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Macroeconomic Factors and Equity Prices: An Empirical Investigation by Using ARDL Approach

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INTRODUCTION

The relationship between macroeconomic variables and the equity prices has attracted the curiosity of academicians and practitioners since the publication of seminal paper of Chen, *et al. (*1986). Many empirical studies those tested the relationship reveal that asset pricing theories do not properly identify macroeconomic factors that influence equity prices [Roll and Ross (1980); Fama (1981); Chen, *et al.* (1986); Hamao (1986); Faff (1988); Chen (1991); Maysami and Koh (2000) and Paul and Mallik (2001)]. In most of these studies, variable selection and empirical analyses is based on economic rationale, financial theory and investors' intuition. These studies generally apply Eagle and Granger (1987) procedure or Johanson and Jusilieus (1990, 1991) approach in Vector Auto Regressor (VAR) Framework.

In Pakistan, Fazal (2006) and Nishat (2001) explored the relationship between macroeconomic factors and equity prices by using Johanson and Jusilieus (1990, 1991) procedure. The present study tests the relationship between macroeconomic variables such as inflation, industrial production, oil prices, short term interest rate, exchange rates, foreign portfolio investment, money supply and equity prices by using Auto Regressive Distributive Lag (ARDL) bounds testing procedure proposed by Pesaran, Shin, and Smith (1996, 2001). The ARDL approach in an error-correction setting has been widely applied to examine the impact of macroeconomic factors on economic growth but it is strongly underutilised in the capital market filament of literature. This methodology has a number of advantages over the other models. First, determining the order of integration of macroeconomic factors and equity market returns is not an important issue here because the Pesaran ARDL approach yields consistent estimates of the long-run coefficients that are asymptotically normal irrespective of whether the underlying regressors are I(0) or I(1) and of the extent of cointegration. Secondly, the ARDL approach allows exploring correct dynamic structure while many econometric procedures do not allow to clearly distinguish between long run and short run relationships.

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In Pakistan, only Akmal (2007) investigated the relationship between stock returns and inflation for the Pakistani equity market by employing ARDL approach. The study covered the period from 1960-2006. The unique aspect of the present study is that it first time explores the relationship among equity prices and a broader portfolio of macroeconomic variables by using a powerful ARDL Approach and offers greater insight from a new dimension. The set of macroeconomic variables includes industrial production index, consumer price index, money supply, exchange rate, foreign portfolio investment, treasury bill rates and oil prices. Karachi stock exchange index has been used as proxy for equity market prices covering the period from June 1998 to June 2008.

The paper is organised as follows. Section II summarises some recent literature on the subject. The data and mathematical model are discussed in Section III. Empirical results and discussion is provided in Section IV while main finding and policy implications are discussed in Section V.

REVIEW OF LITERATURE

The relationship between equity market returns and economic fundamentals has been extensively investigated in developed markets e.g. Chen, *et al.* (1986), Fama (1990), Chen (1991), Cheung and Ng (1998), Choi, *et al.* (1999), Dickinson (2000), Nasseh and Strauss (2000). Chen, Roll, and Ross (1986) investigate the existence of long run relationship among equity prices and industrial production, inflation, risk premium, market return, oil prices, term structure and consumption for US. Industrial production, risk premium, yield curve, and unanticipated inflation were found to be explaining expected returns during periods of high volatility while oil prices, market index, and consumption had no significant role in explaining the equity priced. Other studies exploring the relationship between industrial production and equity market returns found mixed results [Chan, Chen, and Hsieh (1985); Chen, Roll, and Ross (1986); Burnmeister and Wall (1986); Beenstock and Chan (1988); Chang and Pinegar (1990); Kryzanowski and Zhang (1992); Chen and Jordan (1993); Sauer (1994); Rahman, Coggin, and Lee (1998)].

