Stocks as Hedge against Inflation in Pakistan: Evidence from ARDL Approach

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Abstract:

The paper implements ARDL bounds testing approach to cointegration to explore whether or not stocks are good hedge against inflation in the case of a transition economy such as Pakistan, using annual data for the period 1971 – 2008. Ng-Peron (2001) unit root test is applied to determine the stationarity of the series. The results suggest that stocks act as good hedge against inflation in Pakistan both in the long and the short run. The findings should help formulate appropriate policy to encourage investment in financial markets and thereby promote economic growth.

Key Words: Stock Returns, Inflation, ARDL Bounds Testing, Ng-Perron Test

JEL Classifications: N20, E31, C02

1. **Introduction**

The finance literature posits that stock prices reflect the present value of the stream of future dividends. Dividends are determined by firms' earnings which depend on real economic activity. Inflation creates uncertainty, decreases the value of money, and ultimately affects investment causing slow down of economic activity. People tend to purchase stocks, precious metal, foreign currency and other durable assets to hedge against inflation. The theory suggests that stock returns should be positively related to the expected economic activity. The relation between stock returns and inflation suggests that investment in equity markets can act as a good hedge against inflation if the revenue and earnings of a company grow over time. This relationship is consistent with Fisher (1930) theory which asserts that a fully perceived change in inflation would be reflected through a rise in the nominal interest rates. That is, stock returns and inflation move in the same direction, in the long run. The rising prices in response to general inflation can protect investors by increasing the value of stocks in the equity market without affecting their real return.

The objective of the research is to empirically examine the relation between stock returns and inflation in the context of hedge for Pakistan, an emerging economy in the Indian Subcontinent. The study employs the ARDL bounds testing approach for a long run relation, and the error correction model for short run dynamics. The study will help better understand the hedge hypothesis for Pakistan which has been opening up its financial market over the past few decades and is also dealing with significant inflationary pressure. The strategic location of Pakistan dictates that the policy of economic growth through a functioning private capital market can continue for the nuclear armed nation. The findings of the paper have implications for policymakers who can provide the needed help to investors and thus promote the potential for economic growth of the nation of 166 million. The paper is an extension of an earlier work on Pakistan (Shahbaz, 2007) which found only long run relation but not in the short run. By applying a refined methodology for unit root test and using a different measure for inflation which seem more relevant for Pakistan, the paper finds stock market acts as hedge against inflation both in the long and the short run. The paper thus is a contribution to the literature.

The Karachi Stock Exchange (KSE) is the major stock exchange in Pakistan. Located in the port city Karachi, KSE initially began with a 50-share index in 1949. To adapt to the changing needs over time and to make it more reflective, the index list was revised to include 100 companies, on November 1, 1991. This came to be known as "KSE-100", with a base point of 1000. The composition of the index is revised periodically to reflect changes. The Pakistan capital market comprises of three Stock Exchanges (KSE 100-Index, Lahore Stock Exchange 25-Index, and Islamabad Stock Exchange 10-Index). A parliamentary Act created the autonomous Securities and Exchange Commission (SEC) of Pakistan. SEC replaced the Corporate Law Authority in 1999 and functions as the regulatory body.

The stock market in Pakistan has grown in recent years. The turnover on share prices has increased from US$45.82 millions in September, 2003 to US$190.81 millions in January, 2005. In Karachi Stock Exchange alone, the market capitalization also increased from US$15.194 million to US$36.379 million during the same period. Both the *Business Week* and the, *USA Today* recognized KSE among the "Best Performing Stock Market" of the World, due to performance and liquidity. In recent times, the government has initiated several reforms to insure balanced development to stabilize the capital market and the financial sector which helped reduce systemic vulnerabilities in bank-dominated financial system and push the KSE to record highs. The KSE 100 index crossed 14000 during the second half of the decade, then the highest in Pakistan's equity markets (Hasan and Javed, 2009).

Several factors favored a promising performance of the stock market, e.g., expanding the country's economic activities, strengthening exchange rate, lowering interest rates, recovering outstanding loans, rescheduling payment of foreign debts, improving relationship with its neighbors, and the large scale acquisitions and mergers. Both domestic and foreign investors were attracted by the privatization, liberalization, and deregulation policies. Corporate earnings, mainly the banking and non-banking financial sectors, were notable. Nishat and Shaheen (2004) note that industrial production has predicted equity prices well, and inflation predicted unfavorable outcome for stock prices. They argue that the Pakistan's macroeconomic indicators affected stock price movement.

