EXCHANGE RATE AND EQUITY PRICES RELATIONSHIP: AN EMPIRICAL EVIDENCE FROM PAKISTANI FINANCIAL MARKETS

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Abstract

The relationship between stock prices and exchange rate in Pakistan has been examined by using monthly data from July 1981 to June 2004. The cointegration and error-correction model and Granger trivariate causality techniques are used to test the causal relationship between exchange rate and stock prices. The empirical results indicate the uni-directional causal relationship between stock prices and exchange rate. The results indicate that the stock price has negative significant short run causal effect on exchange rate in Pakistan. However, during short run the exchange rate has a bi-directional causal effect on stock prices. No significance relationship is found between stock prices and gold. It suggests that the stock market in Pakistan is inefficient with respect to gold prices. However, money supply and interest rate do affect stock prices, suggesting that monetary policy could be used more effectively to check the movement in stock prices in Pakistan.

1. INTRODUCTION

A change in exchange rate has two effects on stock prices: a direct effect through multinational firms and an indirect effect through domestic firms (Aggarwal, 1981: Ma and Kao, 1990). For a multinational firm involved in exports, a change in exchange rate will change the demand of its product in the international market. The same ultimately reflects in its balance sheet as profit or loss. Once the profit or loss is declared, its stock prices will also change for a domestic firm. On the other hand, currency devaluation could either raise or decrease a firm's stock price. This depends on the firm nature

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of operations. A domestic firm that exports part of its output will benefit directly from devaluation due to an increase in demand for its output. As higher sales result in higher profits, local currency devaluation will cause firm stock price to rise in general. However, if the firm uses imported inputs, currency devaluation will raise the costs and lower profits, thus creating a decline in firm's stock price.

Empirical studies provide contradictory results towards the relationship between exchange rate and stock prices for both fixed exchange rate and flexible exchange rate regime. For Example, studies conducted by Ang and Ghallab, (1976); Levy (1987); Soenen and Hennigar, (1988); Bahmani, Oskooee and Sohrabian, (1992); Frang and Loo, (1994); Loudon (1993); and Amain and Hook (2000) indicated a negative relationship between stock prices and exchange rate. A positive relationship was indicated by Aggarwal (1981) and remaining studies [Frank and Young (1972), Ma and Kao (1990)] found no relationship between stock prices and exchange rate. Most of these researchers tested the impact of exchange rate on stock prices. However, very few have investigated the causal relationship between exchange rate and stock prices. Bahmani, Oskooee and Sohrabian (1992) and Qiao (1997) examined the bi-directional causality between stock prices and exchange rate. Bahmani, Oskooee and Sohrabian (1992) determined the bidirectional causality between stock prices and exchange rate in the US market, whereas Qiao (1997) determined the same result in the Tokyo market.

In Pakistan, because of poor saving rate, limited investment opportunities and lack of awareness, less than 1% of the Population participates in stock market transactions[1]. However, like in many developing countries, investors in Pakistan diversify low portion of risk in different forms.

When they make a portfolio decision investors in Pakistan put their money in different forms, namely cash, particularly the US dollar (56%), gold, estate properties, bonds and shares (12.25%), lending (they put the money in saving accounts, 30.75%) and the remaining investment, in insurance (1%)[2]. The dollar yields the largest return, which varies from 20% to 25% per year as compared to an average return of 10% on other investments. Average inflation rate in Pakistan has been between 6% and 10%. As a result, domestic currency depreciated by almost 50% during study period and hence increased the value and demand for alternative currency, the US dollar.

[1] Annual Report State Bank of Pakistan 2000-2001.

[2] Household saving behavior in Pakistan, a survey conducted by Hanid Mukhtar, (1989); pp 38-40.

From 1982 to1988, we observed no significant variation in exchange rate[3]. However, it has been volatile since the introduction of financial and structural reforms during the 1987-88 annual budget. This volatility reached its peak in May 1998 after the nuclear test. Its consequence is a decrease in the value of Pakistani currency against the dollar. Its rate decrease from an average of Rs. 39 to Rs 50. Facing an acute foreign exchange crunch following the freeze of foreign currency accounts and international economic sanctions have brought many undesirable effects on Pakistan's economy. At the Karachi stock exchange the investor's confidence was badly shaken. Consequently, this was reflected in the KSE-100 index, which went down to a minimum of 879 points immediately after the nuclear test as compared to an average of 1500 during the year. During this period a persistence in volatility in both stock price indices and exchange rate were observed.

