# Empirical Analysis of Effects of Expected Inflation on Stock Returns


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### CERTIFICATE

This is to certify that this thesis entitled "**Empirical Analysis of Effects of Expected inflation on Stock Returns**" submitted by **Farwa Abbas** is accepted in its present form by the Department of Economics and Finance, Pakistan Institute of Development Economics (PIDE) Islamabad as satisfying the requirements for partial fulfillment of the Degree of Master of Philosophy in Economics and Finance.

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# DEDICATION

To the uplifted hands of beloved Father

and

Loving Mother.

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All praises to ALLAH, the compassionate, the omnipotent, who's blessing and exaltation flourished my thoughts and thrive my ambitions, provided me rich environment of learning and cooperative teachers, helping friends and honored me among those who make contribution to scared wealth of humanity.

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## LIST OF ABBREVIATION

| Abbreviation | Explanation |
|---|---|
| ASEAN | Association of Southeast Asian Nations |
| BRICS | BRICS is an acronym for the combined economies of Brazil, Russia, China and South Africa |
| COMPUSTAT | COMPUSTAT is a database of financial, statistical and market information on active and inactive global companies through the world |
| EPSFXQ | Diluted earnings per share/includes extraordinary Items |
| G7 | Group of world's most powerful industrialized countries including US, Japan, Germany, UK, France, Italy and Canada |
| OECD | Organization for Economic Co-operation and Development |
| PBR | Price to book ratio |
| PCE | Personal consumption expenditure |

# ABSTRACT

Existing studies in Pakistan analysed the relationship among inflation and stock returns by adopting concluded a negative correlation. In current study, we adopted asymmetric test specification model to examine the impact of expected inflation on stock returns. While to calculate expected inflation, two methods including Fama money demand model (1981) and ARMA model were employed. We calculated expected inflation through integration of aforementioned models and in sample/iterative, in-sample/non iterative and out of sample/iterative methods. Further, study uses regression to get expected inflation filtered from errors and the fitted values were utilize to filter out errors. The study was divided into sub samples of low and high inflations time periods. In order to divide them in high and low inflation time period the dummy variable were used and the average of inflation was taken as threshold level. Impact of expected inflation on stock returns is analysed by differently calculated expected inflation in order to confirm their results or to see whether there is any difference between their results. Monthly data is obtained covering data span of August 1998 to June 2017 from concerned sources. The result shows a strong relationship between real stock returns (adjusted from inflation) and expected inflation while utmost an insignificant relationship between nominal stocks returns and expected inflation. A negative relationship is noticed between stock returns and inflation during only low inflation time period in contrast to high inflation time period (positive relationship). Nevertheless, in both cases stocks are providing a good protection against inflation. The impact of expected inflation on stock returns by dividing the sample period into sub periods provides insignificant relationship between stock returns and expected inflation which is obvious as stock returns behaves noisy in short time period.

# CHAPTER 1

## INTRODUCTION

The relationship between stock returns and expected inflation plays vital role for investors to take investment decision. Investors need to get the information about behavior of stock returns when there is occurrence of some change in expected inflation. If investors use nominal discount rates to discount real dividends there will be inflation illusion. Which lead to mispricing of assets, when expected inflation is high the price of stock is less than its fundamental value and vice versa. Moreover relationship between stock returns and expected inflation decide whether stock market can be hedged against inflation or not. If there is positive relationship between stock returns and expected inflation it predicts that stock market can be hedged against inflation and vice versa.

Another aspect is that current prices of stocks reflects the future prices but in case of inflation, investors cannot predict future prices by using current prices. For this purpose this is necessary to know the nature of stock return behavior in response to change in expected inflation so that movement of future prices can be forecasted to some extent.

The debate of relationship between stock returns and expected inflation has always been controversial. Some literature suggests that the value of real investment should not be changed by inflation rate, there should not be influence of nominal variables on their real variables in long-run (Tiwari *et al*., 2015). But negative relationship between them is found in many empirical studies and many studies gave the reasons to that relationship (Solnik, 1983; Geske and Roll, 1983).

Fama (1981) suggests that the main reason of negative effect is that when inflation rises it effects money demand negatively and so that stock prices decreases. When

there is fall in money demand corporate profits also decrease which cause equity prices to decrease because of which there is decrease in stock prices as well. Fisher's hypothesis proposed the idea of hedging inflation against different macroeconomic variables in 1930. First, it was applied on interest rate but after some time it was also applied on different assets which also includes stock returns. Various studies show that there is the inverse relationship between stock returns and expected inflation. But some studies showed that there is no significant relationship between stock returns and inflation.

There is contradiction in results of many studies, some studies show that there is existence of negative relationship between stock returns and expected inflation and some shows positive relationship. This contradiction may be because of different methods used to test the relationship by different authors (Nelson, 1976; Geske and Roll, 1983).