In 2007 Pakistan's credit rating was under review which posed serious challenge to the economy in general and the stock markets in particular. This was compounded by uncertainty in the political landscape created by a host of adverse factors such as, poor governance, the upcoming general election, rebellion in Federally Administered Tribal Areas (FATA), unstable macroeconomic situation, rising inflation, mounting internal and external debt, and problems of foreign currency reserves. All these together contributed to a deteriorating performance of KSE (Farrukh, 2009). However things started to change by April, 2007. Market capitalization hit US$59 million. This growth appears to reflect increased public confidence triggered by the government's consistent and transparent economic policies initiated through privatization, better risk management, capital market reforms, and enhanced investor's confidence. All these helped capital formation and investment in Pakistan (Farrukh, 2009).

Between 1991 and 1995, the average annual rate of inflation in Pakistan had gone up from 9.25 to 12.9 percent. "The high rates of monetary enlargement, low rate of economic growth in three out of the five years and adjustment in administered prices contributed to the relatively high rates of inflation" (Shahbaz, 2007, p. 89). The increase in money supply during 1994 was mostly due to accumulation of net assets compared to domestic credit creation. This necessitated a build-up of foreign reserves in the aftermath of its draw down in 1993. In 2004, inflation declined to 8.44 percent but rose to 10.1 percent in December 2006 and again to 12.0 percent in 2007-08.

During 2006-2007 foreign investors were actively participating in securities registered in KSE. State Bank of Pakistan data reveals that FDI in KSE hit US$500 million in 2007. By the end of 2008, 653 companies were listed in the KSE with a market capitalization US$23 billion. At that time, the KSE-100 Index market capitalization was US$58 billion. In January 2009, when the turmoil hit the global financial system, the KSE-100 Index dipped to 4,929 points. This led to a fall in market capitalization to US$20 billion - loss of over 65 percent from the peak. The financial crisis pulled KSE-100 index down from 15,737 points in April, 2008, created loss of confidence and prompted a major capital outflow. The listed market capitalization of the companies was US$33.8 billion and registered capital of US$10.6 billion on September 29, 2009 (see Mohammad et al. 2009).

The rest of paper is organized as follows. Section-II reviews the literature. Data and empirical strategy are outlined in section-III. The findings are discussed in Section-IV. Conclusions are presented in section, V.

2 Literature Review

While the overall literature on the relation between stock returns and inflation has been relatively elaborate, research focus Pakistan has been disappointing. The general evidence available so far varies across nations due to variation in methodological approaches and differences in the characteristics of individual economy. Not surprisingly, a definite conclusion has not yet emerged.

The earliest known study on the relationship between inflation rate and real stock return for Pakistan dates back to Ahmad and Mustafa (2003). The paper applies Full Information Maximum Likelihood (FIML) method to monthly data and annual data (1972 – 2002) using Fama (1981) methodology. The results show that controlling for the real output growth rate, the negative relationship between real stock return and inflation rate disappears, something consistent with Fama (1981). However, the relationship between real returns and unexpected growth and unexpected inflation is found to be negative and significant. The study combines efficient market hypothesis[1] with rational expectation theory.

[1]Efficient market hypothesis posits that stock markets are "informationally efficient". New information relevant to the market is spontaneously reflected in the stock prices. An implication in past prices has no predictive power once the current prices have been included as explanatory variable. Changes in future prices depend on new information that was unknown today, i.e., based on surprise information.

A few other studies have examined a set of macro-economic indicators and stock prices in Pakistan in the context of causality. [Nishat and Saghir (1991), Hussain and Mehmood (2001), Nishat and Shaheen (2004), Mehr (2005), Ihsan et al. (2007), Shahbaz et al. (2008) and Ali et al (2010)]. Much of these studies employ Granger causality test to examine the causal relationship between various macro-economic variables and stock prices. Abdalla et al (1997) and Naeem and Rasheed (2002) examine exchange rate and stock price interactions in financial markets.

