary to the first sub period, the Jarque-Bera test does not reject the null hypothesis of normality for the KSE-100 index. This means that the stock prices at aggregate level are normally distributed during the second sub period. This finding suggests that the movements of stock prices occur with the same frequency that is predicted by the normal distribution. The Jarque-Bera test also provides evidence that the Textile Composite sector index, the Energy sector index, and the Auto parts and Batteries sector index behave as normal distribution.

Correlation Matrix for Industry Indices

Simple correlation coefficients among the stock price indices of different industries as well as with KSE-100 index are reported in Table 3 and in Table 4 for the first sub period and for the second sub period, respectively. If the correlation coefficient between the stock price indices of two industries is low this implies that the stock prices of these industries are independent of each other. Thus, an investor may expand his/her gain by investing in both industries stocks.

Table 3
Correlation Coefficients for Sectoral Indexes,
Weekly Data; January 1995 through December 1998

Industry	Banks & Inv. Companies	Textile Spinning.	Textile Weaving	Textile Composite	Sugar and Allied	Petroleum & Oilfield	Natural Gas & PLG	Energy	Engineering & Metals	Automotive & Assembler	Auto Parts & Batteries	Transport and Communication	Fertilizers	Pharmaceuticals	Chemicals	Paper & Board	Paper & Forest Products	Vanaspati & Allied
Textile Spinning	0.91																	
Textile Weaving	0.77	0.92																
Textile Composite	0.96	0.95	0.83															
Sugar & Allied	0.97	0.88	0.73	0.96														
Petroleum & Oilfields	0.96	0.83	0.64	0.91	0.94													
Natural Gas & LPG	0.97	0.89	0.72	0.95	0.96	0.96												
Energy	0.91	0.78	0.60	0.91	0.95	0.93	0.93											
Engineering & Metals	0.91	0.87	0.77	0.89	0.87	0.87	0.92	0.88										
Automotive & Assemh.	0.96	0.88	0.74	0.97	0.99	0.93	0.96	0.96	0.90									
Auto Parts & Batteries	0.90	0.78	0.57	0.91	0.94	0.93	0.92	0.97	0.85	0.94								
Transport & Comm.	0.55	0.52	0.36	0.49	0.42	0.59	0.50	0.46	0.47	0.43	0.47							
Fertilizers	0.90	0.78	0.56	0.90	0.93	0.94	0.93	0.97	0.85	0.94	0.99	0.46						
Pharmaceuticals	0.93	0.83	0.65	0.94	0.97	0.95	0.97	0.97	0.88	0.97	0.97	0.40	0.98					
Chemicals	0.94	0.85	0.72	0.94	0.98	0.93	0.96	0.95	0.88	0.96	0.92	0.42	0.92	0.97				
Paper & Board	0.87	0.73	0.52	0.86	0.90	0.93	0.90	0.96	0.82	0.91	0.97	0.54	0.97	0.94	0.90			
Paper & Forest Product.	0.88	0.81	0.72	0.90	0.94	0.84	0.90	0.88	0.81	0.92	0.86	0.18	0.86	0.93	0.95	0.81		
Vanaspati & Allied	0.97	0.89	0.73	0.95	0.98	0.95	0.95	0.95	0.88	0.97	0.94	0.53	0.93	0.95	0.96	0.92	0.89	
KSE-100	0.63	0.53	0.33	0.52	0.49	0.70	0.61	0.51	0.53	0.47	0.52	0.91	0.54	0.49	0.49	0.59	0.29	0.58

It can be seen from Table 3 that all the estimated coefficients are positive and statistically significant, suggesting a strong short-run co-movement among different industry indices and with the market index during the first sub period. Most of the estimated coefficients show 80%-90% correlation across the industry indices. However, the highest correlation exists with a magnitude of 0.98 between the stock prices of Vanaspati & Allied and Sugar and Allied industries. The stock prices of Pharmaceutical and Fertilizer industries, and Chemical and Sugar & Allied Industries are also related with the same high magnitude. In contrast, it is found that the lowest correlation for the stock prices of Textile Spinning and Transport & Communication industries is 0.36 over the examined period. Moreover, the table reveals that Transport & Communication sector's index has the highest correlation with KSE-100 index with a magnitude of 0.91. The stock prices for Paper and Forest Products, however, have the lowest correlation (with a magnitude of 0.29) with market movements. These figures provide some evidence of the associations between the market index and the mentioned industry indices.