Different studies used various techniques to estimate expected inflation. Some used survey-based methodology, Fama (1981) and some others used money demand model, Geske and Roll (1983) used adaptive expectation model, Blinder (1997), Mankiw (2001), Stock and Watson (1999) used Phillips curve to estimate expected Inflation. Kim and Ryoo (2011) adopted threshold vector error correction model of two regimes for the century-long data of US.

A study related to relationship between stock returns and inflation is conducted in Pakistan in 2015. Which covered time span of July 1961 to February 2012. This investigation took place using the frequency causality and continuous wavelet transform. Which suggests that during low inflation time periods there is dependency between stock returns and inflation but in high inflation time period they found that

they are independent. As a whole, results presents that in Pakistan stock market is a good hedge against inflation as there are mostly high inflation (Tiwari *et al*., 2015)

Study related to Pakistan analyzed the relationship between stock returns and actual inflation. But this research work is about the relationship between expected inflation and stock returns. Tiwari *et al*., (2015) used real stock returns while this study will be using both nominal and real stock returns to know the difference between results. Moreover we will be using totally different method to analyze the relationship between stock returns and expected inflation that is Asymmetric test specification which is new for the data of Pakistan.

## 1.1 Objectives of Study

First objective is to analyze the effect of expected inflation on stock returns and whether behavior of stock returns differs when expected inflation is high or low? For that we divided the expected inflation into high and low inflation time period and tested the effect. We generated data of expected inflation by calculating it through both ARMA model and Fama's (1981) money demand inflation model and divided both series of expected inflation in two(high and low) groups through asymmetric test specification model. Two methods are used to estimate expected inflation and we compared them through adaptive expectation method to filter out their errors. Trend of expected inflation is calculated by taking its mean and it is considered as threshold to divide them into high and low groups. We analyzed the behavior of stock returns during high inflation era and during low inflation time period through asymmetric test specification.

The second objective of the study is to analyze the expected inflation in both nominal and real stock returns. First effect of expected inflation on nominal stock returns is analyzed then to analyze effect of expected inflation on real stock returns we need to

generate the data of real stock returns. For that we calculated real stock returns after estimating the data of expected inflation from two methods. Study computed real stock returns by taking difference between nominal stock returns and expected inflation computed from both methods. Afterwards this study used real stock returns in testing the relationship of stock returns and expected inflation through asymmetric test specification model. At the end we compared the results we get from nominal and real returns if there is any difference between results obtained from both of them.

## 1.2 Significance of Study

This study will empirically analyze the effect of expected inflation on stock returns which will help the investors to take investment decisions. If investors do not consider inflation factor they will discount real dividends on nominal discount rate and they will not able to forecast future prices and it causes occurrence of inflation illusion.

Moreover, when investors calculate expected inflation for next time period then by knowing its effect on nominal return and real return will help them predicting future returns more closely. Undervaluing shares during the high inflation time period is mostly due to the failure of investors to adjust expected inflation in forecasting its returns. To forecast those returns they need to know the nature of behavior of actual stock returns towards expected inflation.

The empirical results of this study will also assist the investors in their decision about whether they need to take in account nominal returns or real returns or maybe there is no difference between their behaviors against inflation. This could be decided by analyzing effect of expected inflation on both of them and by seeing difference of their behavior.

## 1.3 Study Plan

This study consists of five chapters. Chapter 1 is about introduction which includes study background, gap, objectives and significance of study. Chapter 2 is about literature review which includes different sections related to different findings of authors. Chapter 3 is about data and methodology which includes methodology details which is used in the study. Chapter 4 is about results and discussion which includes estimated results and their interpretations. Chapter 5 is about conclusion and policy recommendations which includes conclusion of whole thesis about results and further recommendations.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

Before moving forward to the study it is compulsory to have knowledge of current evolution in empirical and theoretical literature regarding impact of inflation on stock returns. In the introductory chapter there is quick discussion about existing literature. But there is requirement to identify more gap and to explore strategies in order to fill the gap.

This chapter is divided into different sections based upon several findings and aspects of relationship between stock returns and expected inflation. This chapter is divided in order to combine the findings of different authors related to one aspect and to analyze how many authors have similar findings and methods.

Each section is about different dimension of the topic. Section 2.2 deals with the importance of correlation between stock returns and expected inflation and how it affects investors which is described by some prior studies. Section 2.3 presents different work done by authors on relationship of stock returns and inflation using "expected and unexpected inflation". Section 2.4 showed that whether different methods to calculate expected inflation effects the results. In section 2.5 we explore the evidence of Fisher's hypothesis through inflation. All other sections are showing evidence of several conducted studies regarding different aspects.

## 2.2 How Inflation affect Investors in Stock Market

According to Modigliani and Cohn (1979) discounting real dividend at nominal interest rates generate inflation illusion for the investors as they prefer subjective discount rates over the objective discount rates. Scheinkman and Xiong (2003)

proposed heterogeneous belief hypothesis in this regard. They explained that investors have such subjective beliefs due to confidence bias. When inflation is low prices increases than their fundamental value and that is because of inflation illusion, and when expected inflation is high inflation illusion phenomena decrease price (Ritter and Warr, 2002). As a result error-induced mispricing component occurs in stock prices (Cohen *et al*., 2005).