In Pakistan, gold has been regarded as the most precious metal not only due to its usage in ornaments but also as a widespread mean of investment ("a saving for a rainy day"). No wedding ceremony in Pakistan is complete without gold jewelry, which traditionally has become the most expensive item on the dowry list. Like many other countries in the region, gold jewelry in Pakistan is more than a thing of beauty, a joy for everyone, particularly for women. It is the most credible mean of investment, which offers better returns than fixed deposits. It is believed that investment in gold is feasible. That is why the majority of people in Pakistan invests in gold rather than in financial markets.

Abdalla and Murinde (1997), Naeem and Rashid (2003), Farooq and Keung (2004) and Hussain (2005) investigated the relationship between exchange rate and stock price with reference to Pakistan. Abdalla and Murinde (1997) found no long run relationship between stock prices and exchange rates. However, they determined unidirectional causality from exchange rates to stocks prices. Naeem and Rashid (2003) investigated no long run and short run relation between stock prices and exchange rate. Farooq and Keung (2004) reported no relationship between stock prices and exchange rate. Hussain (2005) found short run relationship between exchange rate and stock prices. This paper investigates the relationship between stock prices and exchange rate both in short and long run from July 1981 to June 2004. The cointegration analysis and error correction methodology, as well as the Granger trivariate causality test are used to determine the relationship between stock prices and exchange rate. The trivariate causality test avoids the

[3] From 1947 to 1981, there was fixed exchange rate in Pakistan. Since 1982, flexible exchange rate is practiced.

methodological problem of the third missing variable in the bivariate causality test. This study is different in three ways from other studies conducted in Pakistan. First, the data set used in this study is large, covering two and half decades. Second, gold prices are used as savings in Pakistan The majority of people invest in gold. Thirdly money supply and interest are also used, which ultimately used to control the two financial variables. The rest of the paper is organized in such a way that the second section describes the econometric methodology and related issues followed by data in section three. The empirical findings and interpretation are presented in section four. Section five provides the concluding remarks.

2. THEORETICAL MODEL AND ECONOMETRIC METHODOLOGY

This study empirically determines the relationship between stock prices and exchange rate. The multivariate model is used to avoid the causality inference due to missing the relevant variable (Lutkepohl 1982). Theory suggests that if the stock prices (SP_t) and exchange rate (ER_t) are considered to be stochastic trends and if they follow a common long run equilibrium relationship, then SP_t and ER_t should be cointegrated. Cointegration is a test for equilibrium between non-stationary variables integrated of same order. According to Engle and Granger (1987), cointegrated variables must have an ECM representation. The main reason for the popularity of cointegration analysis is that it provides a formal background for testing and estimating short run and long run relationships among economic variables. Furthermore, the ECM strategy provides an answer to the problem of spurious correlation. If SP_t and ER_t are cointegrated, an ECM representation could have the following form:

$$\Delta SP_t = \alpha_0 + \alpha_1 B_{t-1} + \sum_{i=1}^{n} \alpha_{2i} (1 - L) \Delta ER_{t-1} + \sum_{i=1}^{n} \alpha_{3i} (1 - L) \Delta SP_{t-1} + e_t \quad (1)$$

$$\Delta ER_t = \beta_0 + \beta_1 C_{t-1} + \sum_{i=1}^{n} \beta_{2i} (1 - L) \Delta ER_{t-1} + \sum_{i=1}^{n} \beta_{3i} (1 - L) \Delta SP_{t-1} + u_t \quad (2)$$

To further precede the model, we checked the stationarity of series. Without checking the stationarity of series the result of estimated model is spurious. Unit root test is used to test the stationarity of series in which Augmented Dicky Fuller (ADF) test is applied to examine the same. These statistics are calculated with constant and constant and time trend. ADF test is used by the following equations.

