Short run and Long run Dynamics of Macroeconomic Variables and Stock prices: Case Study of Karachi Stock Exchange.

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Short run and Long run Dynamics of Macroeconomics Variables and Stock prices: Case Study of KSE (Karachi Stock Exchange)

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ABSTRACT

The prime object of the study is to find the long run relationship between macroeconomic variables and prices of shares in Karachi stock exchange in Pakistan context. For this purpose the study considers the monthly data of several macroeconomic variables such as real foreign exchange rate, foreign exchange reserve, industrial production index, whole sale price index, gross fixed capital formation, and broad money M2 , these variables are obtain from 1987 to 2008 period. For the purpose of finding long run relationship among the variables Johansen co-integration test is applied. The results show that after the reforms in 1991 the influence of foreign exchanges rate and foreign exchange reserve effects significantly to stock market. The result also shows that there was positive relationship between GFCF and M2 while WPI is negative relationship with stock price. The result also highlighted that interest rate is insignificant with stock prices in the long run. The VECM analysis illustrated that the coefficients of ecm1 (–1), and ecm2 (–1) were significant with negative signs. The coefficients of both error correction terms showed high speed of adjustment. The results of variance decompositions revealed that out of seven macroeconomic variables inflation showed greater forecast error for KSE 100 Index.

Key word: Stock prices, Macroeconomics variables

JEL Classification: G12, E20

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I. Introduction

The stock market is supposed to play important role in economy in the sense that it mobilizes domestic resources and channels them to productive investments. However, to perform this role it must have significant relationship with the economics activity. Capital markets are key elements of a modern, market-based economic system as they serve as the channel for flow of long term financial resources from the savers of capital to the borrowers of capital. Efficient capital markets are essential for economic growth and prosperity. After globalization of economies, the international capital markets are also becoming increasingly integrated and such integration is positive for global economic growth, the downside risk is the contagion effect of financial crisis, especially if its origin lies in the bigger markets.

Stock trade process and capital market performance are mainly influence the macroeconomic policies. Policy maker should incorporate stock trade process and capital market performance to design appropriate policy. Moreover, economic literature suggests that stock prices reflect expectation about future corporate performance, corporate profits and the level of economic activities. If the stock prices reflect these fundamentals then the stock prices used as leading indicators of future economic activities. Therefore, the dynamics interactions and relations among the stock prices and macroeconomics variables are very important to design the macroeconomics policies.

As for the effect of macroeconomics variables such as change in fiscal and monetary policy on stock prices, the efficient market hypothesis imply that competition among the investors in perfectly competitive market will guarantee that all the information are known the investor. In efficient market investor are not able to earn supernormal profit through forecast of the future stock market volatility. So it is believe that if efficient market hypothesis hold, there should be no stock broking industry.(Chong and Koh 2003).

The assault on the conclusion drawn from the efficient market hypothesis by Fama, Nelson and Schwert (1978) and Jaffe (1976) agree that macroeconomics variables influence stock returns. So their studies directly challenge the efficient market hypothesis and give evidence that key macroeconomic variables help predict the time series of stock returns.

Ross (1976) made early attempted to capturer the effects of macroeconomics forces in a theoretical frame work based on the Arbitrage price theory (APT). The APT model is designed to capture the risk premium attach with various macroeconomics variables that influence the return on assets. According to Chen, Roll and Ross (1989) economic factor affects discount rates, the firm ability to generate future cash flows, dividend payouts etc. they provide the foundation for the belief that long run equilibrium relationship exists among stock prices and macroeconomics variables

In section 2 the study analysis some previous work done as review literature, section 3 define theoretical modeling and econometrics methodology and also define data set, section 4 define result analysis and finally section 5 define conclusion.