The investors exhibit a resale option as well which means that they are willing to pay more than the fundamental values in the future. Furthermore, Inflation decreases real economic activity which leads to the decrease in money demand which effects corporate profits negatively and so equity prices decreases which became the cause of negative relationship between inflation and stock prices which is "proxy effect" (Fama, 1981).

### 2.3 Expected and Unexpected Inflation

Durai and Bhaduri (2009) test the relationship between inflation and stock prices by using the same method by taking different time periods from India. They decomposed expected and unexpected inflation and tests its relationship with stock prices and the result of both was negative. Wavelet[1] analysis is used after decomposing variables and eradicating expected and unexpected inflation components it was found that unexpected inflation has the negative relationship with the stock prices.

Fama (1981) analyzed that a negative relationship between stock returns and inflation is proxying for the positive relationship between determinants of inflation and stock returns and the negative relation between inflation and its determinants. Monthly

[1] Wavelet is a function of mathematics which divide a function into different components of scale, usually frequency range can be assigned to each component of scale. Wavelet analysis analyze rapidly changing transient signals. Any application using the Fourier transform (decomposing function of time into frequencies) can be formulated using wavelets to provide more accurately localized temporal and frequency information.

quarterly and yearly data of USA is used from 1954 to 1976. Estimated regression method[2] is used. Variables are expected and unexpected inflation, stock returns and real activity and money growth. Results show that anomalous relationship will disappear between stock return and inflation as the real variables and measures of expected and unexpected inflation will be used to explain the stock returns.

### 2.4 Whether Different Methods used to Calculate Inflation Effect the Results

Symmetric methods were used by many researchers to find the correlation between inflation and stock returns and they gave the negative result. There are different ways to calculate the inflation, which can affect the result. Using Asymmetric methods can provide a difference between the low and high inflations regimes and it provides a clear picture (Kolluri and Wahab, 2008).

Results are compared using the properties of inflation time series, Data time aggregation, equation of estimation, the method to measure the inflation. Results show that better the variables and data time aggregation there are more chances to accept the Fisher's hypothesis[3]. It is accepted when the variable of nominal stock returns is used as dependent variable (Madsen, 2007).

Furthermore Schmeling and Schrimpf (2010) show in the research that expected inflation measured through survey has the significant relationship with future stock returns and they are strong predictors of returns in-sample and out of the sample of different industrialized countries. Centre for European economic research conducted the survey by different individuals including economic analysts, treasures etc. at industries and leading banks. Data is from December 1991 to September 2007, total observations are 190 monthly and survey asked 350 respondents monthly. Questions

[2] Least square method. Estimated regression equation is $\hat{y} = b_0 + b_1x$

[3] Proposition by Irving Fisher that the real interest rate is independent of monetary measures, specifically the nominal interest rate and the expected inflation rate.

are asked about inflation, CPI and different macro variables about six countries USA, UK, Italy, Germany, France, and Japan. The simple Regression model is used. Results show that inflation measured through the survey is a good predictor of future stock returns. Moreover, money illusion also plays a role in the results. Future research can be done on whether household inflation effects strongly stocks held by household and general investors.

While Oxman (2012) differs the results of the relationship between stock returns and inflation. This difference is because of the measure which used for inflation. Data of 1966 to 2009 is taken and sub periods are of 1966 to 1983 and 1984 to 2009. VAR[4] method is used and variables are excess return, dividend yield, risk premium and inflation. CPI, CPI-BC and PCE measures for inflation used which estimated different rate inflation. For CPI-BC and CPI inflation has the positive significant relationship with the dividend yield in 1966 to 1983 but an insignificant relationship in 1984 to 2009 and by using PCE measure there is no relationship between dividend yield and inflation either in sub-period.

### 2.5 Inflation and Fisher Hypothesis

Furthermore in a study by using monthly data, relationship of consumer prices and stock prices is analyzed for six African countries (Tunisia, Nigeria, Kenya, Egypt, South Africa, Morocco). Results concluded that there is existence of the positive relationship between them in both long run and short run which shows that stocks are the good hedge for inflation (Alagidede and Panagiotidis, 2010).

Another study tested the relationship between consumer prices and stock returns by using data from 52 countries which includes the USA too and results show there is the

[4] VAR is a statistical technique that measures the amount of potential loss that could happen in a portfolio of investment over a period of time. Value at Risk gives the probability of losing more than a given amount on a given portfolio over a period of time.

positive relationship between them. It is consistent with the Fisher's hypothesis (Omay *et al*., 2015).

But an inverse relationship is found in a study of USA while that inverse relationship is only in regimes of low inflation and a positive relationship floated during high inflation time periods which supports the idea of hedging stocks for Inflation (Kolluri and Wahab, 2008).