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 Y_{t-1} + \alpha_3 + \sum_{i=1}^{n} \Delta Y_{t-1} + \varepsilon_t \quad (3)$$

ADF test is used to check whether the estimation of α_2 are equal to zero. If coefficient of α_2 with negative sign is less than critical t value, which based on Fuller (1976) criteria than Y_t is said to be stationary. If two series i.e. X_t and Y_t are considered to be stochastic trends and if they follow a common long run equilibrium relationship, then X_t and Y should be co-integrated with same order, i.e. I(d). Engle and Granger (1987) have shown that their linear combination in general also is I(d). After establishing the co-integration of order I(d) of variables we establish the long run relationships by co-integration technique, which examined the issue of integrity short run dynamic with long run equilibrium.

First, we estimated a VAR (vector auto regressive) model of five variables (stock price, interest rate, money supply and gold prices) and determined the optimal lag length on the basis of Akiake Information Criteria. Two lags are selected according to this criterion. With these lags we estimated the VAR model and examined the residual for normality and autocorrelation. Since the residual is stationary at the level, we use the multivariate co-integration techniques to determine the relationship between stock prices and exchange rate.

We used the maximum likelihood method suggested by Johansen and Juselus (1990), which is more appropriate for the multivariate system under consideration. To select the number of co-integration vector "r", Johansen and Juselus (1990) reported two likelihood ratio tests. These tests are trace statistics and maximal Eigen value. Later, the Error Correction Models (ECM) were used to examine the relation between economic growth and stock market indicators, because the ECM provides an answer to the problems of spurious correlations. The ECM model has been established in the following equations.

$$\Delta SP_t = \alpha_0 + \alpha_1 B_{t-1} + \sum_{i=1}^{n} \alpha_{2i} (1-L) \Delta ER_{t-1} + \sum_{i=1}^{n} \alpha_{3i} (1-L) \Delta SP_{t-1} + \sum \alpha_{4i} (1-L) \Delta X_{t-1} + e_t \quad (4)$$

$$\Delta ER_t = \beta_0 + \beta_1 C_{t-1} + \sum_{i=1}^{n} \beta_{2i} (1-L) \Delta ER_{t-1} + \sum_{i=1}^{n} \beta_{3i} (1-L) \Delta SP_{t-1} + \sum \beta_{4i} (1-L) \Delta X_{t-1} + u_t \quad (5)$$

Where X_t represents the third variable such as price of gold (GP_t), money supply (M_t) and interest rate (r_t). In ECM equations 4 and 5 B_{t-1} and E_{t-1} are error correction terms and denotes a first difference of a variable. If correc-

tion terms are statistically significant it suggests that economic forces in focus are adjusted towards long run equilibrium. It implies that stock prices and exchange rate adjust towards long run equilibrium. Jones and Joulfaian (1991) have stated that the lag change in the independent variables represents the short run causal impact, while the error correction terms measure the long run effects. To check the stability across different sub-periods, cumulative sum (CUSUM) and length of lag is used, selected on the basis of Akiake Information Criteria.

3. DATA

The monthly data used in this study covers the period from July 1981 to June 2004. The data for money supply (M_t) and interest rate (r_t) are taken from various issues of the State Bank of Pakistan's (SBP) Annual Report. The data for stock prices, price of gold and exchange rate are taken from the Monthly Statistical Bulletin published by the State Bank of Pakistan.

4. EMPIRICAL RESULTS

Table 1 shows the descriptive statistics of daily data for KSE-100 index, exchange rate, interest rate, money supply and gold prices. It indicates that the frequency distribution of the return series of KSE-100 index exchange rate, interest rate, money supply and gold prices are not normal. For normal-

Table 1. Descriptive Statistics

	Exchange Rate	Gold Price	Interest Rate	KSE-100 Index	Money Supply
Mean	3.78	8.47	1.97	7.43	13.89
Median	3.83	8.46	2.19	7.36	13.76
Maximum	4.17	8.95	2.91	8.61	14.72
Minimum	3.28	8.01	-0.30	6.78	13.28
S.Devation	0.29	0.23	0.67	0.39	0.41
Skewness	-0.33	-0.09	-1.30	1.21	0.28
Kurtosis	1.56	2.59	4.31	4.44	1.82
Jorque Bera	15.67	1.28	53.55	50.27	9.97
N	150	150	150	150	150
CV	7.77	2.78	34.35	5.25	2.96