II. Literature review

Nishat (2004) analyze long term relationship between macroeconomic variables and stock price. The study used CPI(Consumer Price Index), IIP(Industrial Index of Production), money supply and foreign exchange rate as explanatory variables. The result shows that causal relation between the stock price and economy. The study used Karachi stock exchange 100 index prices for 1974 to 2004. The result further showed that industrial production index is significant and positive while inflation is significantly negatively related. The study used granger causality test to determined effect the above said variables to stock price and found that interest rate is not cause significantly to stock price. The study used unit root technique to make data stationary. Ahmed and Shahid (2003) had worked on SENSEX index price effects by real and financial sector performance in economy for the period 1997 to 2007. The finding of the study shows that export, foreign exchange rate and foreign direct investment are significantly effects stock prices. Robert D. gay (2008) tried MA method with OLS to find relationship between stock prices and macro economics variables effects on four emerging economies India, Russia, Brazil and China. The result showed that oil price, exchange rate, and moving average lags values as explanatory variables are insignificants which highlighted inefficiency in market. Final conclusion is that these economies are emerging so

that domestics factors more influence as compare to outside factors like oil price and exchange rate.

Aftab(2000) tried to link among monetary policy, fiscal policy and equities market. The result showed that fiscal and monetary policy influence market capitalization through equity and liquidity effects. Liaquat Ali and Nadeem Ahmed(2008) tried to make relationship between economic growth and stock prices. The study found dynamics relationship between stock prices and economic growth. The study employed DF-GLS test first time in case of Pakistan. M.Shahbaz (2006) tried to make relationship between stock prices and inflation rate and used ARDL model for dynamics analysis. The finding showed that stock hedges against inflation in long run but not in short run and discuss black economy which effect long run and short run prices of the stock

Safail Sharma (2007) used rate of interest, exchange rate, industrial production index, money supply and inflation as explanatory variables. The study employed AR (Auto regressive) and MA (moving average) as explanatory variable to remove effects of non stationary in the data. The finding shows that lags of AR and MA are highly correlated with stock prices which show the speculation in market. Exchange rate, industrial production index and money supply are also significantly related. Song-zan-chiou-wei(2000) tried to link among money supply oil price and exchange rate and Asian Stock market. The finding showed that oil prices and inflation are highly effect the stock market of Asian economy Desislava Dimintrova (2005) analysis the exchange rate effects on stock prices by using multivariate model. The study tried to link among fiscal policy, monetary policy,

exchange rate and stock prices. The study also significantly defined the interest parity condition effects on stock prices.

III. Theoretical modeling and Econometrics methodology

oretical modeling

The section define the impact of macroeconomics variables on stock price valuation as follow.

- **prices and foreign exchange rate and reserve:** stock prices relationship regarding to foreign exchange is suggest to be decreasing/ increasing due to liberalization of stock market in any economy foreign direct investment will increase valuation of return and prices are as follows.

$$\left[\lambda = \sum \pi + \Psi / r + \delta = ps\right]$$

Where λ = is total gain which equal to price of share

π = net dividend / profit

ψ = capital gain

r= real interest rate

δ = risk premium

ps = price of shares

As liberalized the stock market it can cause reduced risk premium and increase the competition in stock market which increase stock prices. Due to increase inflow of foreign exchange currency its supply increases it can cause to appreciate local currency so price of share increase due to improve foreign exchange reserve it cause exchange rate appreciate while other thing remain constant.

- **prices and interest rate:** increase in interest rate cause to increase opportunity cost of holding money which can increase substitution between stock and interest bearing securities and cause falling stock prices. Another reason for falling stock prices is that when increase in interest rate it can cause increase in cost of production it can detorate companies profit and dividend which can reduced prices of shares. It may also argue that the effect of discount rate would be negated if cash flows increase in same rate as inflation, however cash flow go not up with inflation other economy suggest pre existing contract would deny any immediate adjustment for firms revenue and cost
- **market and money supply:** the direction of impact of monetary growth is negative because increase money supply increase in inflation so people maintained there real cash balance so they sells share and other assets which cause decline in share prices but on other hand increase monetary growth reduce interest rate which reduce cost of capital and increase earning of corporation. So we have found ambiguous effects.
- **ndustrial production index and stock prices:** the direction IIP (Industrial Index of Production) and stock prices are positive relationship because increase IIP shows the increase in production of industrial sector which increase profit of industries and corporation. As dividend increase and share prices are increases so positive relation is found between IIP and share price
- **oss fixed capital formation and share price:** gross fixed capital formation is defined as fixed assets accumulation. Assets accumulation increase by bond finance and equity finance if cooperation wants to finance assets they floats share so supply of share increase and decline share prices

