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Full Length Research Paper

The relationship of stock prices and macroeconomic variables revisited: Evidence from Karachi stock exchange

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The study examines the relationships between the KSE100 index and a set of macroeconomic variables over sampling period in January 1999 to June 2008. Co-integration, Granger causality and error correction tests were used to analyze the relationship between stock prices (KSE100 index) and macroeconomic variables. The findings from the co-integrating tests suggested that stock prices and macroeconomic variables were co-integrated and that at least a uni-directional causality exists between the two sets of variables. The results further suggested that stock prices were positively related with money supply and short term interest rates and negatively related with inflation and foreign exchange reserves.

Key words: Stock prices, macroeconomic variables, co-integration.

INTRODUCTION

The objective of the particular study is to investigate the relationship between macroeconomic variables and stock prices in Pakistan equity market. Most of the existing theoretical and empirical research on stock markets focuses on the relationship between stock returns and macroeconomic variables. Due to the difference in data and the behavior of financial markets the empirical results vary widely across countries. The relationship of some macro factor could vary from market to market. Both academicians and practitioners have been dominated by the study of the relationship between macroeconomic growth and stock market performance in recent times. Stock market is considered as a barometer for the performance of the economy. Accordingly, it is argued by many academicians and practitioners that stock prices are affected by the state of economic conditions represented by different macroeconomic variables. It is also held that stock prices are useful in predicting future economic conditions (Fama, 1990; Binswanger, 2000). So the relationship can be established both ways; from macro economy to stock prices and from stock prices to the macro economy.

The presence of a relationship, if any, has enticed many researches to empirically establish models to predict stock prices. All these efforts challenged the efficient market hypothesis (EMH). One of the first attempts in this direction was the development of capital asset pricing model (CAPM) (Sharpe, 1964) that uses market return to explain the ups and downs in stock returns. However, recent attempts have been made based on the arbitrage price theory (Ross, 1976) towards development of multifactor models to explain stock returns. Present value model (PVM) using future expected earnings and future expected discount rates has been empirically tested for predicting stock prices (Campbell and Shiller, 1988). The future expected earnings and discount rates are subject to expected economic conditions. Therefore, PVM is useful in establishing a long-term relationship between stock prices and macroeconomic variables.Different macroeconomic and financial variables have been empirically studied to explain the variability of stock returns. Studies have also focused on the two-way relationship between stock prices and macro economy.

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Christopher et al. (2006) argued that investors believe that monetary policy and macroeconomic factors have alarge influence on the volatility of the stock prices. Most of the empirical research has used revised estimates of macroeconomic variables while investigating the relationship between stock prices and macroeconomic variables. Very few studies have been conducted using real time economic data.

This paper is an attempt in the same direction and would try to explore any relationship between the macroeconomic variables and stock returns in Pakistan.

LITERATURE REVIEW

The relationship of some macroeconomic factors and stock prices vary from market to market. Huang and Yang (2004) using vector auto regressive (VAR) model found for Canada, France, Japan, Taiwan and the US that no statistical relationship existed between macro-economic variables and stock prices. However, strong evidence was reported for an indirect relationship for Taiwan via money supply and for US via interest rate. Humpe and Macmillan (2005) comparing US and Japan found a positive relationship between industrial production, consumer price index (CPI) and short rates and a negative relationship between long yield rates for the US stock market. For Japan, they found comparatively weak relationship for industrial production and a coefficient of CPI greater than the US. Bilson et al. (2001) using a model incorporating both global (world market return) and local factors (money supply, goods prices, real activity and exchange rates) for emerging markets found some evidence to indicate the significance of these variables in relation with the stock returns in emerging markets.

Wong and Song (2006) concluded for the hospitality stock indices and macroeconomic variables in the US that the hospitality stock indices followed an auto-regressive process and were affected by macroeconomic variables especially the bond yield.

Sharpe (2002) in his investigation into the effect of inflation on stock valuations and expected long-run returns found that there was a negative relation between expected long-term earnings growth and expected inflation. Jones and Wilson (2006) found that inflation adjustments have little influence on the estimates of stock returns.