Table 2. Augumented Dicky Fuller Unit RootTest

Variables	With Intercept		With intercept and trend		N	Critical values		
	Level	Ist diff.	Level	Ist diff.		1%	5%	10%
Exchange Rate	-1.76	-8.38	-1.55	-8.57	150	-3.47	-2.88	-2.57
Gold Price	-0.82	-8.76	-3.15	-8.74	150	-3.47	-2.88	-2.57
Interest Rate	-3.23	-14.18	-4.18	-14.09	150	-3.47	-2.88	-2.57
KSE-100 Index	-0.44	-8.06	-0.97	-8.15	150	-3.47	-2.88	-2.57
Money Supply	-1.31	-10.14	-3.81	-10.50	150	-3.47	-2.88	-2.57

ly distributed return series the skewness coefficient is zero and Kurtosis is 3. In a Guassian distribution, the kurtosis coefficient is expected to be 3. Generally, a much higher or lower Kurtosis indicates extreme leptokurtic or extreme platykurtic (Parkinson, 1987). In this study the highest coefficient of kurtosis observed for KSE-100 index is 4.446. It falls under the leptokurtic distribution. The lower coefficient of kurtosis is observed in money supply (1.827), which indicates that the series is slim and has a long tail. Jorque Bera (JB) test shows more clearly the normal distribution of series. If it is zero it indicates that series are normally distributed. All return series indicate positive and higher value of Joruque Berra (JB). Generally, values for skewness zero and kurtosis value 3 and JB zero indicate that observed distribution is normally distributed. Thus, skewness and leptokurtic frequency distribution of KSE-100 index interest rate, gold prices money supply and exchange rate indicate that the distribution is not normal. In other words, the non-normal frequency distributions of KSE-100 index interest rate, gold prices money supply and exchange rate indicate that series deviate from the prior condition of random walk model.

In order to examine the integration of the variables the co-integration test is used to check whether the series are stationary or non-stationary. ADF unit root test is applied in which the error term is assumed to be normal. In order to check the data correction generating process one needs to check the significant of a constant and trend as well as to check the absent of auto-correlation. The result is shown in table 2, indicating that the variables are non-stationary in their level data in all variables and stationary at level with intercept at first difference. It implies that KSE-100 index, interest rate, gold prices money supply and exchange rate are stationary at I(1) at first difference with constant and trend.

Table 3. Johansen First Information Maximum Likelihood Test for Co-Integration

Rank	Likelihood Ratio	5%critical value	1% critical value	Max. Eigen-value	5% critical value	1% critical value
R=0	69.59**	68.52	76.07	31.01	30.90	38.77
R≤1	38.58	47.21	54.46	20.23	24.73	32.24
R≤2	18.35	29.68	35.65	11.98	18.60	25.52
R≤3	6.96	15.41	20.04	5.88	12.07	18.63
R≤4	0.08	3.76	6.65	0.08	2.69	6.65

Table 4. Estimates of the Cointegrating Vectors of Stock Price

Normalized Cointegrating Coefficients: 1 Cointegrating Equation

C	ER	GP	Interest rate	Money Supply
-14.641	-0.635 (1.21)	-3.535 (1.106)	1.111 (0.413)	2.690 (1.467)

Table 5. Estimates of the Cointegrating Vectors of Exchangerate

Normalized Cointegrating Coefficients: 1 Cointegrating Equation

C	Stock Price	GP	Interest rate	Money Supply
4.140	-0.282 (0.08)	-0.314 (0.10)	0.179 (0.32)	-0.760 (0.285)

Table 6. Regression Results for Error Correction Models

Firms		ΔSP	ΔER
Constant	Coefficient	0.004	0.005**
	SE	0.007	0.001
	t-value	0.607	2.80
ΔSP(-1)	Coefficient	0.198**	-0.057**
	SE	0.086	0.021
	t-value	2.299	-2.676