or other ways increase assets finance by bond then firm/corporation credit worthiness decline which cause decline firm share prices so theory says increase Gross fixed capital formation decline share price in short run but in long run production increase cause increase share price so we can says ambiguous effects of share prices

$$LSP = \beta_1 + \beta_2 LEXERS + \beta_3 LRER + \beta_4 LGFCF + \beta_5 LIIP + \beta_6 LIR + \beta_7 LM2 + \beta_8 LWPI + \varepsilon$$

LSP = log of Stock prices (All share price index)
LEXERS= log of exchange rate reserve
LRER= log real exchange rate
LGFCF= log gross fixed capital formation
LIIP= log of Industrial Index of production
LIR= log of interest rate (3 months T-bill rate)
LM2= log broad money M2
LWPI= log whole sale price index (proxy of inflation)

HYPOTHESES

Based on financial economics theory (Chen et al. 1986; Fama. 1981) coupled with the pervious studies, this study hypothesizes certain relationships among interest rate, industrial index production, price levels, exchange rate, exchange rate reserves, gross fixed capital formation and stock prices.

The study taken the monthly data from IFS (International Financial Statistics) various issue and Economic Survey of Pakistan various issue of sample period of above said variables from 1989 to 2009 to analysis the effects on share price. The logic behind taken the sample period between 1989 to 2009 is that in 1991 the reform of financial sector is start and it can cause liberalized stock market.

nometrics methodology:

In this section the study provides an overview of the econometric test performed.

The model:

Examination of the dynamics relationship among macroeconomics variables and the stock prices can be measure with the help of Engle and Granger (1987) or Johansen and Juselius (1990). In this study the model is multivariate so the result of Johansen and Juselius (1990) is much reliable as compare to Engle and Granger (1987). The Johansen VECM (Vector error correction model) yields more accurate estimation of co integration vectors. The reason behind the uses of Johansen (1990) VECM is that it can full information of maximum likelihood estimation model, which allows for testing co integration in complete system of equation within one step, without allowing a specific variable to be normalized. It is not possible in Engle and Granger (1987) methodology. One more advantage of Johansen (1990) is that it can allow the avoidance of key assumption of endogenity and exogenity of variables.

The VECM can write as follow.

$$\Delta z_t = \Gamma_1 \sum \Delta z_{t-1} + ... + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi_{t-k} + \mu_t$$

Where delta denotes the first difference, Γ =(I-A1-……AI), I=(1,2…..K-1) and Π = -(I-A1…..Ak), the short run and long run adjustment of the above equation is define by $\Pi and \Gamma$. Π is equal to $\alpha\beta$ where α is speed of adjustment while the β is long run coefficient that represent the long run relationship among the variables and conform that z coverage long run steady state equilibrium.

Estimation

Estimating the VECM proceeds in the following manner:

Pre-test for stationary and lag-length:

Before analysis the long run relationship among the variables. It is very important is that the variables are stationary at same levels. The ADF (Augmented Dicky Fuller) test performed on the variables in levels and first differences. To test for unit roots, the study employ the ADF which analysis the null hypothesis as follow.

$$H_o = \gamma = 0 \text{ in}$$

$$\Delta y_t = \alpha + \gamma Y_{t-1} + \sum \beta \Delta y_{t-k} + \varepsilon$$

It is assumed that error term is normally distributed.

The selection of lag lengths may be decided using the Sims Likelihood test. The suitable number of lag length is very important because too many lags reduce the power of test due to calculation of additional estimators and it can cause losses of degree of freedom. Small number of lags also may not capture the dynamics of the error correction process. The study employes Akaike information criterion (AIC) to determine appropriate lag lengths.

