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RESEARCH ARTICLE

USING ARDL APPROACH TO INVESTIGATE HEDGING POWER OF COMMON STOCKS AGAINST INFLATION IN PAKISTAN

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ABSTRACT

It seems like a puzzle whether stocks have the ability or not to protect from inflation. This study empirically investigated such relationship whether stocks provide hedge or not against the inflation. Monthly data of inflation and stock returns is used for the study to identify and measure the relationship. Period of the study was taken from year 2001 to 2012. Data stationarity is checked through augmented dickey fuller (ADF) and Philipp's Peron (PP) unit root tests. For testing long term relationship between stocks returns and inflation, WALD test is used. For short term relationship Error Correction Mechanism (ECM) test is used. Evidence comes in favor that relationship exist in short term as well as in long term, because both the WALD and ECM tests support the findings of the study as per theory.

INTRODUCTION

It is like puzzle whether shares have the capacity to hedge against inflation or not, according to theory that stock should hedge against inflation because stocks represent the real assets and when inflation increases then ultimately the prices of the real assets increases, so therefore shares should be hedged against inflation. According to Fisher hypothesis (1930) said that nominal interest rate is a function of inflation and real interest rate, if you keep the real return constant then nominal return has one to one relationship with inflation, which means when inflation increases then return should also be increased, so therefore fisher hypothesis also support the theory. According to **Bodie (1976)** return is the function of inflation and real return constant which ultimately support the Fisher hypothesis. **Geske and Rollfound (1983)** found in its empirical analysis that there is relationship between the two variables which are according to theory, as they analyzed whether share prices are true representative of real assets or not, which they proved through empirical analysis.

As in the literature there are number of studies which reported their results against the theory or in other words they reported results against the fisher hypothesis, they said that the studied variables are negatively correlated with each other. Obviously this is not easily acceptable but it also leads to another important consideration. The researcher's argument that negative relationship exist between stock returns and inflation because of tax, when tax is included then relationship comes negative, this is known as tax augmented hypothesis. They also agree on the positive relationship between inflation and stock returns when to exclude the tax from stock returns. For example **Khil and Bong-Soob (2000)** found that there is negative relationship between inflation and stock returns, which means they concluded against the theory. This is also supported by the **Francis and Tewari (2011)** they found negative relationship between the two studied variables i.e. inflation and stock return through their empirical analysis.

The basic goal of this paper is to check the relationship whether common stocks have the capacity to hedge or not against the inflation and also know whether the concept of fisher hypothesis exist in Pakistani stock market or not. Another important motive for this study is that, in the literature it is found disperse opinion about hedging whether stocks return hedge against inflation or not, therefore it is the first study in nature in Pakistan which investigates any relationship between the two important variables. In developed economies it is found most of the time that there is negative relationship between the two variables. For decades it was considered that share prices and inflation are linearly positively related or at least they are nonnegative correlated with each other. After the world War II, unfortunately many researchers found negative relationship. Especially it was observed negative relationship in USA but in other part of the world same kind of information also observed. Some researchers also distinguished that before the world war it was observed the positive relationship between stock returns

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and inflation but after the world war there is negative relationship. So solve this puzzle this research is taken on the developing country like Pakistan.

Objectives of the Study

The objectives of the study include:

- To solve the puzzle whether stocks return provide hedge against inflation or not.
- To empirically test the relationship between stock returns and inflation; in a developing country like Pakistan.
- To provide investors (individuals as well as for institutional) with results that whether the shares have the ability to protect the investors from the inflation, especially in a country like Pakistan.

Significance of the Study

As the other similar studies in the world concluded differently as per their own context and circumstances, therefore the results of those studies cannot be generalized for a developing country like Pakistan which is also facing a lot of political, economic, security and social disturbances. This study focuses primarily on exploring and identifying the linkages between stocks and inflation for a developing country like Pakistan in the time frame which is most robust as Pakistan has observed significant changes in the period under study.

