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RELATIONSHIP BETWEEN STOCK PRICES AND ECONOMIC VARIABLES: SECTORAL ANALYSIS⁴

This study examines the relationship between stock prices and specific economic variables. The study attempts to determine which, if any, of the variables has a relationship with stock prices of Pakistani industries. 9 different industries were selected for this study on the basis of data availability, profitability and performance at the Karachi Stock Exchange. The data for the selected industries and economic variables were obtained for the period of 10 years. Cointegration and Granger causality tests reveal that long-run equilibrium relationship exists between inflation and money supply and stock prices, whereas short-run relationship exists between inflation, exchange rate and money supply and stock prices of most industries. The results also indicate that stock prices of different industries respond differently under similar economic conditions that acquaint investors about the risk-return relationship at the stock market.

Keywords: stock prices, economic variables, Karachi Stock Exchange, Granger causality.

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ВЗАЄМОЗАЛЕЖНІСТЬ МІЖ ЦІНАМИ НА АКЦІЇ І ЕКОНОМІЧНИМИ ЗМІННИМИ: ГАЛУЗЕВИЙ АНАЛІЗ

У статті вивчено взаємозалежність між цінами на акції і деякими економічними змінними. Зроблено спробу визначити, які змінні мають вплив на ціни акцій у пакистанській промисловості. Для цього було вибрано 9 різних галузей промисловості на основі доступності даних, рентабельності у відповідності до показників Фондової біржі Карачі. Дані за окремими галузями і економічними змінними отримано за 10 років. Тест на коінтеграцію і тест Грейнджера на причинність показали довгострокову рівноважну залежність між інфляцією, грошовою масою і цінами на акції і короткострокову залежність між інфляцією, обмінним курсом і грошовою масою і цінами на акції у більшості галузей промисловості. Результати також показали, що ціни на акції в різних галузях по-різному реагують в схожих економічних умовах, що надає інвесторам певну інформацію про залежність ризику і прибутковості на фондовому ринку.

Ключові слова: ціни на акції, економічні змінні, Фондова біржа Карачі, причинність Грейнджера.

Таб. 3. Літ. 29.

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ВЗАИМОЗАВИСИМОСТЬ МЕЖДУ ЦЕНАМИ НА АКЦИИ И ЭКОНОМИЧЕСКИМИ ПЕРЕМЕННЫМИ: ОТРАСЛЕВОЙ АНАЛИЗ

В статье изучена взаимозависимость между ценами на акции и некоторыми экономическими переменными. Предпринята попытка определить, какие переменные

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⁴ This research is sponsored by the International Doctoral Fellowship (IDF) Program of University of Technology Malaysia.

имеют влияние на цены акций пакистанской промышленности. Для этого были выбраны 9 различных отраслей промышленности на основе доступности данных, рентабельности и эффективности деятельности в соответствии с показателями Фондовой биржи Карачи. Данные по отдельным отраслям промышленности и экономическим переменным получены за 10 лет. Тест на коинтеграцию и тест Грейнджера на причинность показали долгосрочную равновесную зависимость между инфляцией, денежной массой и ценами на акции и краткосрочную зависимость между инфляцией, обменным курсом и денежной массой и ценами на акции в большинстве отраслей промышленности. Результаты также показали, что цены на акции в различных отраслях по-разному реагируют в схожих экономических условиях, что дает инвесторам информацию о зависимости риска и доходности на фондовом рынке.

Ключевые слова: цены на акции, экономические переменные, Фондовая биржа Карачи, причинность Грейнджера.