Estimation the model by running the equation Δ z matrix on the lagged difference value of Δ z t-1 and obtained the rank of p. the eigenvector is obtained from the canonical correlation of the set of error term from the matrix equations. To obtained the rank of p, which will give the number of co integration equation in the system

The testing of null hypothesis is that there are at most r number of co integration vectors and thus (n-r) unit roots, i.e $H_0 : \lambda_i = 0$ where i = r+1……

$$\lambda_{trace} = -T \sum \log(1 - I_i) \quad \text{r=0, 1, 2……n-2, n-1}$$

The number of co integration equation in the system is based on the trace test. We will reject the alternative hypothesis where the trace value has full rank as in such a situation.

After determine the number of cop integration next we will determine and analysis the speed of adjustment coefficient. Assuming trace does not have full rank and there are multiple co integration vectors. We will choose the first eignenvector based on the largest eignevalue, which is observed as the most useful.

The vector autoregressive (VAR) by Sims (1980) was estimated to find short-run causality between macro economic variables and stock prices. To illustrate implication of relationships among macro economic variables and stock indices, variance decomposition was employed. In this study, Bayesian VAR model specified in first differences obtained in equations (4) and (5).

$$\Delta X_t = \alpha_1 + \sum_{i=1}^{k} \alpha_{11}(i) \Delta X_{t-i} + \sum_{j=1}^{k} \alpha_{12}(j) \Delta Y_{t-j} + \varepsilon_{xt} \qquad \textbf{(4)}$$

$$\Delta Y_t = \alpha_2 + \sum_{i=1}^{k} \alpha_{21}(i) X_{t-i} + \sum_{j=1}^{k} \alpha_{22}(j) Y_{t-j} + \varepsilon_{yt} \qquad \textbf{(5)}$$

Where ε's are the stochastic error terms, called innovations or shock in the language of VAR.

IV. Result Analysis

Table no. 1 Descriptive statistics

	SP	EXCRES	RER	GFCF	IIP	IR	M2	WPI
mean	127.6368	3553.989	39.89068	110574.6	105.5122	8.030114	400084.3	81.3842
median	103.56	1322	39.765	89578.5	92.29	7.89	395424	84.305
maximum	299.21	14435	64.15	396551	232	15.42	1043700	164.25
minimum	34.57	213	15.98	17259	52.52	1.05	69875.9	27.94
Std. Dev.	78.14981	4217.17	16.81541	88349.3	43.29091	3.050957	280527.7	38.89997
Skewness	0.972571	1.163066	0.019702	1.241375	1.104169	0.175299	0.411707	0.274529
Kurtosis	2.73852	2.669788	1.386929	4.173968	3.264533	2.924647	2.089966	1.960819
Jarque-Bera	14.12381	20.23975	9.546355	27.65491	18.13803	0.471524	5.522628	5.064995
probablity	0.000857	0.00004	0.008453	0.000001	0.000115	0.789969	0.063209	0.07946
observation	264	264	264	264	264	264	264	264

As we saw in above table no.1 it can shows that all the variables are positively skewed which shows that they are asymmetrical. Kurtosis value of all variables also shows data is not normally distributed because values of kurtosis are deviated from 3. So the descriptive statistics shows that the values are not normally distributed about its mean and variance or other word we can says no randomness in data and therefore, being sensitive to speculation shows periodic change. This indicated that individual investor can earn considerably higher normal rate of profit from the Karachi stock market. So the results of above descriptive statistics raise the issue the inefficiency of market. The funds of market are not allocated to the productive sector of the economy.

The result of unit roots test suggested that data/variables is not stationary at level except gross fixed capital formation other wise all variables are not stationary at level but they are stationary at first difference level. The value is 5% level significant of first difference level. We have used ADF (augmented dicky fuller) method used to find stationary of data as suggested in section 5 of this paper.