During the first sub period, as we observed from Table 3, all the said industry indices were highly positively correlated with each other; however, this relationship has considerably changed over the second sub period. On the one hand, the magnitude of correlation coefficients has declined and on the other hand, the nature of the relationship has changed from positive to negative for a number of the industries. It can be observed from Table 4 that the correlation coefficient is close to zero for many industry indices. These findings provide evidence that there is a weak short-run co-movement among the stock prices for the examined industries during the second sub period.

Table 4
Correlation Coefficients for Sectoral Indexes,
Weekly Data: January 1999 through July 2004

Industry	Banks & Inv. Companies	Textile Spinning.	Textile Weaving	Textile Composite	Sugar and Allied	Petroleum & Oilfield	Natural Gas & PLG	Energy	Engineering & Metals	Automotive & Assembler	Auto Parts & Batteries	Transport and Communication	Fertilizers	Pharmaceuticals	Chemicals	Paper & Board	Paper & Forest Products	Vanaspati & Allied
Textile Spinning	-0.39																	
Textile Weaving	0.92	-0.28																
Textile Composite	0.05	0.81	0.19															
Sugar & Allied	0.26	0.61	0.30	0.80														
Petroleum & Oilfields	0.52	0.40	0.56	0.60	0.80													
Natural Gas & LPG	0.89	-0.30	0.90	0.20	0.39	0.59												
Energy	0.77	-0.08	0.64	0.21	0.45	0.62	0.66											
Engineering & Metals	0.39	-0.21	0.24	-0.27	0.05	0.40	0.27	0.57										
Automotive & Assemb.	0.75	-0.04	0.76	0.33	0.54	0.58	0.81	0.65	0.20									
Auto Parts & Batteries	0.79	-0.18	0.70	0.21	0.35	0.43	0.68	0.80	0.26	0.71								
Transport & Comm.	0.82	-0.39	0.76	-0.09	0.14	0.52	0.75	0.60	0.54	0.52	0.49							
Fertilizers	0.20	0.53	0.09	0.44	0.63	0.64	0.07	0.43	0.40	0.26	0.23	0.21						
Pharmaceuticals	0.10	0.71	0.05	0.72	0.70	0.61	0.06	0.44	0.14	0.24	0.35	-0.09	0.73					
Chemicals	-0.26	0.23	-0.37	-0.07	0.13	0.18	0.21	0.01	0.50	-0.21	0.32	0.01	0.38	0.21				
Paper & Board	0.13	0.71	0.28	0.87	0.77	0.64	0.33	0.21	0.19	0.49	0.24	-0.05	0.37	0.64	0.08			
Paper & Forest Product.	0.81	-0.78	0.75	-0.38	-0.24	0.02	0.70	0.52	0.28	0.49	0.64	0.62	-0.29	0.33	0.40	0.28		
Vanaspati & Allied	0.43	-0.22	0.54	0.05	-0.13	-0.02	0.34	0.11	0.28	0.40	0.36	0.17	-0.14	0.09	0.58	0.11	0.47	
KSE-100	0.11	0.71	0.12	0.71	0.87	0.82	0.23	0.40	0.27	0.38	0.16	0.18	0.72	0.70	0.39	0.68	0.41	-0.32

Similarly, the Banks and Investment Companies index, the Textile Spinning sector's index, and the Auto Part and Allied sector's index are not significantly related with the KSE-100 index over the second sub period. However, there is a negative correlation between the KSE-100 index and the Paper & Forest Product sector's index, and the Vanaspati & Allied index.