Introduction. Capital market is the key player at the contemporary market-based economic system as it serves as the channel for the flow of long-term financial resources from the savers of capital to the borrowers of. The economic health of any country is assessable by the performance of its capital market since it depicts the savings, capital growth and confidence of investors in the financial sector of the country. The literature suggests that different economic variables are potentially important in predicting stock returns. According to multifactor models stock returns are based on many factors. The commonly used economic factors are interest rate, consumer price index, risk free rate of return, exchange rate, money supply, industrial production, trading volume etc. Earnings, dividends and information about future economic activity also have effect on stock prices (Fama, 1981). Granger (1986) and then later Engle and Granger (1987) developed the cointegration technique for short-run and long-run relationship variables of concern that motivates researchers and provides them a new dimension. The development of the error correction model (ECM) also aids in examination of the dynamic relationship and the adjustment process towards the long-run equilibrium among variables. One way for further investigation of this phenomenon is to opt the an industry-based perspective, that is, to examine separately the key industries. There exists some narrower investigation in literature that focus on specific economic conditions.

Pakistan's economy shows positive growth as economic indicators improves during the period under study because of some earnest steps taken by the government. These include improvement in economic fundamentals, stability of the exchange rate, reduction of interest rates, recovery of outstanding loans, rescheduling of foreign debts and payment of expensive foreign loans, large-scale mergers and acquisitions, increase in Pakistan's coverage by large international brokerage firms and investment banks. The policies on privatization, liberalization and deregulation encourage private investments which also has a profound effect on economic activities in the country. Corporate earnings and growth opportunities, particularly in telecommunications, banking and finance, have been excellent, prompting foreign investors to extend their activities in these sectors. The economy shows great buoyancy in front of adverse internal factors like political tensions, law and order situations, water shortage and earthquakes, food and energy crisis, international financial crisis and 9/11

attacks (Economic Survey of Pakistan, 2007-09). The economic indicators and stock market which were growing side by side for the last 8-10 years had, started declining during the second quarter of year 2008. This comovement of economic fundamentals and stock market performance needs to be investigated.

The study contributes to the existing literature by analyzing the relationship between macroeconomic variables and stock returns at an emerging Asian market which has a different structure and institutional characteristics from developed stock markets. It is critical to find out whether stock prices in Pakistan respond differently to economic variables or not. This is a sectoral study examining the relationship of stock prices and economic variables.

Literature Review. Substantial literature now exists investigating the relationship between stock prices and a number of macroeconomic and financial variables over different stock markets and periods. The level of return achieved or expected from an investment is dependent on a variety of factors. The key factors are internal characteristics and external forces. Financial information and macroeconomic variables can predict a notable portion of stock returns.

Granger (1986) and later Engle and Granger (1987) developed the cointegration technique for short- and long-run relationship among variables of concern. The development of the error correction model (ECM) also aids in examination of the dynamic relationship and the adjustment process towards the long-run equilibrium between the variables. Luehrman (1991) evaluated the impact of exchange rate changes on the values of two industries, i.e., automobile and steel industries. He finds that the depreciation of home currency causes adverse effects on the value of both industries. Bodnar and Gentry (1993) also studied the relationship between exchange rate and industry portfolio returns over the period of 1979-1988 for Canada, Japan and US. They found that the exchange rate is important in explaining industry returns for each country and also detail exchange rate exposure as a function of industry characteristics. Many studies find a significant relationship between US stock returns and economic variables like industrial production, gross national product, inflation, money supply and interest rates (Fama, 1981; Chen et. al., 1986; Harvey, 1995). Sill (1995) recognized that US stock market excess returns are significantly explained by the factors like industrial production, Treasury bill rates and inflation.

Studies often use VAR-based models to find the relationship between stock returns and economic variables. Muradogalu and Metin (1996) used co-integration test to find the relationship between stock prices and various variables and they observe proxy effect in the short run while a real balance effect appear in the long run equilibrium relationship. Leigh (1997) employed cointegration and auto regression techniques to analyze the Singapore stock exchange behavior in relation to macroeconomic variables. He found that the stock returns at Singapore Stock Exchange are cointegrated with a broad combination of macroeconomic variables including output, consumption, domestic interest rate, exchange rate, broad money supply, stock market wealth and capital stock.