Table no. 2 Unit root test

Variables	At level	At first difference
log(sp)	-1.426297	-3.923520*
log(EXCRES)	3.311289	-5.618675*
log(RER)	-1.335140	-4.189409*
log(GFCG)	-1.647429	-9.058792*
log(IIP)	1.797305	-13.81579*
log(IR)	-1.621632	-4.723153*
log(M2)	-0.978078	-6.420688*
log(WPI)	-0.250161	-4.120358*

*significance level at 5%

Is macroeconomics variables impact on stock prices on long run? In this purpose we have used Johnson Julisse co integration test to find long run relationship among these variables. The result of Johnson co integration test shows below

Table no. 3 result of Co-integration test (Maximum Trace value)

Null Hypothesis	Alternative Hypothesis	Maximum trace value	5% critical value	Probability
r=0	r≥1	295.7974*	159.5297	0.0000
r=1	r≥2	211.8781*	125.6154	0.0000
r=2	r≥3	153.3623*	95.75366	0.0000
r=3	r≥4	101.5966*	69.81889	0.0000
r=4	r≥5	56.18278*	47.85613	0.0068
r=5	r≥6	27.75662	29.79707	0.0845
r=6	r≥7	7.519354	15.49471	0.5181
r=7	r≥8	0.757699	3.841466	0.3840

*significant 5% level

Table no. 4 result of co-integration test (Maximum Eigen value)

Null Hypothesis	Alternative Hypothesis	Maximum Eigen value	5% critical value	Probability
r=0	r=1	83.91926*	52.36261	0.0000
r=1	r=2	58.51585*	46.23142	0.0016
r=2	r=3	51.76571*	40.07757	0.0016
r=3	r=4	45.41381*	33.87687	0.0014
r=4	r=5	28.42616*	27.58434	0.0389
r=5	r=6	20.23726	21.13162	0.0663
r=6	r=7	6.761654	14.26460	0.5177
r=7	r=8	0.757699	3.841466	0.3840

*significant 5% level

Table no. 3 and 4 shows the result of co integration test. The johansen- Juselius co integration test shows that on all these eight variables are co integrated of eight vector as we saw above table no. 3 and table no. 4 both maximum trace statistics and maximum eignen value says r=5 co integration equation. Optimal lag of VAR structure model is 2 lag by using Shewariz criterion by taking minimum value of Shewariz Criterion. So result shows five co integration equations in the VAR model shows long run relationship among variables.

Table no.5 First normalized long run co integration equation: Dependent variables log (SP)

Variables	Coefficient	Standard error	t value
log(EXCRES)	0.895368*	0.14570	6.14481
log(RER)	2.752001*	0.93542	2.9419
log(GFCG)	5.391164*	0.85274	6.32216
log(IIP)	1.918451*	0.79838	2.40316
log(IR)	-0.313961	0.19711	-1.5928
log(M2)	1.409392*	0.34126	4.1452
log(WPI)	-6.656246*	1.32046	5.04104

*significant at 5% level

According to first normalized equation. Stock prices showed significantly positive relationship to exchange rate reserve. As exchange rate reserve increase it can shows stability of local currency and SBP (State bank of Pakistan) has more reserve to stabilized local currency. Stock price is also influence by real exchange rate positively. This implied that as increase in exchange rate (real deprecation) in domestic currency. There was positive effects on export oriented industry/firms that lead to increase in return of firms and ultimately increase the stock prices. Stock prices are also positively influence by GFCF. GFCF is proxy of private investment. As private investment increase demand of shares increases lead to positive effects on share prices. The result is consistent with Ratanapkron and

Sharma (2007). First normalized equation showed that there was significant positive relationship between stock prices and IIP. The result was consistent with finding of many researchers (Fama 1981, Abdullah and Hayworth 1993, Nishat and Shaheen 2004 and Ratanapkon and Sharma 2007). The study found that stock prices and interest rate (3 month T-bills) had negative but showed insignificant relationship with stock price in long run. Ratanapakon and Sharma (2007) also reported positive relationship. The relationship between money supply and stock prices are shows positive and significant. Our result is consistent with the study of Humpe and Macmillain (2009) in case of Japan. Stock prices showed negative and significant relationship with WPI in long run which suggested that stock market did not provide hedge against inflation. The result is consistent with Abdullah and Hayworth (1993) and Ratanapakon and sharma (2007)

Table no.6 Error Correction Model; Dependent variable ∆ log (SP)