In case of India stock returns provide the perfect hedge for expected inflation but there is the negative relationship between unexpected inflation and stock returns (Chatrath *et al*., 1996). There are uncertainties about the relationship between inflation and stock returns for all developed and developing countries.

Side by side, by using wavelet method in India, it is found that by using the frequency band between 16 to 32 months there is existence of Fisher's hypothesis means stock returns and inflation has positive relationship but on other frequencies and time periods there not existence of Fisher's hypothesis which indicates that stock returns cannot use for hedge (Bhanja *et al*., 2012).

### 2.6 Inflation affects the Informative ability of Stock Prices

When a consumer enters into a long-term relationship with the buyer they consider the current prices and according to current prices expect the future prices. Because of inflation, their expectations which are made according to current prices do not fulfill. So inflation reduces the ability of prices to predict future prices or returns (Ball and Romer, 2003).

Moreover, inflation decreases the factor of information or ability to forecast future prices by creating the existence of noise. When inflation is high there is more chance to experience uncertainty in predicting future prices (Friedman, 1977).

Another study shows that Inflation variability causes many costs, one of these costs is uncertainty of variability in stock prices, which make investors suffer when they do not have exact information about inflation. Equity mispricing caused because of inflation illusion, when investors do not consider inflation in forecasting future prices they suffer from inflation illusion (Fischer, 1981).

Future earnings forecast errors can be estimated by using expected inflation proxies these errors are about future stock prices. Analysts estimate the future earnings by compensating inflation in it but they cannot compensate it completely. Investors could not able to include inflation information fully in their forecasted prices (Basu *et al*., 2010).

During the periods when inflation is high, investors cannot forecast earnings accurately. Investor's estimation of inflation is not accurate which impact on the growth of future earnings cause the pile up in an announcement of post-earnings. This underestimation can be due to uncertainty parameter (Chordia and Shivakumar, 2005).

### 2.7 Different behavior of Stock Prices during High and Low Inflation

Kolluri and Wahab (2008) examine the relationship between stock prices and expected inflation. Data of high inflation regimes and low inflation regime is taken from USA. Time period for data is 1949 to 2004. Asymmetric model is used to estimate the results. Results show that there is the inverse relationship between stock prices and inflation illusion during low inflation time period and there no relation or positive relation between stock prices and expected inflation during high inflation period. But in both cases high and low inflation time period stocks have delivered beneficial inflation protection.

Another study shows firms which are headquartered in countries of high inflation their investment decisions have less sensitivity with the stock prices. Data of 27 emerging markets from different countries are used. Data of 2009 to 2014 is taken, the sample is of nonfinancial firms. Main variables are inflation, corporate investment, size, earning per ratio, leverage, payout ratio, growth. To analyze dummies of all variables are introduced and corporate investment is regressed on remaining all variables (Farooq and Ahmed, 2017).

Boamah (2017) analyzed the relationship between inflation and stock returns. To analyze the relationship two groups of countries are taken, group of seven (G7) low inflation countries and the group of five high inflation counties (BRICS). The short run relationship is examined by Fisher effect extension. The study shows that in short run there is a negative relationship between inflation and stock returns in low inflation countries and it is significant while there is the positive relationship between inflation and stock returns in high inflation countries but it is not significant and there is not the existence of one to one relationship. The long run relationship between stock prices and inflation is analyzed by Vector Error Correction and cointegration models which results that there is a positive relationship between stock returns and inflation in both high inflation and low inflation countries.

According to Antonakakis *et al*., (2017) the relationship could be positive or negative between stock prices and inflation. Dynamic conditional correlations are examined over a specific time period to analyze the relationship between inflation and stock prices over a time period in the United States. DCC-GARCH[5] model is employed to analyze the time-varying relationship. Data covered the time span of 1791 to 2015. Results show there is the heterogeneous correlation between inflation and stock prices

[5] Dynamic conditional correlation

over the time. There is positive correlation in 1840, 1860, 1930 and 2011 and negative on the other time period.

Lee *et al*., (2000) investigated the effect of hyperinflation of Germany in 1920s on stock returns. Results of the study exhibits that stock returns and 1920s hyperinflation cointegrates. Positive relationship found between hyperinflation (both realized and expected) and stock returns which means that inflation can be hedged against stock returns during that period.

## 2.8 Long Run Response of Stock Prices to Inflation

Rapach (2002) analyzed the long run response of stock prices to inflation. 16 industrialized countries are taken individually to analyze the long run neutrality propositions. For united stated and united kingdom data of 1802 to 1990 is taken and for other countries, data is taken according to its availability. Results are estimated through King and Watson (1997) methodology. Results show that there is no long-run consequence of inflation on real stock prices. Long run real stock prices response to permanent inflation shock that is positive, zero or highly credible in industrialized countries individually.