Ibrahim (1999) found co-integration evidence for stock prices and three macroeconomic variables; consumer prices, credit aggregates and official reserves in Malaysia. The study also found the presence of Granger-cause in the short run for stock prices affected by changes in two macroeconomic variables; official reserves and exchange rates. Gunasekarager et al. (2004) provided evidence for the Sri Lankan stock market using money supply, treasury bill rate, CPI and exchange rates as macroeconomic variables, that other than the exchange rate all the other three macroeconomic variables especially treasury bill rate had a significant influence on stock prices. But there was no evidence found to support that share price index has influence on macroeconomic variables except the Treasury bill rate. Bordo and Wheelock (2004) found that stock market boom tended to occur during periods of above average growth of real output and below average and falling inflation.

Nishat and Rozina (2004) report a ‘causal’ relationship between the stock market and the economy of Pakistan by taking industrial production index, the consumer price index, M1, and the value of an investment earning the money market rate.

Mohammad et al. (2009) also investigated the relation-ship of macroeconomic variables with stock prices and reported that after the financial reforms in 1991, foreign exchange rate and foreign exchange reserves significantly affect stock prices. Sohail and Hussain (2009) investigated the long-run and short-run relationship of macroeconomic variables and stock returns on the Lahore stock exchange over sample period, December 2002 to June 2008. Their results revealed that inflation negatively affected stock returns while money supply, industrial production and real effective exchange rate positively affected stock prices.

Hasan and Javed (2009) investigated the relationship among monetary policy variables and stock market returns using multivariate co-integration test and Granger-causality test. They reported uni-directional causality between monetary policy variables and stock market returns. Akbar and Kundi (2009) analyzed the relationship between macroeconomic variables and Karachi Stock Exchange (KSE). They concluded that monetary policy variables (inflation, interest rate, money supply, industrial production) and stock prices are co-integrated. They also found that stock prices led industrial production and money supply while inflation led stock prices.

METHODOLOGY

Data and variables

This particular study examines eight macroeconomic variables (Table 1) in relation to stock market prices, consumer price index, manufacturing production index, money supply, broad money, foreign exchange reserves, foreign exchange rate and six months’ Treasury Bills rate. Data on stock prices (KSE100 index) was obtained from Taurus Securities, a subsidiary of National Bank of Pakistan. Monthly data on macroeconomic variables was obtained from International Financial Statistics (IFS) data statistics CD of International Monetary Fund (IMF). All the variables were transformed into natural log form by taking natural log of all the variables.

Unit root test

Time series variables may have time-varying mean or variance or both. When this is the case, the variable is considered to be non-stationary that is, it has a unit root. Therefore, ordinary least

Table 1. Description of variables.

Variables	Definition
Share price index (LNSPI)	KSE100 index is taken as proxy for stock prices. KSE100 index is a market value index and includes representation of all the sectors on KSE except open-ended mutual funds. It includes the top 100 companies listed on the KSE based on market capitalization
Inflation rate (LNCPI)	A consumer price index (CPI) is a measure estimating the average price of consumer goods and services
Nominal exchange rate (LNNEER)	The Pak Rupee/U.S. Dollar nominal exchange rate is taken
Money supply (LNMTW)	Narrowly defined money supply in Pakistan including M1
Manufacturing production index (LNMPI)	Manufacturing production index has been taken as proxy for real activity in the economy
Foreign reserve minus gold (LNRESERVMG)	Foreign exchange reserves held by both the State Bank of Pakistan and commercial banks excluding gold
Market interest rate (LNMTB)	Market interest rates are represented by taking the 6 months Treasury Bills' rate

squares (OLS) can not be used in such a case. The Augmented dickey-fuller (ADF) test (Dickey and Fuller, 1981) and Phillips-Perronn (PP) test (Phillips and Perron, 1988) are used to investigate the unit root property of all the variables under investigation. The mathematical representations of the ADF test with a constant and trend and with a constant and without trend are given as:

$$\Delta z_t = \gamma_1 + \gamma_{2t} + \beta z_{t-1} + \pi \sum_{t=1}^{n} \Delta z_{t-1} + \mu_t \quad (1)$$

$$\Delta z_t = \gamma_1 + \beta z_{t-1} + \pi \sum_{t=1}^{n} \Delta z_{t-1} + \mu_t \quad (2)$$

Equation 1 includes both a constant (γ_1) and a trend tern (γ_{2t}) and Equation 2 includes only a constant trend. In both equations, Δ is a difference operator and μ_t is the error term with zero mean and constant variance. The lagged first differenced values are included to control for autocorrelation in the residuals. Akaike information criterion (AIC) and Schwarz information criterion (SIC) are used to determine the maximum number of lags to include. The rule is to select that number of lag(s) for which the information criterion is minimized. The null hypothesis in both Equation 1 and 2 is $\beta = 0$ that is, the variable has a unit root and the alternative hypothesis is $\beta < 0$. If the null hypothesis in Equation 1 and 2 is rejected, then the variable is considered to be integrated of order zero *I*(0) that is,it is stationary. If the null can not be rejected then the variable is considered integrated of greater than order zero that is,it is non-stationary.