Using quarterly data for the period 1980-98, Paul and Mallik (2001) explored the long run relationship among macroeconomic factors and equity prices in Australian banking and finance sector. They used ARDL model to investigate the causal and dynamic relationship between ASX Banking and Finance Index and macroeconomic variables i.e. consumer price index, interest rates, and seasonally adjusted GDP. The results reveal that interest rate has a significant negative effect while GDP growth has a significant positive effect on the equity prices of banking and finance sector. No significant effect of inflation is observed on equity prices. Maysami, *et al.* (2004) examines the long run relationship among macroeconomic variables and STI and sectoral indices like the property index, finance index and the hotel index. The results confirm the long term relationship of STI and property index with industrial production, inflation, exchange rate, changes in the short and long-term interest rates and money supply.

A number of studies explore the relationship between inflation and equity market returns and found mixed results [Chan, Chen, and Hsieh (1985); Chen, Roll, and Ross (1986); Burnmeister and Wall (1986); Burmeister and MacElroy (1988); Chang and Pinegar (1990); Defina (1991); Kryzanowski and Zhang (1992); Chen and Jordan (1993);

Sauer(1994); Rahman, Coggin, and Lee (1998) and Mark (2001)]. A study by Kessal (1956) concludes that unexpected inflation increases the firm's equity value if the firm is net debtor. A few other studies also find positive relationship between inflation and equity prices [Firth (1979); Gultekin (1983); Boudhouch and Richarson (1993)]. More recently, a study by Ioannidis, *et al.* (2004) using Greece data for the period 1985-2003, finds the evidence of positive relationship between inflation and equity market returns. In contrast, a study by Fama (1981) finds a negative association between equity market returns and inflation. The results were supported by Spyrou (2001) and Amidhud (1996). Similarly, Beenstock and Chan (1988), Sauer (1994) explore the relationship among money supply and equity market returns.

In case of developing countries few studies were found exploring the relationship between equity prices and macroeconomic variables. Shahid (2008) explores causal relationships among equity prices and industrial production, money supply, exports, exchange rate, foreign direct investment and interest rates on Indian data for the period 3/95 to 3/2007 by employing co-integration analysis and Toda and Yamamoto Granger causality test on quarterly data. Short run relationships among variables have also been investigated by using Bivariate Vector Autoregressive Model for variance decomposition and impulse response functions. The study concludes that equity prices lead to economic activity in India in general. However, interest rate is found to lead the equity prices.

By using Pakistani data, Fazal and Mahmood (2001) explore the causal relationship between equity prices and macroeconomic variables i.e. economic activity, investment spending, and consumption expenditure. They apply co-integration analysis and VECM on the data for the period 7/1959 to 6/1999. The study finds the existence of long run relationship between equity prices and macroeconomic variables of the study. Unidirectional causality has been found flowing from macro variables to equity prices. The study, however could not find the influence of equity prices on aggregate demand. In another study, Fazal (2006) again examined the relationship by considering the shifts as a result of economic liberalisation. He finds a unidirectional causality between the real sector and equity prices and could not observe significant change in the patterns. The relationship between equity prices and inflation has been investigated by Akmal (2007) by employing ARDL approach on Pakistani data for the period 1971-2006. The results indicate that stocks are hedge against inflationary pressures (inflation) in the long run.[1]

The survey of the literature shows that although a number of studies investigated the relationship between equity prices and different macroeconomic variables but there is no study that has included broader set of variables in the model for Pakistan. The present study thus fills the gap by including a broader set of macroeconomic variables in the model to explore their relation with equity prices. The other contribution of the study is the use of ARDL model on long term monthly data covering the period from June 1998 to June 2008.

DATA DESCRIPTION

This study explores the long term causal relationship between Pakistani capital market and macroeconomic variables using monthly data for the period 6/1998 to 6/2008. Similar work is done earlier by Chan and Faff (1998). The set of macroeconomic variables included in this study are Industrial Production Index, Broad Money, Oil Prices,

[1]The relationship was statistically significant at α=0.10 level.

Foreign Exchange Rate, Inflation and Interest Rate. The full description of the variables is explained below.

Equity Market Returns

It is the dependent variable of the model and calculated by using the following equation;

$$R_t = \ln (I_t / I_{t-1})$$

where: R_t is Return for month 't'; and
I_t and I_{t-1} are closing values of KSE- 100 Index for month 't' and 't–1' respectively.

Industrial Production Index (IPI)

This independent variable has been used as proxy to measure the growth rate in real sector. Industrial production presents a measure of overall economic activity in the economy and affects stock prices through its influence on expected future cash flows. It is hypothesised that an increase in industrial production is positively related to equity prices.