Basic Statistics of Weekly Stock Returns for Sectoral Indexes

Table 5 and 6 present the basic statistics (mean, median, maximum, minimum, standard deviation, skewness, kurtosis as well Jarque-Bera test statistics) of the weekly rates of return of different industry indices along with the rates of return of KSE-100 index for both the said sub periods, January 1995 through December 1998 and January 1999 through July 2004, respectively. All the estimated weekly average rates of return are negative and almost close to zero not only for industry indices but also for the KSE-100 index over the first sub period. However, during the second sub period, this trend has been changed and the weekly average rates of return are positive not only for the KSE-100 index but also for 9 out of the 18 industry indices⁶. This indicates that an investor can get considerable returns on average by trading of stocks. In addition to this, the higher market rates of return (on average) relative to the industry indices suggests that an investor may get more profit by investing in overall market rather than in the shares of one industry.

Table 5
Basic Statistics of Weekly Stock Returns for Sectoral Indexes,
Weekly Data; January 1995 through December 1998

Industry	Obser.	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Banks & Inv. Companies	205	-0.73	-1.13	18.74	-15.64	4.82	0.74	5.59	76.36
Textile Spinning	205	-0.30	-0.32	12.48	-5.82	2.15	1.75	11.38	703.80
Textile Weaving	205	-0.33	-0.54	14.96	-13.90	4.16	1.16	6.71	163.74
Textile Composite	205	-0.50	-0.70	13.77	-11.27	3.11	0.83	7.81	220.95
Sugar & Allied	205	-1.29	-1.93	25.18	-17.48	4.85	0.95	7.57	208.77
Petroleum & Oilfields	205	-0.72	-0.58	8.42	-21.77	4.03	-1.23	8.74	332.71
Natural Gas & LPG	205	-0.68	-0.86	15.86	-13.72	5.47	0.38	3.05	4.90
Energy	205	-0.49	-0.62	12.32	-8.69	2.87	0.73	5.91	90.73
Engineering & Metals	205	-0.37	-0.56	18.56	-9.99	3.70	1.01	7.22	187.02
Automotive & Assembler	205	-0.50	-0.48	9.56	-9.44	2.59	0.27	5.22	44.65
Auto Parts & Batteries	205	-0.71	-0.49	4.89	-10.46	2.22	-0.68	5.51	69.76
Transport & Comm.	205	-0.36	-0.28	12.91	-18.27	4.46	-0.47	5.18	48.39
Fertilizers	205	-0.47	-0.47	6.26	-8.22	1.79	-0.35	6.83	129.27
Pharmaceuticals	205	-0.67	-0.62	15.02	-9.58	2.59	1.11	10.52	524.84
Chemicals	205	-0.52	-0.75	24.50	-12.13	4.11	1.64	11.05	645.56
Paper & Board	205	-0.37	-0.18	8.74	-10.80	2.60	-0.08	5.97	75.38
Paper & Forest Products	205	-0.23	-0.07	8.44	-6.32	2.11	0.46	5.18	47.61
Vanaspati & Allied	205	-0.29	-0.12	7.38	-6.86	1.83	0.09	5.65	60.50
KSE-100	205	-0.38	-0.24	12.67	-14.19	4.70	-0.29	3.70	7.01

Table 5 highlights the maximum weekly rate of stock return with a magnitude of 24.50 for the Chemical industry index across the industry indices over the first sub period. Conversely, the table shows that the maximum loss is 21.77 for Petroleum and Oilfields industry over the same period. Table 5 also provides evidence that the standard deviation of the rates of stock return of Natural Gas and LPG (that is 5.47) has been higher than the standard deviation of all other examined sectors as well as from the standard deviation of market rates of return. However, weekly rates of stock return for all the remaining industries apart from Banks and Investment Companies and Sugar and Allied sectors are less volatile relative to the market rates of return, i.e., the standard deviation of the weekly KSE-100 index increment (4.70). But the standard deviation of the rates of return of all the examined industry indices is less than the standard deviation of the rates of return of KSE-100 index during the second sub period. Table 6 provides evidence that the rates of return of Textile Spinning sector, Fertilizer industry, and Vanaspati and Allied sector are less volatile relative to other industries over the period from January 1999 to July 2004.