Variables	Coefficient	Standard error	t value
Constant	0.010043	0.02154	0.46617
∆log(SP-1)	0.295923*	0.11630	2.54443
∆log(EXCRES-1)	0.013346	0.03819	0.34945
∆log(RER-1)	0.430579	0.55399	0.77723
∆log(GFCF-1)	0.050041	0.13858	0.36111
∆log(IIP-1)	0.139819	0.09342	1.49673
∆log(IR-1)	0.024297	0.04222	0.57554
∆log(M2-1)	0.081211	0.08165	0.99468
∆log(WPI-1)	-0.268735	0.78094	-0.34412
ECM1(-1)	-0.14775*	0.01833	8.06056
ECM2(-1)	- 0.78950*	0.20925	3.77299
R^2=0.34587	**F-statistics** =3.81.887		

*significant at 5% level

In order to capture the short-run dynamics of the model, error correction mechanism was applied. The result of vector error correction model is reported in Table 6. The coefficients of ecm1 (–1), and ecm2 (–1) showed the speed of adjustment of disequilibrium in the period of study. As both the error correction terms were significant with negative signs, hence the results of vector error correction model (VECM) depicted that the adjustments in LSP were due to the first error correction term (ecm1) and the second error correction term (ecm2). Table shows that coefficient of ecm1 (-1) is significant which implied that LSP is adjusted by 14.7% percent in one month to the long run equilibrium. The results showed that it took approximately (1/0.147=6.802) 7 months to eliminate disequilibrium. The coefficient of second error correction term showed speedy adjustment.

The variance decomposition provided further evidence of relationships among the variables under investigation. The variance decomposition showed that proportion of the forecast error of one variable due to other variables. Therefore, the variance decomposition makes possible to determine the relative importance of each variable in creating fluctuations in other variables (Ratanapakorn and Sharma, 2007). Table no. 7 shows that stock prices is less exogenous in relation to other variables, EXERES, RER, GFCF, IIP, IR, M2 and WPI because almost 60.5 percent of its variance is was explained by its own shock in 24 months. EXERES explained 6 percent impact on stock prices. Movements in other macroeconomic variables, i.e RER, GFCF, IIP, IR, M2 and WPI explained forecast variance 1 percent, 0.08 percent, 0.34 percent, 7.5 percent, 9.5 percent and 35.33 percent respectively for stock prices in Karachi stock exchange.

Table no. 7 Variance decomposition of SP

Month	Standard Error	log(SP)	Log(EXRES)	log(RER)	log(GFCF)	log(IIP)	log(IR)	log(M2)	log(WPI)
1	0.10784	100.00	0.000000	0.000000	0.000000	0.00000	0.0000	0.0000	0.000000
6	0.31879	91.516	0.330279	0.425665	0.025908	0.2325	4.5728	0.1273	10.76872
24	0.50704	60.449	6.050016	0.752873	0.088064	0.34775	7.4798	9.5019	35.33075

V. Conclusion:

The study examine the long run and short run relationship between seven macro economics variables and stock prices of Karachi Stock Exchange (KSE). All the series of variables used in the analysis found non stationary at level but after taken first difference it become stationary. Five long run relationships found between macroeconomics variables and stock prices of KSE. In the long run industrial index of production, real exchange rate, foreign exchange reserve, money supply and gross fixed capital formation is positively impact stock prices while interest rate is insignificant relation with stock prices in the long run and finally inflation is negative impact stock prices in the long run. The results of Variance Decomposition illustrated that among the macroeconomic variables, inflation was explaining the maximum variance. The VECM analysis found that the coefficient of ecm1 (–1) and ecm2 (–1) was significant showing speedy adjustment.

The study recommended that appropriate monetary and fiscal measures should be adopted by monetary and fiscal managers to control inflation so that the instability of the stock markets can be minimized which reduced risk factor in market. The study found that inflation major contributor in stock price instability. The increase in Industrial production can play significant positive role in development of the capital markets of Pakistan. Thus, it is recommended that authorities should formulate such a policy which supports stock prices through the promotion of industrial production. The Competition Commission should keep a close analysis on the operation of stock markets. It is helpful to reduce instability in stock prices.

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