Narrow Money (M1)

Narrow Money (M_1) is used as a proxy of money supply. Increase in money supply leads to increase in liquidity that ultimately results in upward movement of nominal equity prices. It is therefore hypothesised that an increase in money supply is positively related to equity market returns.

Consumer Price Index (CPI)

Consumer Price Index is used as a proxy for inflation rate. It is chosen because of its broad base measure to calculate average change in prices of goods and services during a specific period. Inflation is ultimately translated into nominal interest rate and an increase in nominal interest rate increases discount rate which results in reduction of present value of cash flows. An increase in inflation is expected to negatively affect the equity prices.

Oil Prices

Brent oil prices have been used as proxy for oil prices. Increase in oil prices increases the cost of production and decreases the earning of the corporate sector due to decrease in profit margins or decrease in demand of the product. Oil prices are therefore negatively related to equity prices.

Foreign Exchange Rate

This study employs foreign exchange rate as end of month US$/Rs exchange rate. It is hypothesised that depreciation in home currency is negatively related to equity prices.

T Bill Rate

Treasury bill rates have been used as proxy of Interest rate. Increase in interest rate leads to increase in discount rate and it ultimately results in decrease in present value of

future cash flows which represent fair intrinsic value of shares. Therefore, it is expected that an increase in interest rate will negatively affect the equity market returns.

Foreign Portfolio Investment

Foreign portfolio Investment has been used as proxy of Investor's confidence. Foreign portfolio investment increases liquidity in market and higher demand leads to increase in market prices of shares. It is therefore expected that an increase in foreign portfolio investment will positively affect the equity market returns.

DATA AND METHODOLOGY

Data on monetary variables like Treasury Bill Rates and Exchange Rates, Foreign Portfolio Investment and Money Supply have been collected from various statistical bulletin issued by State Bank of Pakistan. Data on Industrial Production and Consumer Price Index has been collected from statistical bulletins issued by the Federal Bureau of Statistics FBS). The data on stock market (KSE-100 indexes) is obtained from daily Business Recorder newspaper which is reliable source of stock market data. The data on Oil prices are taken from EIA website.

There are several methods available to test for the existence of long-run equilibrium relationship among time-series variables. The most widely used methods include Engle and Granger (1987) test, fully modified OLS procedure of Phillips and Hansen's (1990), maximum likelihood based Johansen (1988, 1991) and Johansen-Juselius (1990) tests. These methods require that the variables in the system are integrated of order one i.e. I(1). In addition, these methods suffer from low power and do not have good small sample properties. Due to these problems, a newly developed autoregressive distributed lag (ARDL) approach to cointegration has become popular in recent years.

This study employs ARDL approach to co-integration following the methodology proposed by Pesaran and Shin (1999). This methodology is chosen as it has certain advantages on other co-integration procedures. For example, it can be applied regardless of the stationary properties of the variables in the sample. Secondly, it allows for inferences on long-run estimates which are not possible under alternative co-integration procedures. Finally, ARDL Model can accommodate greater number of variables in comparison to other Vector Autoregressive (VAR) models.

First of all data has been tested for unit root. This testing is necessary to avoid the possibility of spurious regression as Ouattara (2004) reports that bounds test is based on the assumption that the variables are I(0) or I(1) so in the presence of I(2) variables the computed F-statistics provided by Pesaran, *et al.* (2001) becomes invalid. Similarly other diagonistic tests are applied to detect serial correlation, heteroscadasticity, conflict to normality.

If data is found I(0) or I(1), the ARDL approach to cointegration is applied which consists of three stages. In the first step, the existence of a long-run relationship between the variables is established by testing for the significance of lagged variables in an error correction mechanism regression. Then the first lag of the levels of each variable are added to the equation to create the error correction mechanism equation and a variable addition test is performed by computing an F-test on the significance of all the lagged

variables. The second stage is to estimate the ARDL form of equation where the optimal lag length is chosen according to one of the standard criteria such as the Akaike Information or Schwartz Bayesian. Then the restricted version of the equation is solved for the long-run solution.