In another study Geetha *et al*., (2011) examines the short run and long-run relationship between stock returns and expected, unexpected inflation in three countries USA, Malaysia and China. Yearly data is used to examine the hypothesis from January 2000 to November 2009. Methodology used is vector error correction modeling and augmented dickey fuller test. Variables are used interest rate (Treasury bill of Malaysia and US and bank rate of China), Exchange rate, Inflation, GDP (share prices and industrial production). Results show that there are short-run and long-run relationship among expected and unexpected inflation and stock returns in case of China. But in case of US and Malaysia, there is the existence of long-run relationship

between expected and unexpected inflation and stock returns but there is no existence of a relationship in short run. So results recommend that USA, Malaysia, and China can use information of GDP, expected and exchange rate, unexpected inflation and interest rate to predict the stock market movement.

## 2.9 Evidence of the Negative Relationship between Stock Price Movement and Inflation

Several studies have found the negative correlation between stock returns and inflation (Fama and Schwert, 1977; Nelson, 1976; Bodie, 1976). These studies have focused on the performance of financial instruments including common stocks in comparison to each in hedging against inflation in the United States, and found the poor performance on the regard of common stock in hedging against both expected and unexpected inflation in the country. Furthermore, Fisher hypothesis is also not supported by the cointegration results in the short-term whereas it has proven to hold one-to-one relation with the U.S. data in the long-run (Fahmy and Kandil, 2003).

Geske and Roll (1983) also found the negative relationship between stock returns and inflation both expected and unexpected. The study proposed a reversed causality explanation for this negative correlation. According to this explanation, a higher rate of monetary expansion results from the drop in economic activity due to higher inflationary expectations in the cases of low stock returns consistency with them. An empirical evidence for this explanation was provided by Solnik (1983) by using a panel of nine countries during 1971-80, and found a negative correlation between inflationary expectations and stock price movement.

In a study, Yeh and chi (2009) tested credibility of different hypothesis which explained the relationship of stock returns and inflation. They included 12 OECD countries to test relationship and their result shows negative significant relationship between inflation and stock returns in short-run. Some countries like Netherland,

Ireland, Australia and France do not exhibit a long run relationship between inflation and stock returns in equilibrium. This result is compatible with the hypothesis of Modigliani *et al*. (1979), Feldstein (1980) and Fama (1981) which shows that because of increase in inflation there is decrease on real returns of stocks. This result is also consistent with Rapach (2002) and Caporale and Jung (1997). They displayed negative significant effect of inflation on stock returns.

In contrast Spyros (2001) tested Fisher's Hypothesis. Results displayed that inflation can be hedged against stock returns. This study find out that there is negative but insignificant relationship between stock returns and inflation in Greece in time period of 1990__2000. Floros (2004) conducted the same study on economy of Greece and results showed that stocks and inflation are considered as independent variables as results for different tests shows that there no existence of relationship between stock returns and inflation in Greece.

Another study examines the relationship between stock returns and inflation in Australia covering time span 1875__1996, and results showed that there is no permanent changes in stock returns or inflation in case of Australian economy. Results exhibit there is existence of negative relationship between two variables (stock returns and inflation) which depends on the time period which is covered (Crosby, 2001).

Moreover another study conducted on the influence of inflation on stock returns which covered Central and Latin American countries (Venezuela, Mexico, Argentina, and Chile) and time period of study was 1981 to 1996. Results displayed that in case of Chile and Argentina there is existence of one to one relationship between inflation

and nominal return. Results shows that lagged inflation effects stock returns which means inflation can be hedged against stock market (Choudhry, 2001).

Patra and poshakwale (2006) tested the consequence of economic variables on stock returns in Greece data span covering 1990__1999. Results reveal that there is existence of long run and short run relationship between some macro variables like inflation, money supply and volume of trade with stock prices in Greece. But there was no long run or short run relationship was found between stock prices and exchange rate.

Another study conducted in turkey covering time span 1986__2000 showed that real stock returns and expected inflation have no correlation. Results exhibit negative relationship between stock returns and inflation, May be it is because of negative effect of unexpected inflation on stock returns. These results do not fulfil Fisher hypothesis because of non-existence of correlation between these variables but findings are in line with the proxy hypothesis as they displayed negative significant relationship between inflation and returns (Ugur & Ramzan, 2005).

A similar study conducted on US and ten pacific-rim countries and results shows that in all countries there is negative correlation between stock returns and inflation except Malaysia (Khil and Lee, 2000). Study of Sellin (2001) and Adrangi *et al*. (2001) also showed a negative relationship between two variables which is in line with proxy hypothesis. Aperigis and Eleftheriou (2002) also found negative link between stock returns and inflation in Greece.

### 2.10 Stock Returns and Macro Variables

Singh *et al*., (2010) examined the effect and cause relationship of stock returns with macro variables in Taiwan. Macro variables include GDP, Employment rate,

Inflation, Exchange rate and money supply. Yearly basis data is used which covered the time span of 2003 to 2008. Simple OLS regression methodology is used. For estimation employment rate, P/E ratio portfolio, Exchange rate, GDP, Inflation, money supply, yield portfolio, PBR portfolio variables are used. Results show that stock returns have the positive relationship with GDP and exchange rate and negative relationship with other macro variables inflation, money supply, and employment rate. For small companies, internal financing or high financing ratio depicts high growth. On the other hand, companies having more bond financing or equity financing tend to have low growth.