Habibullah (1998) used the cointegration and vector error correction model to investigate the relationship between stock prices and money supply and to determine the market level of informational efficiency at the Kuala Lumpur stock exchange. He

determined that stock prices and money supply are non-stationary in their level form but are cointegrated in the long run with the presence of error correction representation and money supply Granger causes stock prices unidirectionally. Adrangi, Charath, and Shank (1999) investigated the relationship between inflation, output and stock returns for developing markets of Peru and Chile. They found weak long-run equilibrium relationship between stock prices and general price levels as indicated by the findings of cointegration test. Inflation can affect stock returns because inflationary pressures might threaten future corporate profits and nominal discount rate rises under inflationary pressures reducing current value of futures and thus stock returns. Ibrahim (1999) investigated the dynamic relationship between 7 macroeconomic variables (real industrial production index, consumer price index, domestic credit aggregates, official reserves, exchange rate and money supply variables M1 and M2) and stock prices of an emerging market, Malaysia, using the cointegration and Granger causality tests. The results suggested cointegration between stock prices and 3 macroeconomic variables-consumer price index, credit aggregates and official reserves. Whereas Maysami and Koh (2000) found significant contribution of interest rate and exchange rate in the long-run relationship between Singapore's stock prices and various macroeconomic variables.

Panetta (2002) studied the stability of the relation between stock market and macroeconomic forces. The study identifies macroeconomic factors like term structure spread, exchange rate, industrial production, oil prices and inflation that influence Italian equity returns and tests the stability of their relation with securities returns. The relationship between stock returns and macroeconomic variables is highly unstable for both individual securities and portfolios and the instability is not limited to a single time period or to shares in a particular risk class but has been detected in each of the sub-periods that has been considered and for shares in all risk classes. Similarly, Ibrahim and Aziz (2003) analyzed the dynamic relationship between stock prices and 4 macroeconomic variables (consumer price index, industrial production, money supply (M2) and exchange rate). The results of the study suggested long-run relationship between these variables and stock prices, particularly positive short-run and long-run relationship between stock prices and consumer price index and industrial production. However, exchange rate associates negatively with stock prices. Money supply (M2) has an immediate positive liquidity effect and negative long-run effect of money supply expansion on stock prices.

According to the financial theory, exchange rate changes should affect stock prices of a firm or an industry. Recently, Patra and Poshakwale (2006) examined the short-run dynamic adjustments and the long-run equilibrium relationships between selected macroeconomic variables, consumer price index, money supply, exchange rate and trading volume, and stock returns at the emerging Greek stock market during the period 1990 to 1999. The results showed the existence of short- and long-run equilibrium relationship between consumer price index, money supply and trading volume and the stock prices at the Athens stock exchange. However, no short-run or long-run equilibrium relationship occur between exchange rates and stock prices. The results of their study also suggested that Athens Stock Exchange is informationally inefficient because publicly available information relating to macroeconomic variables can be used in predicting stock market prices. Gonsel and Cukur (2007)

evaluated the performance of the arbitrage pricing theory at the London Stock Exchange using monthly data. Out of 7 selected macroeconomic variables for the study, 5 are similar to the study of Chen, Roll, and Ross (1986). The additional 2 factors are industry specific variables, such as sectoral dividend yield and sectoral unexpected production. The results revealed that macroeconomic variables have significant effect on the UK stock market. However, each factor may affect different industry in a different manner. That is, a macroeconomic factor may affect one industry positively, but may affect the other industry negatively.

Method.

Data: 9 different industries selected for this study are the top performers at Karachi Stock Exchange (KSE 100 index). These are banking, pharmaceuticals, cement, fertilizer, automobile, textile, tobacco, ghee & oil and petroleum industries. This study examines the relationship of stock prices with economic variables like market return (KSE 100 Index), consumer price index (CPI), risk free rate of return (RFR), exchange rate (ExRate), industrial production (IP) and money supply (M2). KSE 100 Index as the measure of market return; CPI as the measure of inflation, RFR represents the yield on 6 month Treasury bills and as a measure of interest rate and the Rupees/Dollar exchange rate as a measure of the foreign exchange rate. Industrial production is the measure of real output. Money supply to the economy is measured by M2.