The following model is used to examine the relationship between equity market returns and macroeconomic factors;

$$\text{Ln } I_t = ß0 + ß_1 \text{LnIPI}_t + ß_2 \text{lnOil}_t + ß_3 \text{ lnXRate}_t + ß_4 \text{TBill}_t + ß_4 \text{CPI}_t + ß_4 \text{FPI}_t + ß_4 \text{M1}_t \mu_t$$

Where

I = KSE -100 Index
Oil = Oil prices in $
XRate = Foreign Exchange Rates $/ Rs.
TBill = Six Month Treasury Bill Rate
CPI = Consumer Price Index
FPI = Foreign Portfolio Investment
M1 = Narrow Money.

An ARDL representation of above equation is as below:

$$\text{Ln } I_t = ß_0 + S\, \psi_i \text{ Ln } I_{t-1} + S\, ß_i \text{ Ln IPI}_{t-i} + S\, \lambda_i \text{ lnOil}_{t-i} + S\, d_i \text{ LnXRate}_{t-i} + S\, f_i \text{ LnTBill}_{t-i} + S\, \eta_i \text{ LnCPI}_{t-i} + S\, \gamma_i \text{ LnFPI}_{t-i} + S\, \zeta_i \text{ LnMI} + \mu_t$$

Where i ranges from 1 to p

The third stage entails the estimation of the error correction equation using the differences of the variables and the lagged long-run solution, and determines the speed of adjustment of returns to equilibrium. A general error correction representation of equation is given below:

$$\Delta \text{ Ln } I_t = ß_0 + S\, ß_i \Delta \text{ Ln IPI}_{t-i} + S\, \lambda_i \Delta \text{ Ln Oil}_{t-i} + S\, d_i \Delta \text{ LnXRate}_{t-i} + S\, f_i \Delta \text{ LnTBill}_{t-i} + S\, \eta_i \Delta \text{CPI}_{t-i} + S\, \gamma_i \Delta \text{FPI}_{t-i} + S\, \zeta_i \Delta \text{M1}_{t-i} + \text{ECM} + \mu_t$$

It is expected that interest rates, inflation and oil prices have negative impact on returns. The coefficients λ, f and η are therefore expected to have negative sign i.e.

$\lambda < 0$, $f < 0$ and $\eta < 0$.

As industrial production, foreign portfolio investment and money supply are expected to have a positive effect on equity returns, therefore the coefficients ß, γ and ζ are expected to be positive, i.e.

ß > 0, $\gamma > 0$, $\zeta > 0$.

Finally, stability of short-run and long-run coefficients is examined by employing cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests. The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points. If the plots of CUSUM and CUSUMSQ statistics stay within the critical bonds of 5 percent level of significance, the null hypothesis of all coefficients in the given regression are stable and cannot be rejected.

EMPIRICAL RESULTS

Table 1 reports the results of unit root test applied to determine the order of integration among time series data. ADF Test and Phillips-Perron Test have been used at level and first difference under assumption of constant and trend.

Table 1

Unit Root Analysis

	ADF- Level	ADF- Ist Diff	PP- Level	PP- Ist Diff
Ln Kse100	–2.1686	–12.015	–2.0872	–12.2821
Ln IPI	–3.1322	–8.9420	–2.8182	–8.7609
Ln Oil	–2.3550	–8.3208	–2.0543	–8.2033
Ln X Rate	–2.3659	–6.6074	–3.1003	–6.4168
Ln T Bill	–1.6981	–3.6063	–1.3595	–7.8162
Ln CPI	2.9023	–8.6160	2.6215	–8.6190
Ln FPI	0.4762	–3.6651	–0.4640	–10.8700
Ln M1	–1.8832	–10.245	–1.9545	–10.2284
1% Critic. Value	–4.0363	–4.0370	–4.0363	–4.0370
5% Critic. Value	–3.4477	–3.4480	–3.4477	–3.4480
10%Critic Value	–3.1489	–3.1491	–3.1489	–3.1491

Results clearly indicate that the index series are not stationary at level but the first differences of the logarithmic transformations of the series are stationary. Therefore, it can safely be said that series are integrated of order one I (1). It is worth mentioning that results are robust under assumption of constant trend and no trend. This testing is necessary to avoid the possibility of spurious regression as Ouattara (2004) reports that bounds test is based on the assumption that the variables are I(0) or I(1) so in the presence of I(2) variables the computed F-statistics provided by Pesaran, *et al.* (2001) becomes invalid.