The evidence in favor of a positive relation between inflation and stock return is ample, supporting a generalized Fisher hypothesis [e.g., Firth, 1979; Boudhouch and Richarson, 1993.] Kessel (1956) documents positive relation between unexpected inflation and equity value for a firm, not in debt. Hasan and Javed (2009) finds support for Fisherian hypothesis from British data. He finds bidirectional relationship which is robust across model specifications. Luintel and Paudyal (2006) find long run positive relation between the pairs of stock and retail price indices. Using post-World War II Danish data, Olesen (2000) examine the relationship between stock prices and general prices to test hedge hypothesis. He found strong support for the hedge property, defined in the narrow sense of a perfect hedge. Spyrous, (2004) investigates the relationship between inflation and stock returns for ten major Emerging Stock Market, Chile, Mexico, Brazil, Argentina, Thailand, S. Korea, Malaysia, Hong Kong, the Philippines and Turkey, during the 1990s. The relationship for the entire sample period is positive and statistically significant for three of the markets but positive and statistically insignificant for another three. Just for one market the relationship is negative and statistically significant. In a related paper Spyrou (2001) examine the same relation for Greece, during the 1990s and finds a negative relation only until

1995. Beyond that, the relationship is not statistically significant. In both studies he suspects the increased role of monetary fluctuations. Sharpe (2002) explains the negative relationship by arguing that a rise in expected inflation may be associated with low expected real earnings growth and high required real returns. He argues that the result is due to the role of money and the positive relationship between consumer prices and output. Ioannidis *et al.* (2004) find positive relation between inflation and stock market returns in Greece between 1985 and 2003. Gazioglu and Bulut, (2008) test the Fisher hypothesis for Turkey and find a positive relationship.

Fama (1981) proposes the proxy hypothesis where the relationship between returns and inflation is not true one; instead it is only a proxy relationship between stock return and growth rate of real income and an inverse relation between stock returns and inflation. It implies that high rate of inflation may decrease the demand for money thus decreases growth in real activity. On the other hand, rising inflation decrease the future expected profit, ultimately leading to lower stock prices. This argument is consistent with Fisher (1930) which states that real returns are determined by real factors. Fama (1981) argues that if the effect of real output growth is controlled, the negative relation will disappear. The proxy-effect hypothesis explains the possibility of negative stock return-inflation phenomenon because of the observed negative relationship between inflation and stock returns is spurious Fama opines that in the postulated statistical relationship between stock returns and inflation, the latter serves only as a proxy for expected economic activity.

Fama and Schwert (1977) and Fama (1981) conclude that common stock is a poor performer as a hedge against expected and unexpected inflation, although the empirical literature on the Fisher hypothesis is prolific, findings largely are negative (e.g. Gertler and Grinols (1982), Buono, (1989)). This casts doubts about the validity of the Hypothesis. Bodie (1976), Nelson (1976), Fama and Schwert (1977) examine the United States data. Solnik (1983), and Gultekin (1983), and Lee (1996) study other industrialized nations. Kwok and Li (1993) and Kwok (1994) analyze the Pacific Basin countries. Other studies include, Linter, (1975); Schwert (1981); Geske and Roll (1983); Asprem, (1989); Marshall (1993); Barnes *et al.* (1999), Gallagher and Taylor (2002); Chatrah et al (1997) for India. Jaffe and Mandelker (1976), Bodie (1976) and Nelson (1976) find significant negative relationship between the proxies of inflation and stock returns.

Ansari and Kolari, (2001) document an inverse relation between stock prices and inflation in the short run, but found a positive long run relation. Al-Khazali and Pyun (2002) examining the relation for nine countries in the Pacific-Basin found negative correlation between real stock returns and inflation in the short run but a positive in the long run. Shanmugam and Mishra, (2008, 2009) examine Indian data from 1980 to 2004 and find a negative relation. The link ceases to exist once they control for the relation between inflation and real economic activity. Zhao (1999) finds an inverse relationship for China. Adrangi and Chatrath, (2000) investigate the relation for Brazil and find a negative relation, both in the long and the short run. Floros (2004) did not find any long run relation for Greece.

A study of African nations shows that stock markets acted as partial hedge during the inflationary periods in Egypt, Tunisia, Kenya and Nigeria (Alagidede and Panagiotidis, 2007). However in South Africa the relationship was found to be positive but not statistically significant. It is plausible that stock markets in these countries are not very effective in allocating capital during inflationary periods.

Saunders and Tress (2007) examine the link for Australia within a "rational investor" valuation framework. Their results suggest that stocks returns are poor hedge against inflation for the period 1965-79. Granger (1969) and Sims (1972) find unidirectional causality from price level to equity index. Montagnoli et al. (2007) examine the link between stock prices and goods prices to gauge whether or not investing in stock market acts as hedge against inflation. Positive relation is found between stock returns and goods prices for sixteen OECD countries over the period 1970-2006.