The data of closing monthly stock prices, KSE 100 index and economic factors was obtained from the Karachi Stock Exchange, Business Recorder, Federal Bureau of Statistics, State Bank of Pakistan and various editions of Economic Survey of Pakistan. All the data was monthly to capture the long-term movements in volatility and to avoid the effects of settlement and clearing delays and avoid spurious correlation problem (Faff, Hodgson and Kremmer, 2005, Ibrahim, 1999, Patra and Poshakwale, 2006). The choice of monthly data was constrained by the fact that most of the economic variables under study were available as monthly. The data for most of the firms was taken for the period of 120 months i.e., from Jul 1998 to Jun 2008. Since, Pakistani industry consisted of private firms and privatized firms (formerly nationalized), the data for most of the firms was not available before 1998 because most of the firms were either established or privatized and subsequently enlisted at Karachi Stock Exchange after that date. After getting the monthly closing stock prices and the data related to the selected economic variables, all the data series were expressed in logarithmic form. This helped in eliminating the problems related to non-stationary variables. Monthly returns were calculated as the logarithmic difference between the two consecutive prices. The industry returns were calculated as the equally weighted average of the returns of the all firms of each industry.

Procedure: The analytical process of the study suggested 3 steps in the analysis. As the first step, descriptive analyses were performed to find out the temporal properties of the data. Each variable was analyzed in terms of mean, standard deviation, skewness and kurtosis. At the second stage variables were tested for unit root to establish the order of integration by employing the augmented Dickey-Fuller Statistics (ADF) developed by Dickey and Fuller (1979). ADF test was applied on all the variables at log level and first difference.

The appropriate number of lags selected using Schwarz (1978) information criteria (SIC). SIC is widely used in literature and had become a standard tool for selecting lag structure. Once the order of integration established for each variable, the next step is to evaluate the cointegration properties of the data series. Johansen (1988, 1991) and Johansen and Juselius (1990) developed a VAR-based approach to test the cointegration between 2 variables. Granger causality test is applied at the first differences of the variables to measure the short-term relationship between stock prices and economic variables.

Results and Discussion. This section delineates the results of the analytical process applied in this study which consists of (1) descriptive statistics (2) unit root test, to establish the order of integration through ADF, (3) cointegration test, to measure the long-run relationship and (4) Granger causality test, to examine the short-term relationship between the variables under study. It also demarcates the discussion on the results/findings of the study in the light of previous research where practical implications are drawn on the basis of risk and return relationship ascertained.

Descriptive Statistics and ADF Test:

Table 1. Results of Descriptive Statistics and ADF Test for Unit Root

Variables	Mean	Std Dev	Skewness	Kurtosis	T-Stat at Level	T-Stat at 1st Diff
KSE	8.18	.94	.099	1.47	-0.66	-5.67
CPI	4.74	0.17	0.59	2.28	-2.23	-4.77
RFR	1.88	0.64	-1.28	3.46	-1.91	-3.24
IPI	5.47	0.28	0.23	2.67	-2.32	-6.15
ExRate	4.07	0.06	-0.84	3.49	-0.65	-3.45
M2	14.58	0.43	0.19	1.66	-2.04	-7.08
Petroleum	5.09	0.62	-0.18	1.67	-0.54	-5.47
Pharma	4.03	0.88	-0.22	1.42	-0.78	-5.01
Ghee & Oil	3.07	0.66	-0.01	1.41	-1.38	-5.29
Automobile	3.86	0.79	-0.02	1.29	-0.78	-4.51
Cement	2.64	0.95	0.03	1.45	-0.53	-5.18
Tobacco	3.31	0.81	0.33	1.69	-1.74	-5.51
Fertilizer	4.67	0.49	0.16	1.67	-1.56	-5.39
Textile	3.65	0.53	-0.29	1.81	-0.21	-4.74
Banking	3.14	0.67	0.17	1.49	-0.97	-5.29

5% critical value at level -2.8865, at 1st dif -2.8868.