Now causal relationship among the macroeconomic variables has been studied by employing ARDL approach. Akaike Information Criterion, Schwarz Bayesian Criterion and Hannan-Quinn, Log Likelihood equation are most common measures to determine the number of lags. Duration of the lag which provides the smallest critical value is identified as the model's duration of lag if no autocorrelation is observed. In this study, maximum duration of lag has been taken as 3. The number of lags which minimise the Schwarz Bayesian Criterion is 2 and LM test confirms that no autocorrelation problem exists at this duration of Lag. Criteria and test values are given in Table 2 (a) and Table 2 (b).

Table 2(a)

Statistics for Selecting the Lag Order

	AIC	SBC	LL
Lag 1	127.2179	114.6742	136.2179
Lag 2	125.6181	113.1121*	134.6181
Lag 3	128.7087	113.4699	139.7087

Table 2 (b)

Diagnostic Tests

Item	Test Applied	CHSQ(χ^2)	Prob
Serial Correlation	Lagrange Multiplier Test	18.74	0.095
Normality	Test of Skewness and Kurtosis	2.88	0.236
Functional Form	Ramsey's RESET Test	0.59	0.443
Heteroscedisticity	White Test	4.68	0.03

Above results indicate that econometric problems like autocorrelation, conflict to normal distribution has not been observed. Similarly, no model specification error exists with reference to functional form. Shrestha (2005) states that presence of hetero-scedasticity does not affect the estimates and as time series in the equation are of mixed order of integration so it is natural to detect heteroscadasticity.

Table 3 below exhibits results of ARDL Model based on Schwarz Bayesian Criterion. Results reveal that industrial production, oil prices, inflation are not statistically significantly while interest rates, exchange rates, foreign portfolio investment and money supply have significant impact on equity prices. The results of the bounds testing approach for Co-integration show that the calculated F-statistics is 1949 which is significant at 1 percent level of significance implying that the null hypothesis of no cointegration cannot be accepted and there exists cointegration relationship among the variables in this model. An analysis presented in Table 3 indicates that macroeconomic variables significantly explain equity prices. The value of R-Bar-Squared is 0.99 which indicates a high degree of correlation among variables. F-Statistics is also significant at 1 percent which indicates overall goodness of fit.

Table 3

ARDL (1, 0, 0, 0, 0, 0, 1, 0) Selected based on SBC

Regressor	Coefficient	S. Error	T Ratio	Prob.
Ln INDEX(-1)	0.6068	0.0742	8.1819	0.000
Ln IPI	–0.0225	0.0388	0.5783	0.564
Ln OIL	0.0481	0.0360	1.3345	0.185
Ln XRATE	0.4675	0.2239	2.0879	0.039
Ln TBILL	– 0.0797	0.0176	4.5251	0.000
Ln CPI	0.2757	0.3315	0.8316	0.407
Ln FPI	0.7712	0.3376	2.2841	0.024
Ln FPI(-1)	–0.7401	0.3428	–2.1589	0.033
Ln M1	0.4790	0.1037	4.6178	0.000
R^2			0.9929	
Adj R^2			0.9925	
AIC			125.61	
SBC			113.11	
F-Statistics			1949	
F-Significance			0.000	
D.W. Statistics			2.1000	

Table 4 displays the long term coefficients under ARDL Approach. Results reveal that industrial production, oil prices, inflation and foreign portfolio investment are statistically insignificant while interest rates, exchange rates and money supply have significant long run effect on equity prices.