ΔSP(-2)	Coefficient	-0.063	-0.019
	SE	0.087	0.021
	t-value	-0.732	-0.881
ΔER(-1)	Coefficient	-0.443	0.310
	SE	0.365	0.091
	t-value	-1.212	0.385
ΔER(-2)	Coefficient	0.455***	-0.173***
	SE	0.359	0.090
	t-value	1.266	-1.931
ΔM(-1)	Coefficient	0.117	-0.033
	SE	0.228	0.057
	t-value	0.513	-0.587
ΔM(-2)	Coefficient	0.413***	-0.034
	SE	0.228	0.057
	t-value	1.808	-0.602
Δr(-1)	Coefficient	-0.004	-0.008
	SE	0.017	0.004
	t-value	-0.264	-1.842
Δr(-2)	Coefficient	-0.015	-0.002
	SE	0.015	0.003
	t-value	-0.982	-0.624
ΔGP(-1)	Coefficient	-0.213	-0.033
	SE	0.238	0.059
	t-value	-0.894	1.048
ΔGP(-2)	Coefficient	-0.008	-0.017
	SE	0.244	0.061
	t-value	-0.035	-0.280
B(-1)	Coefficient	-0.009	—
	SE	0.009	—
	t-value	-0.489	—
C(-1)	Coefficient	—	0.000
	SE	—	0.002
	t-value	—	1.365
R^2		0.1068	0.219
AIC			

After examining the stationarity of the individual series at I(1), the Johanson and Juselius (1988) test is used to determine the long run equilibrium relationship between stock returns and exchange rate return. The results from Johanson co-integration are given in table 3. It shows the result of KSE-100 index interest rate, stock price money supply and exchange rate respectively. The result examines the null hypothesis about no co-integration (r=0) the trace statistics is 69.599 which is above 5 percent critical value i.e. 68.52. This implies that it rejects the null hypothesis i.e. H_0 : r=0 and accepts the alternative hypothesis i.e. $r \geq 0$. As is evident in table 3, the null hypothesis $r \leq 1$, $r \leq 2$ $r \leq 3$ and $r \leq 4$ cannot be rejected at 5 percent level of significance. Consequently, there is only one cointegration relationship involving five variables of KSE-100 index, interest rate, gold prices money supply and exchange rate. Turning to maximum eigen value, the null hypothesis of no cointegration (r=0) is rejected at 5% level of significance in favour of the alternative hypothesis that there is one cointegrating vector, r=1. However, the test fails to reject the null hypothesis of $r \leq 1$, $r \leq 2$ $r \leq 3$ and $r \leq 4$. This infers that there is only one cointegrating relationship amongst the five I(1) variables. Thus, both the trace and the maximum Eigen value test statistics reject the null hypothesis of r=0 at 5% level of significance, and suggest that there is a unique cointegrating vector.

The cointegrating vectors are given in table 4, which shows that the stock prices is positively related to money supply and interest rate. It indicates that the higher the money supply and the interest rate, the higher the stock prices. However, an inverse relationship exist between exchange rate and gold price. It implies that when exchange rate increases, the value of local currency decreases. Hence, it makes local firms less competitive. Moreover, Pakistan imports intermediate goods, which would impact on the cost of production of export, which decreases the export, this in turn decreases the stock prices. Table 4 also shows that when the price of gold increases people purchase too much gold. The same decreases the demand for shares consequently decline in stock prices. Table 5 shows the impact of money supply, gold price, stock price and interest rate on exchange rate. Exchange rate is negatively related to stock prices, money supply and the price of gold.

After establishing the co-integration relationship, ECM is applied to determine the short run behavior of stock price to exchange rate. The results of ECM are presented in table 6. The estimated coefficient of error correction terms B_{t-1} and E_{t-1} show the long run relation. This is statistically insignificant with negative sign indicating that there is no long run relation among variables. The estimated coefficient of error correction term indicates that the system does not correct its previous level of disequilibrium in a month.