The PP test is also estimated with constant & trend and with constant and without trend as:

$$\Delta z_t = \alpha_1 + \alpha_{2t} + \pi z_{t-1} + \mu_t \quad (3)$$

$$\Delta z_t = \alpha_1 + \pi z_{t-1} + \mu_t \quad (4)$$

Here Equation 3 includes both a constant (α_1) and (α_2) trend and Equation 4 includes only a constant term (α_1). The null hypothesis in Equation 3 and (4) is $\pi = 0$. Unlike the ADF test which is more restrictive and assumes that the error terms are (μ_t) white noise (zero mean and constant variance) and hence uncorrelated, the PP test accounts for autocorrelation in error terms (μ_t) by correcting the coefficient from AR (1) regression. Hence the PP test allows for autocorrelation in error terms (μ_t). Both ADF and PP tests generally give the same results regarding the order of integration of the variable(s). However, the power of both ADF and PP tests is low for stationary processes that have unit root close to the non-stationary boundary. Hence null might not be rejected either because the null was true or because of lack of information in the sample that is, because of small sample size (Brooks, 2008).

Co-integration test

If non-stationary variable become stationary after differencing once, they are said to be integrated of order one *I*(1). It is possible, however, that combination of two non-stationary variables integrated of the same order,that is,. *I*(1), may be stationary and hence termed as co-integrated variables.

Broadly, there are two types of tests to investigate co-integration properties of variables. The first test is the Engle and Granger (1987) unit root test of the regression residuals. However, there are some problems with the use of Engle-Granger (EG) co-integration methodology. First, it is possible that in two variables situation, one regression might suggest that variables are co-integrated. However, if the order of the variables in the regression is reversed, the results suggest no co-integration. Test of co-integration should be insensitive to the variables selected for normalization. Further, the EG test requires large sample properties which are mostly missing in practice in the field of economics. Secondly, EG approach fails to detect more than one co-integrating vector when there are more than two variables involved. Further, the EG approach is based on two steps procedure. In the first, residuals are obtained from regression model and then in the second step, these residuals are investigated for unit root to establish co-integration. Hence, an error in the first step gets compounded in the second step (Enders, 2004).

The second type of tests was developed by Johansen (1988, 1991, 1995) and Johansen and Juselius (1990) known as the maximum-likelihood based tests. This type of tests overcomes the short comings of EG approach. To investigate the co-integration properties of the variables, we follow the Johansen-Juselius (JJ) methodology. The general specification of the JJ co-integration model is given as:

$$\Delta x_t = \phi x_{t-1} + \sum_{i=1}^{k-1} \vartheta_i \Delta x_{t-i} + \lambda y_t + \varepsilon_t \qquad (5)$$

Here,

x_t = ($n \times 1$) random vector of time series variables $I(1)$

λy_t = ($n \times 1$) vector of constants

ϑ_i = ($n \times n$) matrices of short term coefficients that is parameters of lagged difference

ϕ = ($n \times n$) matrix of long term parameters of the error correction factor

The rank (r) of the matrix ϕ represents the number of independent co-integrating vector(s). So if the rank of ϕ = 0, the matrix ϕ is considered null and Equation 5 is the conventional first differenced VAR model. On the other hand, if the rank of ϕ = K, the matrix ϕ is stationary and can be estimated using ordinary least squares (OLS). Finally if the rank of ϕ is 0<r<K then there are (r) multiple co-integrating vector(s) and x_{t-1} is the error correction factor.