Table 4

Estimated Long Run Coefficients for Selected ARDL Model

Regressor	Coefficient	S. Error	T Ratio	Prob.
LNIPI	–0.0572	0.0964	–0.5934	0.554
LNOIL	0.1222	0.0829	1.4743	0.143
LNXRATE	1.1891	0.5260	2.2604	0.026
LNTBILL	–0.2027	0.0369	–5.4946	0.000
LNCPI	0.7012	0.8286	0.8463	0.399
LNFPI	0.0794	0.2713	0.2927	0.770
LNM1	1.2185	0.1704	7.1487	0.000

A statistically significant negative relationship is found between interest rate and equity returns which is logical because increase in interest rates leads to increase in discount rate and it ultimately results in decrease in present value of future cash flows which represents fair intrinsic value of shares. X rate is significantly related to equity prices and as exchange rate is taken as $/ PRs so Ln XRate will always be negative so depreciation of home currency is negatively related to equity market prices. Money growth rate is positively related with equity prices that are in line with results drawn by Maysami and Koh (2000). The possible reason is that increase in money supply leads to increase in liquidity that ultimately results in upward movement of nominal equity prices.

Error Correction Representation of above long run relationship is reported in Table 5 which captures the short-run dynamics of relationship among macroeconomic variables and equity prices. The error correction model based upon ARDL approach establishes that changes in industrial production, oil prices and inflation are statistically insignificant while changes in interest rates, exchange rates, foreign portfolio investment and money supply have significant short term effect.

Table 5 (a)

Error Correction Representation for the Selected ARDL Model

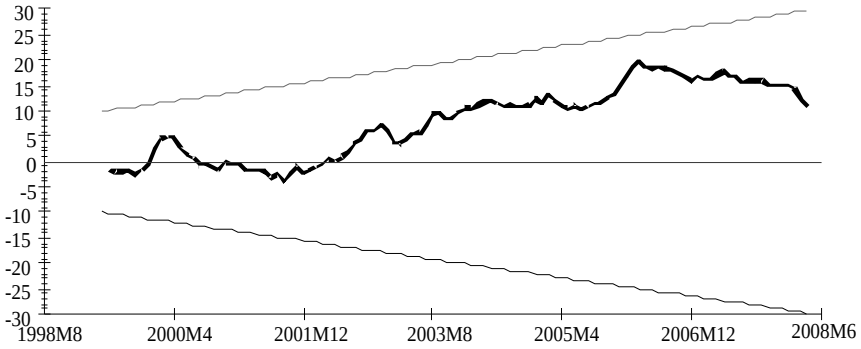
Regressor	Coefficient	S. Error	T Ratio	Prob.
ΔLnIPI	–0.2248	0.0389	–0.5783	0.564
ΔLnOIL	0.0481	0.0360	1.3345	0.185
ΔLnXRATE	0.4675	0.2239	2.0879	0.039
ΔLnTBILL	–0.0797	0.0176	–4.5251	0.000
ΔLnCPI	0.2757	0.3315	0.8316	0.407
ΔLnFPI	0.7713	0.3377	2.2841	0.024
ΔLnM1	0.4790	0.1037	4.6178	0.000
ECM(–1)	–0.3932	0.0742	–5.3007	0.000
R^2	0.2670			
Adj R^2	0.2137			
AIC	125.61			
BIC	113.11			
F-Statistics	1949			
F-Significance	0.000			
D.W. Statistics	2.1000			

ECM = Ln Index + 0.057190*Ln IPI – 0.12224*LnOiL – 1.1891*Ln XRate
+ 0.20266*LnTBill – 0.70118*LnCPI – 0.079440*Ln FPI – 1.2185*LnM1

According to results, short term elasticities of interest rates, exchange rates and money supply are –0.08, 0.47 and 0.48 respectively. It is worth mentioning that these elasticities are much lower than long run elasticities. It is also observed that foreign portfolio investment is not significant in long term but it is statistically significant in short term. ECM (–1) is one period lag value of error terms that are obtained from the long-run relationship. The coefficient of ECM (–1) indicates how much of the disequilibrium in the short-run will be fixed (eliminated) in the long-run. As expected, the error correction variable ECM (–1) has been found negative and also statistically significant. The Coefficient of the ECM term suggests that adjustment process is quite fast and 39 percent of the previous year's disequilibrium in equity prices from its equilibrium path will be corrected in the current year.