Another study analyzed that macro-economic variables budget deficit and money supply are important to forecast the stock price. Quarterly data of four countries (Hong Kong, South Korea, Taiwan, Singapore) is used and results showed that monetary and fiscal policies have long-run relationship with stock prices. Stock prices are not always adjusted quickly in short run with the change in monetary and fiscal policies (Chuang *et al*., 2007).

Furthermore, a Study of USA shows that macroeconomics variables can forecast future market return. Macro variables are industrial production growth, term spread, T.bill rate, dividend-price ratio and default spread (Chen, 1991).

Moreover, a study gave a hypothesis about monetary and fiscal linkages between stock prices and expected inflation. This Hypothesis suggests that when economic activities decrease it effects stock prices but it also decreases revenue of government which lead to the fiscal deficit. Then Central bank monetizes the currency which causes the increment in money supply leads to increment in Inflation (Geske and Richard, 1983).

A study investigated the relationship some macroeconomic variables and stock prices. Macro-economic variables include total personal consumption, real oil price, GNP, money supply in Germany, Japan, USA, Italy, and Canada. Results show the same movement of these macroeconomic variables and stock prices in long run (Cheung and Ng, 1998).

A study investigates the relationship of stock prices with macroeconomic variables in ASEAN countries (Thailand, Philippines, Indonesia, Malaysia and Singapore). Stock prices have the positive relationship with output growth in long run. While in the short run stock prices is based on the current and previous values of macro-economic variables (Wonbangpo and Sharma, 2002).

## 2.11 Different Methodologies to Analyze Relationship Between Stock Returns and Inflation

There are different methods used by authors to analyze the relationship between stock returns and inflation, in a study Spyros (2001) used cointegration test and Vector-Auto regressive (VAR) model to identify the relationship between stock returns and inflation in case of Greece as emerging economy. While Siklos and Kwok (1999) adopted Vector-Granger Causality test, Autoregressive (VAR) model and unrestricted cointegration test. They used these methods to investigate relationship between inflation and stock returns in United State covering data span from 1962 to 1992.Moreover a study investigated relationship between stock returns and inflation by employing correlation analysis Vector Autoregressive (VAR) model and Ordinary least square (OLS). This study is based on the data of Australia which covered time period from 1875 to 1996 (Crosby, 2001).

In another study Floros (2004) examines the link between inflation and stock returns in Greece covering data set from 1988 to 2002. Study considered both the lead and lag

periods of stock returns and inflation for which they adopted Pairwise Granger Causality Test, Ordinary least square (OLS) and Johansen Cointegration Test. While another study based upon data of Turkey adopted Standard Causality and Ordinary Least Square (OLS) in order to investigate correlation amid stock returns and inflation (Ugur and Ramzan, 2005).

Choudhry (2001) analyzed the effect of inflation on stock returns in some Central and latin American country, for this purpose spectral regression model, Auto-Regressive Integrated Moving Average (ARIMA) and unit root test is adopted. Moreover Geske and Roll (1983) and Lee *et al.,* (2000) also adopted unit root test, ARIMA and OLS to estimate the effect of inflation on stock returns on inflation in United State and impact of German hyperinflation of stock returns respectively.

On the other hand Patra and Poshakwale (2006) adopted Pairwise Granger Causality test, Error Correction model (ECM) and Johansan Cointegration Test to estimate whether economic variables like stock prices, exchange rates, volume of trade, money supply, and interest rates have effect on stock returns.

## 2.12 Other Factors Effecting Stock Returns other than Expected Inflation

Chen *et al.,* (2013) researched that base of stock market mispricing and excess volatility is heterogeneous expectations or beliefs and inflation illusion. Equity mispricing takes place because investors subjective expectations about the rate of return and dividend growth. There are hypotheses that excess volatility is because of inflation illusion and heterogeneous beliefs. The study showed heterogeneous beliefs play the more important role in mispricing stock market. The hypothesis is tested by VAR analysis by taking quarterly data of S&P500 index from 1974 to 2008. This study concludes that inflation expectations do not predict mispricing of the stock

market. Granger causality analysis showed the weakest response of stock market pricing to inflation expectation, on the other hand, heterogeneous beliefs had very strong relation with stock market mispricing.

Brown *et al*., (2015) further explains the money illusion hypothesis of Modigliani and Cohn (1979) with the extension of cross-sectional asset pricing Stock with Large earning yield to inflation sensitivities are most influenced by inflation illusion. They construct factor of inflation illusion with the act of buying stocks which are more sensitive about earning yield to inflation and they sell the stocks with less sensitivity. The sample from July 1963 to December 2014 is taken. Quarterly earnings of EPSFXQ[6] are taken which are of each firm from COMPUSTAT[7]. Earning yield of each firm is regressed on inflation. Results show that results are robust qualitatively to the control of unlike attributes of the firm.