Literature review

Stock returns and inflation have lot of literature, according to this scenario this study taken the help from the fisher hypothesis (1930) which states that when real rate of return is constant then nominal interest rate will be increased when inflation will be increased. If we take this hypothesis in this study then it will be like this, nominal return on stocks will be equal to real rate of return plus the inflation component. Suppose real rate of return is constant then nominal return on stocks is equal to the inflation, theoretically when inflation will increased it will cause to increase the nominal return to equate the equation. Therefore the conclusion can be drawn from the above discussion that stock return will be increased when inflation will be increased, keeping other factors constant. According to **Bodie (1976)** stock returns are depended upon the unexpected and expected nominal return and also on the expected and unexpected inflation. Originally in literature in year 1983 Geske and Roll construct the word hedging of stock return against inflation and also said that stock return should be positively related with each other because shares represent the real assets, so therefore when inflation will increase ultimately the value of real asset will also increase.

Reilly *et al.* (1970) found in his study that shares are not able to hedge against inflation, they concluded on the basis of portfolio of shares; unfortunately this portfolio of shares did not increased return when inflation increased. Later on two other studies also supported the Reilly's conclusion which he said that shares are not capable of hedging against inflation. **Fama and Schewart (1977)** analyzed the shares whether they can hedge against inflation efficiently or not but their conclusion did not support the theory. Another study which also supports the previous study was analyzed by **Adams *et al.* (2004).** The author analyzed in this study whether shares have the capacity to hedge against inflation which has two components expected inflation and unexpected inflation, but the shares was unable to hedge. It was found that both the types of inflation either it is expected or unexpected inflation, shares show inability to hedge.

Moosa (1979) on the basis of empirical analysis concluded that shares are not capable of hedging against inflation, because inflation is not only single factor that affect the shares prices as uncertainty and income effect may also affect the stock prices and affect its hedging ability. **Day (1984)** find negative results, to support the result of study he argued that manufacturing sector exhibit random return therefore there should be negative relationship between the two variables. **Erb *et al.* (1995)** concluded that realized stocks returns are unable to hedge against the realized inflation. Another study which is analyzed by **Foort and Martin (1996)** on other sector of the economy and found that real estate sector also does not protect from inflation during the analyzed period, but it is possible after or before the study period they show positive relationship between them. In 1996 Tarbert also support Martin that commercial and real property cannot hedge against inflation. That was evidence against the theory and from the nonfinancial sectors. In recent decades also number of studies found the result which is contradictory against the theory for example according to **khil and Bong-Soob (2000)** based on the comprehensive analysis, they concluded opposite the theory, which means there is negative relationship but in their study they only found in Malaysia that there is positive relationship between stock returns and inflation. Another recent study which is analyzed by Francis and Tewari found no relationship between the shares return and inflation rather in their study they found negative relationship between the two variables. There are number of studies concluded that there is negative relationship between the study variable or at least they are not able to hedge against inflation, but number of studies also represent which favor the theory. Those studies which concluded positive relationships are mentioned one by one.

The oldest literature which comes on stock return and inflation that has the positive relationship between the two variables is analyzed by Firth in year 1979; he concluded that inflation and shares returns have positive relationship. In year 1998, Martina conducted the study on the relationship between stock return and inflation by using the tests including parametric as well as nonparametric test, and he found positive relationship between the stock return and inflation. **Schotman and Mark (2000)** also find the positive relationship not even in short term period but also they found positive relationship in the long term horizon as well. There is valuable contribution in literature by **Ding (2006)** found positive as well as negative relationship between the two, based on the certain factors, he found positive relationship between the two variables because of strongly impact of monetary policy, when he found negative relationship between the two, and it was due supply shock. There are some most recent studies including **Bekaert and Engstorn (2010)** concluded positive relationship between expected return and expected inflation, both type of securities debt and shares have the capacity to hedge against inflation. Both type of securities' return are highly positively related with expected inflation. Alagidede and Panagiotidis in year 2010 find the positive relationship between inflation and stock return, they employed parametric as well as nonparametric test for testing the relationship and their conclusion supported the