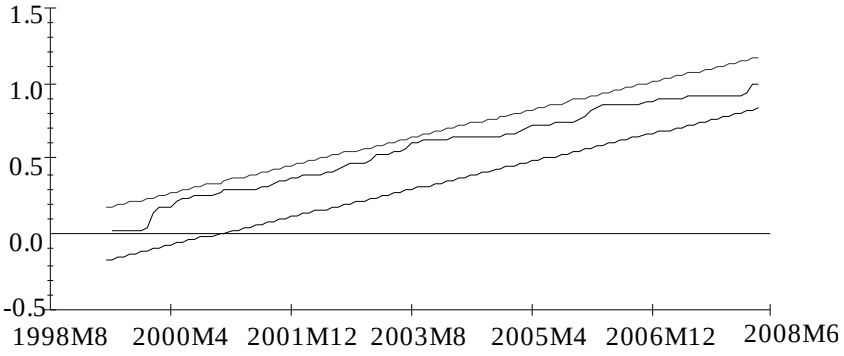
Finally, CUSUM and CUSUMSQ plots are drawn to check the stability of short run and long run coefficients in the ARDL error correction model. Figure 1 shows the cumulative sum of recursive residuals whereas Figure 2 displays the cumulative sum of squares of recursive residuals.

Fig. 1. Plot of Cumulative Sum of Recursive Residuals



The straight lines represent critical bounds at 5 percent significance level

Fig. 2. Plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at 5 percent significance level

Figures 1 and 2 show that both CUSUM and CUSUMSQ are within the critical bounds of 5 percent so it indicates that the model is structurally stable.

CONCLUSION

This study examine the relationship among the inflation, industrial production, oil prices, short term interest rate, exchange rates, foreign portfolio investment, money supply and equity prices for the period 6/98 to 6/2008 by using ARDL approach based on bounds testing procedure proposed by Pesaran and Shin (2001). The ARDL approach has been applied as it more powerful procedure to explore the long run relationship as well short term dynamics of relationship and yields consistent estimates of the long-run coefficients that are asymptotically normal, irrespective of whether the underlying regressors are I(0) or I(1). Data has been tested to examine econometric problems like serial correlation, functional form, normality, heteroscdasticity and unit root by using LM test, Ramsey Reset test, skewness and kurtosis test, white test and ADF Test and Phillip Parren Test respectively. Results indicate that econometric problems like autocorrelation, conflict to normal distribution has not been observed. Similarly, no model specification error exists with reference to Functional form. Unit root test clearly indicate that the index series are not stationary at level but the first differences of the logarithmic transformations of the series are stationary. However, white test indicates the presence of heteroscadasticity. Shrestha (2005) states that presence of heteroscedisticity does not affect estimates. In ARDL, we deal with data series which may not be integrated at same level so detection of heteroscedisticity is quite natural.

Results of ARDL long run coefficients reveal that industrial production, oil prices and inflation are statistically insignificant in determining equity prices in long run while interest rates, exchange rates and money supply have significant long run effect on equity prices. The error correction model based upon ARDL approach captures the short term dynamics of prices and it also confirms that changes in industrial production, oil prices and inflation are not statistically significant in short run while changes in interest rates, exchange rates, and money supply have significant short term effect. However, foreign portfolio investment has significant short term effect in short term and no long term effect in long term. The error correction variable ECM (–1) has been found negative and statistically significant. The Coefficient of the ECM term suggests that adjustment process is quite fast and 39 percent of the previous year's disequilibrium in equity prices from its equilibrium path will be corrected in the current year. The plots of CUSUM and CUSUMSQ are drawn to check the stability of short run and long run coefficients in the ARDL error correction model. These plots show both CUSUM and CUSUMSQ as within the critical bounds of 5 percent which is an indication of the fact that the model is structurally stable.

This study facilitates the investors in taking effective investment decisions as by estimating the expected trends in exchange rates, money supply and interest rates, they can estimate the future direction of equity prices and can allocate their resources more efficiently. Efficient market hypothesis provides that capital markets respond to arrival of new information so macroeconomic policies should be designed keeping in view the response of the capital market. Therefore, architects of monetary policy should be careful in revision of interest rates as capital market responds negatively to such decisions.

Similarly, State Bank of Pakistan should also consider the impact of money supply on capital markets which has significant relationship with equity returns.

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