Table 1 presents the results of descriptive statistics of the logged data. The values of skewness indicate that the data series of KSE, CPI, IPI, M2, cement industry, tobacco industry, fertilizer industry and banking industry are positively skewed whereas the data series of RFR, Ex rate, petroleum industry, pharmaceutical industry, ghee & oil industry and cement industry are negatively skewed. The kurtosis values indicate that all the series are platykurtic, except the series of Ex rate and RFR which are leptokurtic. Since the values of skewness and kurtosis are not significantly different from zero and 3 respectively, the departure may not seriously affect the test of cointegration. From the results of ADF statistics, it is evident that all the series in this study are integrated to order 1.

Results of cointegration test: Table 2 summarizes the results of cointegration test. The results reveal cointegration between stock prices and inflation (CPI) for all the

industries except pharmaceuticals. Similarly, there is cointegration between stock prices of all industries and money supply, except ghee & oil. Industrial production index is cointegrated with stock prices of pharmaceutical, ghee & oil, automobile and fertilizer industries. Market return (KSE) and RFR variables are cointegrated to stock prices of cement industry and ghee & oil industry respectively.

Table 2. Results of Cointegration Tests

Variables	KSE	CPI	RFR	IPI	ExRate	M2
Petroleum Ind	6.24	15.89*	7.13	9.73	4.65	20.43*
Pharma Ind	7.69	14.84	11.39	19.38*	8.05	21.12*
Ghee & Oil Ind	3.67	17.91*	17.51*	25.01*	3.01	11.91
Automobile Ind	7.56	22.67*	11.66	17.89*	4.52	15.44*
Cement Ind	17.35*	25.27*	9.08	10.46	3.81	20.05*
Tobacco Ind	10.18	21.97*	9.73	12.99	7.03	19.37*
Fertilizer Ind	8.39	18.55*	11.78	16.23*	3.71	17.43*
Textile Ind	5.16	17.81*	8.88	10.62	4.98	19.42*
Banking Ind	2.73	18.08*	11.66	13.42	3.53	15.71*

5% critical value 15.41, * denotes rejection of the null hypothesis at the 5% significance level

However, no relationship exists between exchange rate and stock prices. These results are in contradiction to some previous studies (Ibrahim, 1999; Maysami and Koh, 2000; Ibrahim and Aziz, 2003). This study identifies 2 major determinants of stock prices of Pakistani industries, i.e. inflation and money supply. The cointegration between stock prices and inflation and money supply at the market level is already documented by earlier studies (Ibrahim and Aziz, 2003; Patra and Poshakwale, 2006).

Results of Granger Causality Test:

Table 3 presents the results of bivariate Granger causality test. The results show that petroleum industry stock returns Granger-cause exchange rate and have bidirectional causality with money supply. Stock returns of pharmaceutical industry Granger-cause market return but do not have relationship with other economic variables. For ghee & oil industry, unidirectional causality runs from inflation (CPI) and risk free rate to stock returns and from stock returns to money supply. For automobile industry, bidirectional causality exists between stock returns and market return, inflation and exchange rate and unidirectional from stock returns to money supply.

Stock returns of the cement industry Granger cause inflation and exchange rate and risk free rate causes stock returns. Money supply is the only variable having short-term relationship with stock returns of tobacco industry. Stock returns of fertilizer industry Granger cause risk free rate, exchange rate and money supply. Unidirectional causality runs from stock returns of textile industry to market return and money supply. Banking industry stock returns have bidirectional causal relationship with inflation and money supply; whereas market return does Granger cause banking stock returns and stock returns unidirectionally cause exchange rate. The results suggest that changes in stock prices have significant short-run effect on inflation, exchange rate and money supply. However, there is no relationship between stock returns and growth in industrial production. The results of this study are consistent with some earlier works (Adrangi et al., 1999; Ibrahim, 1999; Ibrahim and Aziz, 2003).