As can be seen from the table, the magnitude of skewness of the weekly rates of stock return for 13 industries is less than one during the first sub period. However, skewness of the rates of return in 5 out of the 18 industries is less than zero. The market return is also negative skewed with a magnitude of -0.29. This implies that the rates of stock returns (at aggregate level) in Pakistan have symmetric distribution. This implication is strongly robust during the second sub period.

The value of kurtosis of the weekly increments is greater than 3 for industry indices not only for the first sub period but also over the second sub period. This means the distribution of weekly stock returns for all the examined industries is leptokurtic.

Leptokurtic distribution has higher peak with fatter tails relative to normal distribution. This suggests that the frequent trading of stocks of these industries may be an important factor in the departure of observed distribution from normality. These findings are strongly supported by Jarque-Bera test results except for the Natural Gas & LPG index where the test rejects the null hypothesis of non-normality.

Table 6
Basic Statistics of Weekly Stock Returns for Sectoral Indexes,
Weekly Data; January 1999 through July 2004

Industry	Obser.	Mean	Median	Maximum	Minimum	Std. Dev.	Skew ness	Kurtosis	Jarque-Bera
Banks & Inv. Companies	214	-0.17	-0.24	9.29	-12.58	3.47	-0.26	4.18	12.19
Textile Spinning	214	0.13	-0.05	7.59	-3.18	1.58	1.47	7.94	243.95
Textile Weaving	214	-0.14	-0.04	11.43	-11.01	3.28	-0.01	4.99	29.25
Textile Composite	214	0.13	0.07	19.43	-23.37	3.95	-0.25	14.74	1018.80
Sugar & Allied	214	0.20	-0.02	16.71	-12.07	4.39	0.40	4.60	23.54
Petroleum & Oilfields	214	0.13	-0.12	22.05	-20.90	4.30	0.12	10.02	363.89
Natural Gas & LPG	214	-0.04	-0.14	12.90	-11.39	4.23	0.18	3.68	4.37*
Energy	214	-0.02	0.04	10.93	-18.17	3.48	-0.88	8.09	213.76
Engineering & Metals	214	0.14	0.00	16.97	-14.95	4.25	0.13	6.01	67.16
Automotive & Assembler	214	0.00	0.02	10.77	-7.42	2.36	0.47	6.01	73.24
Auto Parts & Batteries	214	-0.08	-0.11	21.46	-18.87	4.12	0.32	12.87	721.60
Transport & Comm.	214	-0.05	-0.21	14.59	-14.18	4.20	0.02	4.80	23.79
Fertilizers	214	0.04	0.12	6.52	-8.53	1.98	-0.68	6.88	124.60
Pharmaceuticals	214	0.09	0.03	9.48	-8.71	2.97	0.26	4.13	11.37
Chemicals	214	0.13	0.26	13.85	-13.54	2.92	-0.26	8.90	258.55
Paper & Board	214	0.11	0.13	10.24	-12.51	2.50	-0.59	9.19	292.78
Paper & Forest Products	214	-0.28	0.00	8.68	-11.99	2.68	-0.95	8.38	239.95
Vanaspati & Allied	214	-0.06	0.00	6.31	-7.26	1.91	0.21	5.26	39.01
KSE-100	214	0.36	0.32	45.80	-46.31	6.39	-0.24	31.70	6074.66

Correlation Matrix of Weekly Stock Returns for Sectoral Indices

Table 7 and 8 present the correlation coefficients across the rates of stock return of different industries as well as with market return for the first and second sub periods, respectively. It can be observed from the Table 7 that all the estimated coefficients are positive but have low magnitude except for some industries. For example, the weekly rates of return of Natural Gas & LPG, Banks & Investment Companies, Textile Composite, and Sugar & Allied sectors are highly correlated among each other as well as with market rate of return during the first sub period.