Under the JJ methodology, there are two tests formulated to investigate co-integration. These are Trace test and Maximal Eigenvalue test.

$$\lambda_{trace(r)} = -T \sum_{i=r+1}^{k} \ln(1-\hat{\lambda}_i) \qquad (6)$$

$$\lambda_{\max}(r, r+1) = -T \ln(1-\hat{\lambda}_{r+1}) \qquad (7)$$

where (r) is the number of co-integrating vectors under the null hypothesis and $\hat{\lambda}_i$ are the estimated eigenvalues from the estimated matrix ϕ. When $\hat{\lambda}_i$ = 0 then λ_{trace} = 0. The further are the eigenvalues from zero, ln(1- $\hat{\lambda}_i$) becomes more negative. This results in a larger λ_{trace}. The $\lambda_{\max}$ tests the null of (r) co-integrating vectors against (r+1) co-integrating vectors. Here too, the further the eigenvalues are from zero, the larger will be $\lambda_{\max}$.

When it is determined that the variables are co-integrated, it means that the variables share an equilibrium relationship and can not move independently of each other. It means that the time paths of such co-integrated variables are affected by the magnitude of deviations from the long-run equilibrium relationship. Hence, if any deviations from the long-run equilibrium take place, one or more variables must react to re-establish the equilibrium. It suggests that short-run changes must be influenced by the long-run disequilibrium.The error correction model (ECM) is based on this argument (Enders, 2004). In the JJ methodology, this is where Δx_t is a function of ϕx_{t-1} where ϕ is the number of co-integrating vectors and x_{t-1} is the error correction factor(s).

The fact that two or more variables are co-integrated evidences, the presence of at least a unidirectional Granger-causality (Granger, 1988). This is based on the premise that co-integrated variables have common stockhastic trend(s) and hence the short-run changes in the dependent variable are a function of (tha is, Granger-caused by) lagged values of the error correction terms (the deviations from the long-run equilibrium). However, as Maddala (2001) points out that co-integration is a concept that is rooted in statistics encompassing the time series properties, therefore, the presence of more than one co-integrating vectors may not be having any economic meaning except a statistical solution.

EMPIRICAL FINDINGS

In the first place, The ADF and PP tests are applied to investigate the unit root properties (that is order of integration) of the variables under investigation. Table 2 shows the results of the ADF and PP tests with and without the time trend. The table has been divided into two panels that is panel A and panel B. Panel

A show the results of the log levels, while panel B shows the results of the first differences of the log levels. The results of the log levels at panel A suggest that all variables except LNMPI and LNMTW contain unit roots. That is, the null hypothesis of a unit root in all cases except LNMPI and LNMTW cannot be rejected. The exception is the LNMPI with time trend using the ADF test and PP test and LNMTW with the time trend using the PP test. The results of the first difference of the log levels time series in panel B show that the null hypothesis of a unit root is rejected for all the variables in the first difference of log levels except for LNMTW using ADF test. It, therefore, suggests that all the variables are integrated of the same order that is *I*(1).

We proceed to examine the co-integration properties of share prices index (LNSPI) with other macroeconomic variables in the bivariate form. The appropriate lag length was one according to the AIC and SIC. The results of the bivariate co-integration tests are reported in Table 3 that the LNSPI and LNCPI are co-integrated as suggested by trace test and maximal-eigenvalues at the 0.05 level. The Trace test and maximal-eigenvalues tests also reveal that LNSPI and LNRESERVMG are co-integrated. Same findings are reported for LNSPI and LNMPI. In case of LNSPI and LNSMTB the Trace test suggests that these variables are co-integrated. However, the maximal-eigenvalue suggests that there is no co-integration between them. Both the trace and the maximal-eigenvalue tests suggest that LNSPI and LNNEER as well as LNSPI and LNMTW.

The multivariate test version of the Johansen's co-integration procedure is applied to investigate the co-integrating relationship stock prices and macroeconomic variables in the multivariate form. The results for multivariate analysis are reported in Table 4. The trace test indicates that there are two co-integrating vectors that fasten the two sets of variables that is, LNSPI and macroeconomic variables. The same result is also revealed by maximal-eigenvalue test which indicates two

Table 2. Unit root test result log levels and first difference of log levels.