Table 3. Results of Pair wise Granger-Causality Tests

Null Hypothesis	KSE	CPI	RFR	IPI	ExRate	M2
Ind Var does not Granger Cause Pet Ind	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Reject Ho*
Pet Ind does not Granger Cause Ind Var	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Reject Ho**	Reject Ho*
Ind Var does not Granger Cause Pharma	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho
Pharma Ind does not Granger Cause Ind Var	Reject Ho*	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho
Ind Var does not Granger Cause Ghee&Oil Ind	Accept Ho	Reject Ho*	Reject Ho*	Accept Ho	Accept Ho	Accept Ho
Ghee&Oil Ind does not Granger Cause Ind Var	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Reject Ho*
Ind Var does not Granger Cause Automob Ind	Reject Ho**	Reject Ho*	Accept Ho	Accept Ho	Reject Ho**	Accept Ho
Automob Ind does not Granger Cause Ind Var	Reject Ho**	Reject Ho**	Accept Ho	Accept Ho	Reject Ho*	Reject Ho**
Ind Var does not Granger Cause Cement Ind	Accept Ho	Accept Ho	Reject Ho*	Accept Ho	Accept Ho	Accept Ho
Cement Ind does not Granger Cause Ind Var	Accept Ho	Reject Ho**	Accept Ho	Accept Ho	Reject Ho**	Accept Ho
Ind Var does not Granger Cause Tobacco Ind	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho
Tobacco Ind does not Granger Cause Ind Var	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Reject Ho*
Ind Var does not Granger Cause Fertilizer Ind	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho
Fertilizer Ind does not Granger Cause Ind Var	Accept Ho	Accept Ho	Reject Ho**	Accept Ho	Reject Ho*	Reject Ho*
Ind Var does not Granger Cause Textile Ind	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Accept Ho
Textile Ind does not Granger Cause Ind Var	Reject Ho*	Accept Ho	Accept Ho	Accept Ho	Accept Ho	Reject Ho*
Ind Var does not Granger Cause Banking Ind	Reject Ho*	Reject Ho**	Accept Ho	Accept Ho	Accept Ho	Reject Ho*
Banking Ind does not Granger Cause Ind Var	Accept Ho	Reject Ho**	Accept Ho	Accept Ho	Reject Ho*	Reject Ho*

** (*) denotes rejection of null hypothesis at the 10% (5%) significance levels.

Conclusions and Recommendations:

Stock prices of different industries behave differently in relation to economic factors. Short- and long-run relationship exists between some economic variables and stock prices. Both short- and long-run relationship exists between stock prices and inflation and money supply and these variables appear to be the determinants of stock prices of most of Pakistani industries. Industrial production has shown some long-run association with stock prices of some of the industries but no short-run relationship exists between stock prices and industrial production. Market return and risk free rate are not related to stock prices in the long-run, however, there exists a short-run relationship with stock prices of some industries. Similarly, the study finds no long-run

association between stock prices and exchange rate but both respond to each other in the short run. Stock prices and all the economic variables respond to each other in the short run, except for industrial production but in the long run the relationship is mainly due to inflation and money supply.

Since the relationship between economic variables and stock prices varies across industries, investors should be careful in formulating investment strategies as the relationship may change in time and across industries. The expansion of money supply in the economy influences stock prices both in the short and long run. So, SBP should carefully monitor the money supply situation in order to get optimal benefit of this monetary instrument. The interest rate changes can affect stock prices in the short run, so its adjustment should not limit the availability of resources and increase in the cost of resources. Though industrial production has not shown any relationship with stock prices in short term, it should not be ignored in decision-making since the relationship is available in the long run and empirical literature related to other markets. Exchange rate and stock prices react to each other in the short term therefore, the government should take measures to stabilize the national currency which value is declining consistently for the last few years. Rising inflation in the country is not only affecting stock prices; it also results in higher consumption and lower savings of individuals. The mounting prices for essentials in the country may deter availability of resources for investment. The stability of prices is required since inflation and stock prices respond to each other both in the short and long run. The results provide an opportunity for risk diversification at Pakistani stock market. Since the stock prices of different industries behave differently under similar economic conditions, investors should analyze the nature of industry before making investment decisions.

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Стаття надійшла до редакції 04.09.2012.