3. Empirical Strategy

3.1 Data

The study covers the period 1971-2008. The data on stock price index (for returns) has been constructed from various issues of the monthly statistical bulletins of the State Bank of Pakistan. Data on Treasury bill rate (for interest rate) and inflation (for producer price index) have been taken from the IFS, 2009-CD-R0M. Finally, data on black economy was obtained from Hussain and Ahmad (2006), but extrapolated by the authors to cover up to 2008.

3.2 Methodology

The empirical model is specified in log-linear form. Bowers et al., (1975) suggest that Ehrlich's (1975) log linear specification is sensitive to the functional form. Ehrlich (1977) and Layson (1983) argue that the log linear specification produces better empirical outcome. The following benchmark equation sets the stage for assessing the impact of inflation on stock market returns.

$$LSMR = \delta_1 + \delta_{INF} LINF + \delta_{IR} IR + \delta_{BMP} LBMP + \mu \qquad (1)$$

where, SMR indicates stock market returns from the share price index, INF for inflation proxied by producer price index, IR for interest rate measured by "T-Bill 6 months" the - Treasury bill rate, and BMP refers to black economy.

Some of the research relating to the impact of inflation on stock return uses consumer price index (CPI) as proxy for inflation. Shanmugam et al., (2008, 2009) argue that PPI (producer price index) or WPI (wholesale price index) serves as superior indicator of inflation compared to that CPI and that the later can produce misleading results. PPI covers prices of foods, metals, lumber, oil and gas, and many other commodities in Pakistan. Thus PPI is a better measure for inflation. This is a novel feature of this paper. Investment in stock may serve as a good hedge against inflation if the firm's revenue keeps pace with inflation and the investors retain the value of their stocks in equity markets without changes in real returns on assets. A priori, we expect $\delta_2 > 0$.

Treasury bill rate is used to measure interest rate. The later raises the discount rate and lowers the present value of future earnings -- the fundamental value of shares. We expect stock markets returns and interest rate to be inversely related i.e., $\delta_3 < 0$.

Black economy refers to underground economic operation where rules of economic and financial laws are absent. High corruption, absence of free play of market forces, and too much bureaucracy help a thriving black economy. This is a serious problem in the Indian sub continent. Estimates suggest that the size of black economy is about half that of the formal Pakistan economy. Black economy exerts negative effect on general welfare, impedes economic growth, and significantly lowers the performance of financial markets. Thus we expect $\delta_4 < 0$.

3.3 Ng-Perron Unit Root Test

Ng-Perron (2001) developed a test statistics wherein GLS is applied to de-trend the series D_t^d. The critical values of the tests are based on those of Philip-Perron (1988) Z_α and Z_t statistics, Bhargava (1986) R_1 statistics, and Elliot, Rotherberg and Stock (1996). The following annotations are used:

$$k = \sum_{t=2}^{T} (D_{t-1}^d)^2 / T^2 \quad (2)$$

The de-trended GLS tailored statistics is given by:

$$MZ_a^d = (T^{-1}(D_T^d)^2 - f_\circ)/(2k)$$

$$MZ_t^d = MZ_a \times MSB$$

$$MSB^d = (k / f_\circ)^{1/2}$$

$$MP_T^d = \left\{ (\bar{c}^{2} k - \bar{c} T^{-1} (D_T^d)^2 / f_\circ, and, (\bar{c}^{2} k + (1 - \bar{c}) T^{-1} (D_T^d)^2 / f_\circ \cdots \right. \quad (3)$$

3.4 ARDL Bound Testing for Cointegration

The ARDL bound testing method is applied to check the existence of cointegration among the four macroeconomic series. Let x_t represent a time series vector $x_t = \{SMR, INF, BMP, IR\}$ with $y_t = SMR$, applied within an unrestricted vector autoregression (VAR) framework:

$$z_t = \mu + \sum_{j-1}^{q} \delta_j z_t + \varepsilon_t \quad (4)$$

where, $z_t = [y_t, x_t]^{'}$; μ is a vector of constant, $\mu = [\mu_y, \mu_x]^{'}$ and δ is a matrix of vector autoregressive (VAR) parameters of lag *j*. Following Pesaran, Shin and Smith [PSS] (2001), a pair of time series y_t and x_t can be integrated at either *I(0)* or *I(1)* or be mutually cointegrated. In other words, the time series vector x_t: stock market returns, inflation, interest rate and black economy can have different orders of integration. The error terms vector $\varepsilon_t = [\varepsilon_{y,t}, \varepsilon_{x,t}]^{'} \sim N(0, \Omega)$, where Ω is positive definite. Equation 4 in its modified form can be written as a vector error correction model as given below:

$$\Delta z_t = \mu + \gamma z_{t-1} + \sum_{j=1}^{q-1} \lambda_j \Delta z_t + \varepsilon_t \quad (5)$$

where, $\Delta = 1 - L$, and

$$\lambda_j = \begin{bmatrix} \lambda yy, j & \lambda yx, j \\ \lambda xy, j & \lambda xx, j \end{bmatrix} = -\sum_{k=j+1}^{q} \varphi k \quad (6)$$

Here, γ is the long run multiplier matrix written as follows:

$$\gamma_j = \begin{bmatrix} \gamma yy & \gamma yx \\ \gamma xy & \gamma xx \end{bmatrix} = -(I - \sum_{j=1}^{q} \varphi_j) \quad (7)$$

Where, **I** represents an identity matrix. The diagonal essentials for the matrix are left unrestricted. This implies that each of the series can be stationary either *I(0)* or *I(1).* This approach enables us to examine the maximum number of cointegrating vectors that include both y_t and x_t, such that either γyx or γxy can be non-zero, not both. Given our aim is to examine the long run impact of inflation, interest rate and black economy on stock market returns, the restriction $\gamma xy = 0$ indicates that inflation, interest rate and black economy have no long run impact on stock market returns. Under this assumption (that is $\gamma xy = 0$), Equation-7 can be rewritten as follows:

$$\Delta y_t = \beta_\circ + \beta_1 y_{t-1} + \beta_2 x_{t-1} + \sum_{j=1}^{q-1} \beta y,_j \Delta y_{t-j} + \sum_{j=1}^{q-1} \beta x,_j \Delta y_{t-j} + \varphi \Delta x_t + \mu_t \qquad (8)$$

where;

$$\beta_\circ = \mu_y - \omega^{'} \mu_x ; \beta_1 = \lambda_{yy} ; \beta_2 = \lambda_{yx} - \omega^{'} \lambda_{xx} ; \beta_{y,j} = \lambda_{yy,j} - \omega^{'} \lambda_{xy,j}$$

and $\beta_{x.j} = \lambda_{yx,j} - \omega^{'} \lambda_{xx,j}$.

The ARDL model of PSS (2001) is represented by an unrestricted error correction model (UECM). Equation-8 can be estimated by ordinary least squares. The F-statistics is used to test the long run relation among the series. The null hypothesis is: $\beta_1 = \beta_2 = 0$ against the alternate $\beta_1 \neq \beta_2 \neq 0$. Equation-8 is the reduced form which can be re-written to obtain the long run relation among the running variables as:

$$y_t = \varphi_1 + \varphi_2 x_t + v_t \qquad (9)$$

Where $\varphi_1 = -\beta_\circ / \beta_1 , \varphi_2 = \beta_2 / \beta_1$ and v_t is a stationary random process with zero mean. In terms of the PSS (2001), the distribution of F-statistics is based on the order of integration of the series. The ARDL bound testing calculates $(p + 1)^k$ number of regressions, where p refers to the appropriate order of the lag and k to the number of actors in the equation to be estimated.

To check the short run impact of inflation on stock market returns we use a battery of other variables based on Equation-1. The error correction representation under ARDL model for short run dynamics is given by the equation below:

$$\Delta LSMR = \beta_1 + \sum_{j=0}^{n} \beta_{INF} \Delta LINF_{t-j} + \sum_{j=0}^{n} \beta_{IR} \Delta IR_{t-j} + \sum_{t=j}^{n} \beta_{BMP} \Delta LBMP_{t-j} + \eta ECM_{t-1} + \mu_i \quad (10)$$

The inclusion of an error-correction term among the cointegrated variables implies that changes in dependant variable are a function of both the levels of disequilibrium in the cointegration relationship (represented by the lagged ECM) and the changes in other explanatory variables. This tells us that any deviation from the long run equilibrium will feed back on the changes in the dependant variable forcing the movement towards the long run equilibrium

Sensitivity analysis is used to examine potentials for serial correlation, functional form, normality, and heteroscedisticity associated with the model. The stability test is conducted by employing CUSUM and CUSUMsq.