Panel A Log Levels	ADF Tests		PP Tests	
	No Trend	Trend	No Trend	Trend
LNSPI	-0.831	-1.558	-0.869	0.795
LNNEER	0.665	-2.07	0.984	-2.083
LNLNRESERVMG	-1.241	-0.244	-1.238	-0.778
LNMTW	0.424	-2.735	2.592	-4.850*
LNCPI	5.585	2.638	4.928	2.384
LNSMTB	-1.654	-1.38	-1.66	-1.322
LNPPI	0.008	-7.286*	-1.494	-4.232*
Panel B 1st Differences				
LNSPI	-9.216*	-9.177*	-9.134*	-9.091*
LNNEER	-9.538*	-9.631*	-9.538*	-9.631*
LNLNRESERVMG	-2.774**	-2.917	-11.196*	-11.245*
LNMTW	-2.364*	-1.781	-11.781*	-13.343*
LNCPI	-7.047*	-8.323*	-7.316*	-8.278*
LNSMTB	-7.774*	-8.208*	-8.308*	-8.647*
LNPPI	-4.806*	-4.779*	-13.183*	-13.201*

*, Significant at 1%; **, significant at 5%.

Table 3. Bivariate co-integration test results.

Variable	CE(s)	Trace	Prob	MEV	Prob.
LNSPI and LNCPI	None	18.545	0.017	17.773	0.013
	At most 1	0.771	0.380	0.771	0.380
LNSPI and LNNEER	None	5.020	0.807	5.017	0.740
	At most 1	0.003	0.955	0.003	0.955
LNSPI and LNRESERVMG	None	21.785	0.005	19.246	0.008
	At most 1	2.539	0.111	2.539	0.111
LNSPI and LNMTW	None	7.542	0.516	4.805	0.766
	At most 1	2.737	0.098	2.737	0.098
LNSPI and LNMPI	None	21.545	0.005	20.927	0.004
	At most 1	0.618	0.432	0.618	0.432
LNSPI and LNMTB	None	16.817	0.031	13.221	0.073
	At most 1	3.596	0.058	3.596	0.058

The tests were applied assuming a constant and trend.

co-integrating vectors that do not allow the identified variables to move independently of each other.

To investigate the short-run and long-run interaction of the two sets of variable, we estimated the vector error correction model (VECM) as stated based on the JJ co-integration methodology assuming one co-integrating vector. The results are reported in Table 5 where the t-values for all the estimated normalized co-integrating coefficients, error correction coefficients and lagged coefficients are given in parenthesis.

The normalized co-integrating coefficients suggest that stock prices are positively related to money supply and short term interest rates and negatively related to inflation and foreign exchange reserves (Table 5, Panel A). A positive relationship between stock prices and money supply is consistent with Brunner (1961) who suggested

Table 4. Multivariate co-integration test results.

Hypothesized CE(s)	Trace Stat.	Prob.	Max-eigen	Probability
None *	178.884	0.000	67.152	0.000
At most 1 *	111.731	0.003	42.820	0.024
At most 2	68.912	0.059	27.744	0.226
At most 3	41.167	0.183	19.925	0.346
At most 4	21.243	0.343	13.409	0.415
At most 5	7.834	0.483	4.831	0.763
At most 6	3.003	0.083	3.003	0.083

The tests were applied assuming a constant and trend.

Table 5. Vector error correction model.

Panel A: Normalized co-integrating coefficients							
LNSPI(-1)	LNPPI(-1)	LNMTW(-1)	LNSMTB(-1)	LNCPI(-1)	LNRESERVESMG(-1)	LNNEER(-1)	C
1	0.095	-8.156	-8.930	15.592	0.413	-0.848	40.143
	[0.379]	[-7.474]	[-4.081]	[6.985]	[2.557]	[-0.823]	

that variation in stock prices can be explained using money supply as an explanatory variable. Increase in money supply is associated with increased liquidity in stock market, higher volumes of trade and rising stock prices (Akbar, 2008).

A positive relationship between short term interest rates and stock prices is also consistent with economic theory. Short term interest rates are a measure of real rate of return in an economy. Therefore, rising short term rates suggest a higher real return on investment and economic growth which are both conducive for higher stock prices. Inflation is considered a long term phenomena and hence is suggested to be reflected in long term interest rates (Maysami et al., 2004). Hence, Akbar (2008) suggests that rising short term interest rate (Maysami et al., 2004) attracts money flows into the equity market from money market.

A negative relationship between inflation and stock prices suggests that stocks are not a good hedge against inflation and hence negates the Fisher hypothesis. This finding is consistent with the earlier findings of Nishat and Shaheen (2004) and Akbar (2008). However, this finding contradicts Akmal (2007) who suggested that stock prices were a hedge against inflation in Pakistan in the long run. A negative relationship of stock prices and foreign exchange reserves is inconsistent with Mohammad et al. (2009) who reported a positive relationship. These results suggest that the EMH does not hold in the KSE as macroeconomic variables have statistically significant influence in explaining the variations in stock prices in the long run.