The correlation coefficients of market rate of return and the rates of return of Natural Gas & LPG, Petroleum & Oilfields, Banks & Investment Companies, and Transport & Communication industry indices are 0.73, 0.72, 0.69, and 0.67, respectively. These figures show that there is a strong short-run co-movement between the weekly increments of these industry indices and KSE-100 index's increments. However, the rates of returns in other industries are also positively correlated with market rates of return over the first sub period but they are not large.

Table 7
Correlation Matrix of weekly Stock Returns for Sectoral Indexes,
Weekly Data; January 1995 through December 1998

Industry	Banks & Inv. Companies	Textile Spinning.	Textile Weaving	Textile Composite	Sugar and Allied	Petroleum & Oilfield	Natural Gas & LPG	Energy	Engineering & Metals	Automotive & Assembler	Auto Parts & Batteries	Transport and Communication	Fertilizers	Pharmaceuticals	Chemicals	Paper & Board	Paper & Forest Products	Vanaspati & Allied
Textile Spinning	0.51																	
Textile Weaving	0.46	0.68																
Textile Composite	0.52	0.73	0.69															
Sugar & Allied	0.77	0.50	0.43	0.50														
Petroleum & Oilfields	0.61	0.30	0.23	0.32	0.49													
Natural Gas & LPG	0.81	0.47	0.44	0.51	0.76	0.66												
Energy	0.31	0.28	0.32	0.35	0.29	0.16	0.27											
Engineering & Metals	0.62	0.41	0.37	0.40	0.56	0.43	0.52	0.41										
Automotive & Assemh.	0.45	0.39	0.43	0.42	0.45	0.34	0.44	0.41	0.60									
Auto Parts & Batteries	0.30	0.29	0.34	0.31	0.29	0.14	0.23	0.18	0.24	0.19								
Transport & Comm.	0.43	0.22	0.19	0.27	0.42	0.45	0.40	0.12	0.29	0.24	0.26							
Fertilizers	0.58	0.35	0.32	0.40	0.53	0.40	0.57	0.29	0.36	0.34	0.36	0.37						
Pharmaceuticals	0.58	0.41	0.36	0.48	0.62	0.37	0.56	0.40	0.48	0.46	0.24	0.23	0.46					
Chemicals	0.29	0.32	0.27	0.35	0.24	0.11	0.21	0.15	0.29	0.13	0.26	0.32	0.11	0.30				
Paper & Board	0.11	0.08	0.04	0.10	0.16	0.10	0.17	0.03	0.11	0.11	0.19	0.15	0.19	0.10	0.03			
Paper & Forest Product.	0.16	0.33	0.25	0.25	0.21	0.07	0.20	0.29	0.28	0.27	0.13	0.05	0.12	0.30	0.22	0.13		
Vanaspati & Allied	0.32	0.28	0.25	0.25	0.37	0.23	0.25	0.27	0.25	0.37	0.18	0.20	0.31	0.28	0.12	0.11	0.14	

Table 8
Correlation Matrix of weekly Stock Returns for Sectoral Indexes,
Weekly Data; January 1999 through July 2004