theory and supported the fisher hypothesis. In year 2011 Akash found in his empirical study that there is positive relationship between the two variables. Some researchers also concluded that at some level inflation and stock returns are positively related but after that it seems less likely to have positive relationship between them. For example kolluri and its coauthor wahab in year 2008 studied the relationship whether stock return are able to hedge against inflation or not and found that during the high inflation period they show the positive relationship but low to moderate inflation period they did not show positive relationship.

Theoretical Framework

Theoretical framework of this study is based on the purely fisher hypothesis which states that nominal interest rate is equal to real interest rate plus inflation. That is given below,
Nominal interest rate = Real Interest rate + inflation

We can write the equation in symbolic form,

$$R_t = (E_{t-1}[r_t]) + (E_{t-1}[\pi_t]) + \mu_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In the above equation symbol Rt is the nominal interest rate, while (Et-1[rt]) is the real expected rate and this is the (Et-1[πt]) is the expected inflation and last symbol in this equation is the error term symbol. It may be possible that expected inflation and actual inflation may vary so therefore equation will look like this,

$$\pi_t = E_{t-1}[\pi_t] + V_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

In equation (2) π_t is the realized inflation whereas $E_{t-1} - [\pi_t])$ is the inflation which is expected and V1t is the error term which is the difference between actual and realized inflation. In a similar way the equation of real interest rate is like this

$$r_t = E_{t-1}[r_t] + V_{2t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

In equation three rt is the actual interest rate, while Et-1[rt] is the interest rate which is expected and this symbol V2tis the difference between actual and expected rate, the equation of real interest rate is given below,

$$r_t = R_t - \pi_t + v_t * \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$*V_t = \mu_t - V_{1t} - V_{2t}$$

If we place the above theoretical framework in the context of stock market return and inflation it gives the true picture and make the relationship between inflation and stock returns, therefore the base of this study is the fisher hypothesis and is the above theoretical framework.

Data and methodology

In this study mainly two variables are used namely stock price indices and inflation that is taken from consumer price index (CPI) and the frequency of data is monthly. Stock price index is taken from yahoo finance website and the data of inflation is taken from IMF. The reason of taking monthly data is, to get a lot of number of observations for the best analysis. In this study, first of all data series is analyzed for stationary, both the series were not stationary at the same level that leads towards the Auto Regressive Distributive Lag (ARDL) methodology. Wald Test is used to know the relationship between the two variables in the context of long term and to check the short term relationship we apply ECM test. Augmented Dicky fuller (ADF) and Phillips peron (PP) test were used for testing unit root.

RESULTS AND DISCUSSION

Descriptive statistics (Table 1) tells that the mean return of stock is 4.463 which is considered worse and the standard deviation is 40 which is considered too high, which means there is too much variation in stock return and table shows that data has little bit left skewed and kurtosis is considered acceptable at the give level. The average inflation of the period which is included in the study is 8.271% which is single digit and considered little bit higher than other countries in the region and the standard deviation of the inflation is 4.439 which is substantially less than standard deviation of the stock return, which tells us that inflation is fluctuating only 4.4 percent around its mean, data is showing right skewed and its kurtosis is also accept which is near to four.

Table 1. Descriptive Statistics

	Stock Return	Inflation
Mean	4.463	8.271
Standard deviation	40.319	4.439
Skewness	-0.574	0.917
Kurtosis	3.972	4.091

Results of unit root test (Table 2) suggest that the series of return is stationary at level under 5% level of significance but inflation is stationary at first difference under the 5% level of significance. Since two series are stationary at different level therefore simple regression cannot be used to test the relationships rather ARDL as a regression approach will be used.