Whereas the coefficient of lagged values of stock prices and exchange rate are significant showing that a short run relation exists between stock prices and exchange rate. However, no relation is observed between stock price and the price of gold and between the exchange rate and the price of gold.

To check the stability of the estimated model CUSUM and CUSUM square are applied. These tests employ graphical techniques, which show the plot of CUSUM and CUSUM square statistics, and also a pair of straight line drawn at 5% level of significance. If either of the line crosses, the null hypothesis that the regression coefficients are stable must be rejected at 5% level of significance. As shown in figures 1 to 4, the CUSUM and CUSUM square indicate that the parameters of the error correction models are instable during the sample periods.

Figure 1

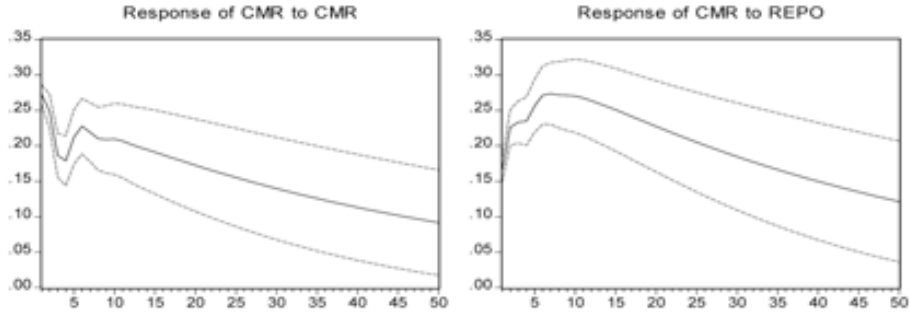
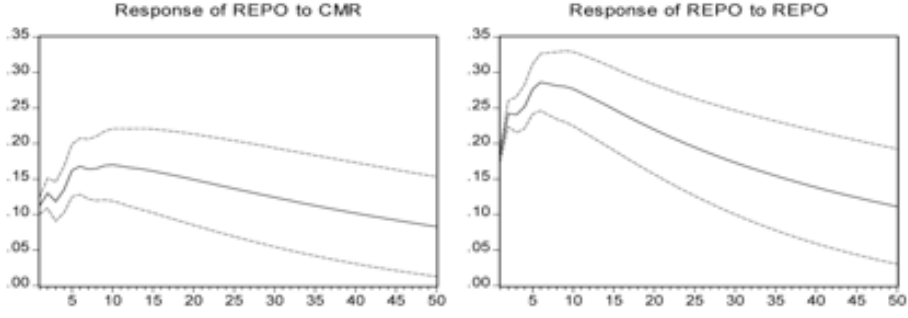


Figure 2



5. CONCLUDING REMARKS

The paper determines the causal relationship between stock prices and exchange rate by using cointegration and ECM models and Granger trivariate causality tests using monthly data from July 1981 to June 2004. The empirical results indicate that exchange rate has no long run causal effect on stock prices in Pakistan. However, during the short run, exchange rate has significant causal effect on stock prices. It implies that the stock market, in the long run, is not efficient with respect to exchange rate. Furthermore, money supply and interest rate do affect the stock prices, which suggests that monetary policy could be used more effectively to check the movement in stock prices in Pakistan. However, no significant relationship is found between stock price and prices of gold. These two variables (stock prices and gold prices) are treated differently in Pakistan. Gold is treated as precautionary purpose, whereas equities are treated as speculative purpose.

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Résumé

La relation entre les prix des actions et le taux d'échange au Pakistan a été examine dans cet article sur des données qui couvrent la période Juillet 1981 - Juin 2004. Les résultats montrent une relation unidirectionnelle où le prix des action à un effet négatif significatif dans le court terme sur le taux d'échange. Toutefois, le taux d'échange a un effet bidirectionnel sur les prix des actions. Il n'y a pas de relations entre prix des actions et prix de l'or, ce qui entraîne une inefficience du marché. Il y a cependant un effet de l'offre de monnaie et du taux d'intérêt sur les prix actionnaires. La politique monétaire pourrait donc être utilisé pour contrôler les mouvements des prix actionnaires.