Industry	Banks & Inv. Companies	Textile Spinning.	Textile Weaving	Textile Composite	Sugar and Allied	Petroleum & Oilfield	Natural Gas & LPG	Energy	Engineering & Metals	Automotive & Assembler	Auto Parts & Batteries	Transport and Communication	Fertilizers	Pharmaceuticals	Chemicals	Paper & Board	Paper & Forest Products	Vanaspati & Allied
Textile Spinning	0.38																	
Textile Weaving	0.31	0.50																
Textile Composite	0.34	0.47	0.23															
Sugar & Allied	0.46	0.38	0.27	0.50														
Petroleum & Oilfields	0.43	0.34	0.38	0.29	0.30													
Natural Gas & LPG	0.58	0.32	0.30	0.29	0.46	0.41												
Energy	0.27	0.18	-0.01	0.21	0.19	0.13	0.19											
Engineering & Metals	0.30	0.05	0.06	0.02	0.18	0.21	0.28	0.24										
Automotive & Assemh.	0.33	0.18	-0.10	0.18	0.25	0.14	0.20	0.10	0.34									
Auto Parts & Batteries	0.08	0.09	-0.03	0.16	0.14	0.07	0.00	0.17	0.16	0.16								
Transport & Comm.	0.50	0.23	0.29	0.16	0.28	0.48	0.48	0.19	0.28	0.15	0.07							
Fertilizers	0.41	0.42	0.27	0.26	0.42	0.34	0.39	0.13	0.25	0.23	0.12	0.39						
Pharmaceuticals	0.27	0.31	0.13	0.36	0.32	0.26	0.33	0.14	0.16	0.31	0.25	0.21	0.23					
Chemicals	0.15	-0.01	0.09	-	0.11	0.02	0.20	0.08	0.01	0.08	0.05	0.02	0.26	0.11	-0.02			
Paper & Board	0.31	0.28	0.29	0.14	0.33	0.24	0.28	0.13	0.19	0.17	0.09	0.31	0.32	0.13	0.14			
Paper & Forest Product.	0.00	0.10	0.12	0.14	0.12	0.16	0.07	-0.01	0.01	-0.04	0.05	-0.02	0.08	-0.04	0.04	-0.04		
Vanaspati & Allied	0.15	0.10	0.09	0.06	-0.02	0.25	0.08	0.08	0.04	0.02	0.03	0.15	0.11	0.23	0.26	-0.03	0.02	
KSE-100	0.41	0.24	0.12	0.19	0.41	0.40	0.36	0.09	0.21	0.31	0.13	0.45	0.34	0.26	0.17	0.23	0.05	0.07

During the second sub period, as Table 8 reports, the correlation coefficients are relatively low. The correlation coefficients for most industry indexes are close to zero. This means that the rates of return are uncorrelated. For some industries, however, the rates of return are negatively correlated. Low correlation implies a weak short-run co-movement between the rates of return of the said industry indices. Thus, according to

portfolio diversification models, investors can reduce portfolio risk by diversifying their portfolio, i.e., they may hedge their loss by investing in more than one industry stock.

IV. Conclusion

The primary objective of this study was to explore whether changes in stock price volatility in one industry affects the stock price volatility of the other industry. This analysis was demonstrated by correlation of stock price indices and returns indices of 18 industries among each other as well as with the KSE-100 index.

The computed magnitude of skewness and kurtosis indicate that the stock prices as well as stock returns (at aggregate level) in Pakistan contain a symmetric distribution. This implies that the Pakistani stock market may go up gradually but goes down sharply. This piece of evidence is robustly supported by the Jarque-Bera test results.

In addition to the above, our results provide evidence that there is low correlation between the examined industry indices and market index that are found by using correlation coefficients of stock price indices and rates of return. These findings are more robust over the second sub period relative to the first sub period. This shows that there is opportunity for investors to reduce the degree of risk. Our findings also suggest that fluctuations in the level of stock indices do not result in similar volatility in the rates of return. In other words, high stock price index does not necessarily give high returns. Finally, we found a positive weekly average rate of return for KSE-100 index over the second sub period.

Notes:

¹ Source: Global Stock Market Fact book 2003.

² See for details, Figure 1

³ Jarque-Bera test statistic is computed as: $J-B = \frac{n}{6} (S^2 + \frac{K-3}{4})$, where S is the skewness, K is the kurtosis, and n represents the number of estimated coefficients used to create the series. Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed as χ^2 with 2 degrees of freedom.

⁴ Sectors name are given in Appendix A. 1..

⁵ The stock return is not a total market return since dividends are not included.

⁶ However, the market average return is higher than the sectoral rates of returns.

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