Akturk (2016) provides the empirical evidence of the relationship between inflationary expectations and stock returns. Data of Turkish common stock market and industries is taken from January 1986 to June 2013 and monthly data is used. Data of one hundred seventy industries and common stock market index is taken. Main variables are real and nominal return and rate of inflation. (DF-GLS) unit root tests are applied. Stock returns have positive relationship with ex-ante/out of sample inflationary expectations and stock returns have negative relation with ex-post/in sample inflationary expectations. Results show that stock returns give good hedge against ex-ante/out of sample inflationary expectations but not for ex-post inflationary

[6] Diluted Earnings Per Share / Includes Extraordinary Items
[7] COMPUSTAT is a database of statistical, market and financial information on both active and inactive global companies throughout the world.

expectations. Moreover, manufacturing industries give 15% more hedge than services industry.

### 2.13 Review Related to Pakistan

Fisher hypothesis suggests that inflation is completely independent of stock prices so it can be used for a hedge. That means investors are always compensated for the movement of inflation in way of changing stock returns accordingly so that real returns will remain unaffected. To test empirically fisher's hypothesis mostly nominal stock returns are used instead of real returns to regress on inflation. In some studies real returns are used in the procedure to test the hypothesis, In this case, returns should be taken as an independent. Results showed that in Pakistan stock returns can be hedged against inflation in long run at least because there is mostly high inflation in Pakistan (Tiwari *et al*., 2015).

Ahmed and Mustafa (2012) also conducted a study on Pakistan in which they considered rational expectation theory and efficient market hypothesis to check out impact of inflation on stock returns. This stud used data span of 1972 to 2002 on monthly and yearly basis. They used full information maximum likelihood to analyze causal relationship between real stock returns and inflation. Findings show that stock returns are inversely related to unexpected growth and unexpected inflation. They find out that control of real output growth causes to disappear inverse relationship amid these variables over the time.

Another study is conducted on Pakistan which analyzed the relationship of macroeconomic variables like inflation, gross domestic product and inflation with stock prices. Monthly data is taken which covered time span of December 1991 to August 2012. Results displayed that macroeconomic variables have impact on stock prices. Moreover stock prices are the indicators of country’s economy and stock

prices in Pakistan have much volatility which is not favorable (Attari and Safdar, 2013).

## 2.14 Conclusion

Most of the literature is presenting a negative relationship between stock returns and expected inflation. Some studies supported Fisher's hypothesis but that is mostly in high inflation time periods. Different authors concluded negative relationship between stock returns and expected inflation using different methodologies and there is evidence of different behaviors of stock returns during high and low inflation time period. It is also found in many studies that there are many other factors which also affect the stock returns other than expected inflation.

Studies conducted in Pakistan related to topic of study find out impact of inflation on stock returns instead of expected inflation. While this is need for the betterment of investment decisions that how much there should be reliance on current prices of stock prices and how much expectations regarding inflation effects the investment decision. Moreover this study differentiates the behavior of stock returns when expectations regarding inflation get high from its average level and when it gets low from its trend (mean).

# CHAPTER 3

# DATA AND METHODOLOGY

This Chapter is divided into several sections. Section 3.1 is about theoretical models to get the results. It is about derivations of equations we used in estimations it has further sub sections which are about generating equation of expected inflation by following two authors and final equation.

While section 3.2.is explaining the econometric techniques to estimate the equations. Section 3.3. is about data set used in estimations. Last section 3.4. is about summary of whole chapter.

## 3.1 Theoretical Model

There are different methods used to calculate expected inflation by different authors. Schmeling and Schrimpf (2010) used survey method to calculate expected inflation. Some used expected inflation calculated from phillips curve model (Mankiw, 2001; Blinder 1997; Stock and Watson 1999). While Fama (1981) used money demand model. Geske and Roll (1983) used adaptive expectation model to generate expected inflation series.

When there is a decrease in inflation real economic activity will also decrease which causes money demand to decline and it effects corporate profits negatively which lead to decrease in equity prices so it cause negative relationship between stock prices and inflation (Fama, 1981).

We enlisted two well-established and fundamental forecast models to generate expected inflation in order to use in analyzing influence of expected inflation on stock returns. These models follow a rational traditional approach which identifies linkage between, money market, stock returns, product market and inflation.