4. Findings and Discussion

Table-1 presents the descriptive statistics. The correlation matrix shows that the stock market returns and inflation are positively related and Black economy is also positively linked with stock returns but inversely related to inflation. The correlation between interest rate and stock market returns is negative but interest rate is positively associated with inflation[2].

[Table 1 about here]

The correlations between the pair of variables are consistent with expectations. The results also [2] suggest absence of multicolinearity.

The bounds test is based on the assumption that the variables can be ***I(0)*** or ***I(1)*** or mutually cointegrated. This makes testing the order of integration of the series [*I(0)* or *I(1)*] uninteresting. A unit root test is still needed to ensure that none of the series is integrated of ***I(2)*** or higher. According to Sezgin and Yildirim, (2002) and Ouattara (2004), only in the presence of ***I(2)*** variables, the computed F-statistics from **PSS** (2001) become invalid. The Ng-Perron (2001) test results are reported in Table-2. Clearly, interest rate (IR) is stationary ***I(0)*** and stock market returns (SMR), inflation (INF) and black economy (BMP) are integrated of ***I(1)***. The ARDL bounds testing approach can handle this dissimilarity in the order of integration of the series.

[Table 2 about here]

ARDL cointegration (PSS. 2001) is a two-step procedure. In the first stage, the order of lag length on the first difference is obtained from unrestricted vector autoregression (VAR). This is done by estimating the conditional error correction version of the ARDL model from Equation-8. The lag order is selected at 2, based on the minimum value of AIC, as reported in Table-3. The total number of regression estimated following the ARDL method in Equation-1 is $(2+1)^3 = 27$. The results from the bounds test approach reject the null hypothesis. This confirms the existence of cointegration among the series (Table-4). The *F-statistics* 12.735 is larger than the upper level of the bounds critical value of 8.603 at the 1 percent level of significance and value of lower bounds is 7.527 (See Narayan, 2005).

[Table 3 about here]

[Table 4 about here]

[Table 5 about here]

Table-5 lists the partial long run relations obtained through ARDL-OLS estimation. The estimates suggest that a 1 percent increase in the stocks returns in the previous period will lead to an (expected) increase in the return in current period by 0.51 percent, ceteris paribus. The positive relationship between inflation and stock markets returns suggests that a 1 percent increase in inflation stimulates stock market returns by 0.22 percent (expected, ceteris paribus). These findings are consistent with Ahmad and Mustafa (2003) and Shahbaz (2007). The results lend support to the hypothesis that investment in stock markets acts as hedge against inflation in Pakistan. The coefficient of interest rate is negative and highly significant. The rising interest rate increases opportunity of holding cash. This can cause reallocation of assets to bonds from stock leading to reduction in stock prices and thus its returns (Mohammad et al. 2009). An increase in interest rate reduces the present value of cash flows in future for the fundamental value of shares. A 1 percent increase in interest rate is expected to lower the value of stock returns by 0.64 percent which is consistent with the findings of Hasan and Javed (2009). The impact of Black economy on the stock returns is positive and statistically significant. This might imply attempts to whiten money.

The equation-10 refers to the specification used here for short run analysis. The short run impact of the independent variables on stock market returns is reported in Table-6. The error correction term ecm_{t-1} shows the speed of adjustment to re-establish the equilibrium in the dynamic setting. The coefficient of ecm_{t-1} is (-0.971) and significant at the 1 percent level. This suggests that the long-term deviation in stock market returns is corrected by 97.1 percent each year. A negative ecm_{t-1} implies a stable long run cointegrating relationship among the series (Bannerjee et al. 1998).

[Table 6 about here]

Table-6 shows that 0.54 percent of stocks in current period are expected to be produced by 1 percent increase in stocks in previous period, ceteris paribus. The coefficient of LINF is positively related to LSMR. This suggest that investment in stock markets is a good hedge against inflation even in the short run. Interest rate reduces the rate of stock market returns which is highly significant. The Black economy shows that stock returns respond positively and is dominant both in the short and the long run.

Diagnostic test of the model reveal that the error term is normality distributed and that there is absence of serial correlation, White heteroskedasticity, and ARCH. Model appears well specified. The results of the tests are reported in Table-3. The ECM-ARDL fit is satisfactory with R^2 = 44.479%. There is no autocorrelation and ECM-ARDL model is also significant (see Table-6).

4.1 Sensitivity Analysis

Stability of the long-run coefficients and the short run dynamics, are checked by applying the CUSUM and the (CUSUMsq) tests following PSS (2001). The graphs are presented below in Figures 2 and 3. The null hypothesis of correct specification cannot be rejected at the 5% significance level because the plots of the statistics are within the critical bounds.