Mathematical model

Mathematical model of our study is given below,

$$\Delta(Stock\ \mathrm{Re}turn)_t = \alpha + \beta\Delta(Inflation)_t + \mu_t \quad \ldots\ldots\ldots (5)$$

In the above equation stock return is our dependent variable and inflation is independent variable, alpha is constant. ARDL equation is given below

$$\Delta(Stock\ \mathrm{Return})_t = \alpha + \beta_1\Delta(Stock\ \mathrm{Return})_{t-1} + \beta_2\Delta(Inflation)_t + \beta_3\Delta(Inflation)_{t-1} + \beta_4(Stock\ \mathrm{Return})_{t-1} + \beta_5(\mathrm{inf}lation)_{t-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

In equation number six stock returns is dependent variable, and there are five independent variables namely lag value of inflation and stock return, with difference and lag value of inflation and with difference and lag value of stock return.
For testing long term relationship we applied coefficient restriction as β(4)=0 and β(5)=0. For testing short term relationship the ECM equation is given below,

Table 2. Unit Root Test

	No Trend				Trend and Intercept			
	ADF		PP		ADF		PP	
	Level	1st diff	Level	1st diff	Level	1st diff	Level	1st diff
Return	-3.71***	-4.99***	-3.003**	-10.9***	-3.811**	-5.01***	-3.0434	-10.9***
Inflation	-2.701*	-5.05***	-1.9852	-12.8***	-2.7740	-5.04***	-2.0564	-12.8***

* refers at 10%, and ** shows at 5% and *** shows at 1%.

$$\Delta(Stock\ \mathrm{Re}turn)_t = \alpha + \beta_1\Delta(Stock\mathrm{Re}turn)_{t-1} + \beta_2\Delta(Inflation)_t + \beta_3\Delta(Inflation)_{t-1} + ECM(-1) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Originally the short term relationship only is based on ECM term. If ECM term is significant then it would be the matter otherwise nothing is beneficial. The results of ARDL (TABLE 3), Wald test (TABLE 4), and ECM (TABLE 5) suggest that stock return and its previous values have the relationship because coefficient sign is significant and positive which is the evidence of relationship. Difference and with lag of inflation's coefficient is in the favor of theory which leads to the hypothesis of Fisher. Wald test statistics found significant long term relationship which in terms refers to the support of theory. So as per the inferential results of empirical analysis it can be said that shares have the ability to hedge and investors can be protected from the inflation. For short term relationship ECM is applied which also gives the statistics which is in the favor of theory because ECM result is also significant. So it can be concluded that short term investors are also protected from inflation. The study supported the valuable findings in the literature (**Firth, 1979; Hondroviannis and Papapetrou, 2006**) supporting the theory which turns into conclusion that shares have the capacity to protect the investors from the inflation.

Table 3. ARDL

	Coefficient	T-statistics	Probability
Δ(SR(-1))	0.256	3.90	0.000
Δ(INF)	0.259	0.301	0.764
Δ(INF(-1))	0.111	0.127	0.898
SR(-1)	-0.094	-3.946	0.000
INF(-1)	-0.595	-2.853	0.004

Table 4. Wald Test

Statistics Name	F statistics	Probability	Chi Square	Probability
Values	8.205	0.000	16.410	0.000

Table 5. ECM

	Coefficient	T-statistics	Probability
Δ(SR(-1))	0.7303	4.1567	0.0001
Δ(INF)	0.1711	0.1981	0.843
Δ(INF(-1))	-0.875	-1.019	0.843
ECM(-1)	-0.5747	-3.030	0.002

Conclusion

The study tested the hedging capability of stock returns against inflation. After empirical analysis it was found that the short term and long term relationships are present based on ARDL, Wald test and ECM. The study concluded that stock return and its previous values have the relationship. Coefficient values are in the favor of theory which leads to the hypothesis of Fisher. So as per the inferential results of empirical analysis it can be said that shares have the ability to hedge and investors can be protected from the inflation.

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