The results in Panel B of Table 5 reveal that the model has been correctly specified and estimated as the sign of the first error correction coefficient in determination of LNSPI is negative (-0.016), though the t-value is statistically insignificant. This reveals that stock prices do not respond in a statistically significant manner to re-establish the equilibrium relationship once deviation occurs. In addition, all the lagged coefficients are statistically insignificant except D(LNMTW(-1)) which is found to be statistically significant in determining LNNEER. However, the other macroeconomic variables that is, LNMPI, LNMTB, LNCPI and LNRESERVESMG do respond to re-establish the equilibrium relationship once deviations take place. However, the lagged coefficients are insignificant. Overall, the results from the VECM suggest that stock prices lead macroeconomic variables, however, macroeconomic variables do not lead stock prices. In the short run, there are no statistically significant interactions between the two sets of variables except for the correction

Table 5. Contd.

Panel B: Error correction coefficient and lagged coefficients							
Error correction	**D(LNSPI)**	**D(LNMPI)**	**D(LNMTW)**	**D(LNMTB)**	**D(LNCPI)**	**D(LNRESERVMG)**	**D(LNNEER)**
CointEq1	-0.016	0.005	0.017	0.005	0.007	-0.129	-0.004
	[-0.546]	[0.122]	[3.307]	[2.397]	[2.971]	[-4.083]	[-0.644]
D(LNSPI(-1))	0.112	0.18	-0.036	-0.007	-0.012	-0.007	0.006
	[1.102	[1.368]	[-1.989]	[-0.996]	[-1.521]	[-0.067]	[0.306]
D(LNMPI(-1))	0.081	0.007	-0.007	-0.004	0.001	0.031	0.002
	[1.065]	[0.072]	[-0.508]	[-0.792]	[0.208]	[0.378]	[0.166]
D(LNMTW(-1))	0.024	1.368	-0.105	-0.013	0.064	0.493	-0.214
	[0.0438]	[1.920	[-1.072]	[-0.360]	[1.450]	[0.841]	[-2.043]
D(LNMTB(-1))	-1.934	2.621	0.199	0.158	0.125	0.76	0.112
	[-1.371]	[1.436]	[0.792]	[1.714]	[1.107]	[0.506]	[0.415]
D(LNCPI(-1))	-0.772	-0.414	-0.475	0.011	0.089	1.875	-0.365
	[-0.509]	[-0.211]	[-1.758]	[0.108]	[0.736]	[1.162]	[-1.264]
D(LNRESERVMG(-1))	0.004	-0.03	0.011	-0.007	0.000	-0.239	0.019
	[0.046]	[-0.251]	[0.668]	[-1.204]	[0.033	[-2.406]	[1.064]
D(LNNEER(-1))	-0.033	0.459	0.191	-0.032	-0.02	0.926	0.024
	[-0.064]	[0.667]	[2.008]	[-0.915]	[-0.458]	[1.636]	[0.232]
C	0.015	-0.008	0.017	0.000	0.005	0.007	0.000
	[1.101]	[-0.476]	[6.913]	[0.082]	[4.150]	[0.453]	[0.042]

of the deviations from the long run relationship.

Conclusions

This study examined the relationships between the KSE100 Index and a set of macroeconomic variables during the period of January 1999 to June 2008. The time series data in this study contains the monthly observations of the KSE100 index, the inflation rate (CPI), total reserves minus gold (RESERVEMG), manufacturing production index (MPI), six month treasury bills (SMTB) rate, nominal exchange rate (NEER) and money supply (M2).

The ADF and the PP tests suggested that all the time series variables were integrated of order one that is, non-stationary. Subsequently, we estimated the bivariate co-integration tests that suggested that the share price index is co-integrated with inflation rate, reserve minus gold as well as manufacturing production index. Share price index was found to be not co-integrated with the nominal exchange rate and money supply. The multivariate co-integrating tests suggests that stock prices and macroeconomic variables are co-integrated and that at least a uni-directional causality exists between the two sets of variables. The results suggested that stock prices were positively related with money supply and short term interest rates and negatively related with inflation and foreign exchange reserves. However, no statistically significant relationship was found of industrial production and exchange rate with stock prices.

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