[Figure 2 about here]

[Figure 3 about here]

5 Conclusions

The paper explores the relationship between inflation and stock market returns for Pakistan using ARDL bounds testing and ECM approach in an effort to assess whether or not investing in stock market can act as good hedge against inflation.

The results suggest that an increase in inflation tends to increase the revenue and income of firms over time laving real return unaffected. Results show that stocks returns are good hedge against inflation both in the long and the short run. A rise in interest rate negatively impacts stock returns. Finally, black economy raises the stock market return which is significant in the long and the short run. This might be interpreted as an effort on the part of the holders of Black Money to whiten their assets by channeling them through the stock market.

The results provide useful insight about the investors' behavior in Pakistan. The policy makers can take advantage of this relation in formulating appropriate incentive policies to help investors make decision about investing in financial market. Such policy may increase public participation in the stock market in Pakistan and ultimately promote economic growth. One aspect that seems to pose concern: developing appropriate apparatus for dealing with the black economy. Regulations and its implementation can help to control the underground economy. Interest rate also can be used as a tool to incentivize investors in general, and particularly those in stock markets of Pakistan.

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Table-1: Statistics Descriptive and Correlation Matrix

Variables	LSMR	LINF	LBMP	IR
Mean	5.1184	3.6647	3.1073	2.4106
Median	5.1364	3.6393	3.1726	2.3887
Maximum	6.3298	5.2928	3.3032	2.7472
Minimum	4.2275	1.7404	2.8033	1.8405
Std. Dev.	0.5520	0.9758	0.1763	0.1987
Kurtosis	2.3180	1.9905	1.7075	3.6402
Jarque-Bera	1.8697	1.8594	4.1616	3.9002
Probability	0.3926	0.3946	0.1248	0.1422
Observations	38	38	38	38
LSMR	1.0000			
LINF	0.1337	1.0000		
LBMP	0.2416	-0.1660	1.000000	
IR	-0.3578	0.2499	-0.1070	1.000000

Table-2 Unit Root Evidence

Variables	Ng-Perron Test at Level			
	MZa	MZt	MSB	MPT
LSMR	-9.2452	-2.0672	0.2236	10.1782
LINF	-13.2057	-2.5656	0.1942	6.9226
LBMP	-7.4770	-1.9012	0.2542	12.251
IR	-20.2284[b]	-3.1800	0.1572	4.5063
Ng-Perron Test: First Difference				
LSMR	-28.4409 [a]	-3.7710	0.1325	3.2040
LINF	-97.0081[a]	-6.8469	0.0705	1.3799
LBMP	-16.9072[c]	-2.9046	0.1718	5.4068
IR	-22.7911[b]	-3.3130	0.1453	4.3701

Note: a, b and c indicate the significance at the 1 %, 5 % and 10 % level

Table-3 Lag Length Selection

VAR Lag Order Selection Criteria				
Lag	LogL	LR	FPE	AIC
0	-25.33324	NA	6.28e-05	1.676185
1	135.0597	274.9593	1.65e-08	-6.574839
2	158.2704	34.48445*	1.14e-08*	-6.986878*
3	174.1496	19.96248	1.27e-08	-6.979978

Short run Diagnostic Tests

ARCH Test = 0.2096 (0.6500)

Serial Correlation LM Test = 2.2471 (0.1244)

Heteroscedisticity Test = 0.7281(0.6914)

Ramsey RESET Test = 1.0740 (0.3085)

Jarque-Bera Test = 1.1784 (0.5547)

Note: * indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at the 5% level, FPE: Final prediction error, AIC: Akaike information criterion

Table-4 ARDL F-statistics Calculation

Variable			ARDL Cointegration F-Statistic	
			Lag Order 2	
LSMR			12.735	
LINF			2.520	
LBMP			3.205	
IR			2.972	
Critical Value	**Pesaran Smith & Shin (2001)**		**Narayan, P (2005)**	
	Lower Bound Value	Upper Bound Value	Lower Bound Value	Upper Bound Value
1 %	6.34	7.52	7.527	8.603
5 %	4.87	5.85	5.387	6.437
10 %	4.19	5.06	4.477	5.420
Parsimonious Model Estimation for Cointegration				
Variable	**Wald – F-value**	**Prob-value**	**Chi-square**	**Prob-value**
LMIR	5.306	0.0044	21.226	0.0003
LINF	2.100	0.1187	8.400	0.0780
LBMP	2.671	0.0620	10.685	0.0303
IR	2.477	0.0771	9.908	0.0420

Table-5: Long Run Estimates

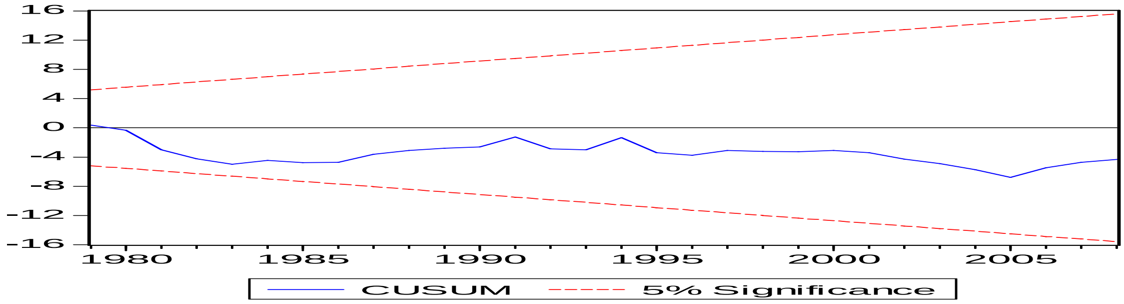
Dependent Variable = LSMR				
Variable	**Coefficient**	**Std. Error**	**T-Statistic**	**Prob-Value**
Constant	0.7815	0.9105	0.8584	0.3970
$LSMR_{t-1}$	0.5061	0.1385	3.6516	0.0009
LINF	0.2221	0.0642	3.4580	0.0016
IR	-0.6424	0.2101	-0.0575	0.0045
LBMP	0.8071	0.3200	2.5222	0.0168
R-Squared = 0.8383 Adjusted R-Squared = 0.8181 Akaike Info Criterion (AIC) = 0.0575 Schwarz Criterion (SBC) = 0.2752 F-Statistic = 41.493 Prob(F-Statistic) = 0.000 Durbin-Watson = 1.832				

Table-6: ECM-ARDL (2, 1, 1, 1)

Dependent Variable = ΔLSMR			
Variables	**Coefficient**	**T-Statistics**	**Prob-value**
Constant	-0.1104	-1.3523	0.1864
$\Delta LSMR_{t-1}$	0.5413	2.4480	0.0204
ΔLINF	0.1418	1.9098	0.0658
ΔIR	-0.7491	-2.2973	0.0288
ΔBMP	0.9250	1.9414	0.0617
ECM_{t-1}	-0.9717	-3.3771	0.0020
R-Squared = 0.44479 Adjusted-R-Squared = 0.35226 Akaike Info Criterion (AIC) = 0.0377 Schwarz Criterion (SBC) = 0.3016 F-Statistic = 4.8068 Prob(F-statistic) = 0.0024 Durbin-Watson = 1.8073			

Figure: 2

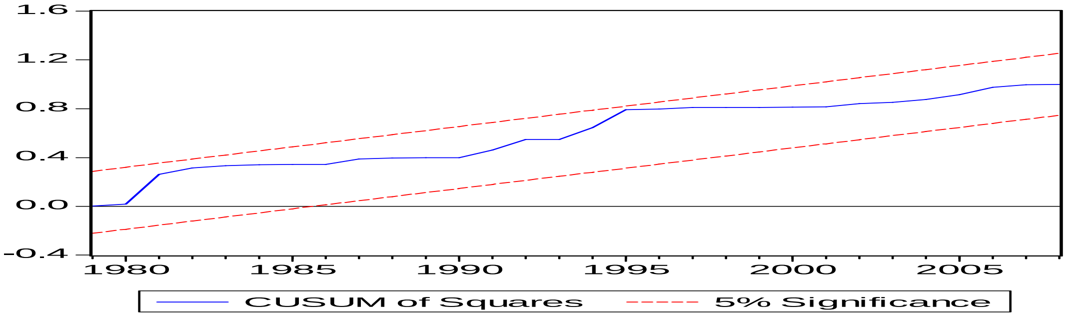
The plot of Cumulative of Recursive Residuals



The straight lines represent critical bounds at the 5% significance level.

Figure: 3

The plot of Cumulative Sum of Squares of Recursive Residuals



The straight lines represent critical bounds at the 5% significance level.