### 3.1.1 First model to Generate Expected Inflation (Fama Money Demand Model 1981):

To calculate expected inflation Fama (1981) used two models one is money demand based which calculates inflation in terms of real activity and money growth and other is based upon the beginning period of the treasury bill. We will use money demand model as the treasury bill based method is proved poor to forecast expected inflation. Money demand model is

$$\Delta lnrm_t = \Delta lnNM_t - \Delta lnp_t = \alpha_0 + \alpha_1 \Delta lnAR_t + \alpha_2 \Delta lnTB_t + e_t \quad \text{.....(3.1)}$$

$rm_t$ =real money quantity

$NM_t$ =nominal money quantity

$\Delta lnp_t$=Actual inflation for time period t

$AR_t$=real anticipated activity

$TB_t$=nominal interest rate on treasury bills

To measure "$AR_t$" industrial production is used. By assuming exogeniety of real activity and rearranging the equation Fama obtained following new equation (Fama, 1981):

$$\Delta lnp_t = -\alpha_0 - \alpha_1 \Delta lnAR_t - \alpha_2 \Delta lnTB_t + \alpha_3 \Delta lnNM_t + \mu_t \quad ; while\ \mu_t = -e_t$$

Then variable of interest rate is excluded as it was found the weakest variable. This is found insignificant when other variables are added.

$$\Delta lnp_t = \pi_t = \beta_0 + \beta_1 \Delta lnNM_t + \beta_2 \Delta lnAR_t + \beta_3 \Delta lnAR_{t+12} + \mu_t \quad \text{.....(3.2)}$$

$AR_t$ and $AR_{t+12}$ have the negative relationship with inflation and $NM_t$ seem to have the positive relationship with inflation. When real activity decreases there is a fall in demand for real money and to compensate this price increase. To measure anticipated activity industrial production or real growth is used. $AR_{t+12}$ is industrial production or real growth for the $t + 12$ month. We use Fama's money demand method and use

actual growth rate instead of anticipated real activity as it has more satisfactory attributes to predict inflation. Fama Money demand model is based upon rational expectations.

### 3.1.2 Second Method to Generate Expected Inflation (ARMA Model):

Another method is used to calculate expected Inflation in order to compare results for Fama money demand model and ARMA model.

$$E_t(\pi)_{t+1} = \alpha_0 + \alpha_1 E_{t-1}(\pi_t) + \alpha_2 \epsilon_{t-1} + \in_t \quad \text{.....(3.3)}$$

ARMA and Fama model may have errors in forecasting the expected inflation. To filter those errors we use Adaptive expectations model and that model would give us best-expected inflation to find their relationship with stock prices (Kolluri and Wahab, 2008). So there are two steps just like two-stage least square model, first to develop a model to estimate expected Inflation and second is to calculate inflation.

$$E_t^*(\pi_{t+1}) - E_{t-1}^*(\pi_t) = \beta(\pi_{t-1}) - E_{t-1}^*(\pi_t)$$

$$E_t^*(\pi_{t+1}) = (1-\beta)E_{t-1}^*(\pi_t) + \beta(\pi_{t-1}) \quad \text{.....(3.4)}$$

$E_t^*(\pi_{t+1})$ is forecasted true inflation at time period t but unobserved.

$\pi_{t-1}$ is lagged one-period inflation

Let $E_t(\pi_{t+1}) = E_t^*(\pi_{t+1}) + e_t$

So $E_t^*(\pi_{t+1}) = E_t(\pi_{t+1}) - e_t$

$E_t(\pi_{t+1}) =$ Estimated inflation through ARMA at time period t for the t+1 time period.

If the model is estimated in terms of adaptive expectations then equation (3.4) will show unobserved but true inflation.

$$E_t^*(\pi_{t+1}) = \alpha_0 + \alpha_1 E_{t-1}^*(\pi_t) + \alpha_2(\pi_{t-1}) + \in_t \quad \text{.....(3.5)}$$

As $\alpha_1 = 1 - \beta$

Short-term expectations of inflation are influenced by previous or lagged inflation. To extend the model to make it adaptive expectations model, there is k-lags of independent variables are added.

By putting value of $E_t^*(\pi_{t+1})$ in (3.5) equation.

$$E_t(\pi_{t+1}) = \alpha_0 + \alpha_1 E_{t-1}(\pi_t) + \alpha_2(\pi_{t-1}) + \omega_t$$

$$\text{While} \quad \omega_t = \epsilon_t - \alpha_1 e_{t-1} + e_t$$

Coefficients $\alpha_1$ and $\alpha_2$ are positive and significant statistically and adaptive expectations are designated here.

### 3.1.3 Testing Impact of Expected Inflation on Stock Returns:

Now asymmetric test specification is used to test the relationship between expected inflation and stock returns.

$$R_{t,s} = \alpha + \beta_0 \delta E_{t-1}^*(\pi_t) + \beta_1(1-\delta)E_{t-1}^*(\pi_t) + \mu_t \quad \text{.....(3.6)}$$

While $\delta = 1\ if\ E_{t-1}^*(\pi)_t \geq inflation\ trend\ rate\ otherwise\ 0$

$R_{t,s} =$ Monthly continuously compounded stock returns

$\delta =$Dummy variable which is used to find out different responses of the stock market in return of expected inflation trend level in long run.

Equation (3.6) is the extended version of Fisher (1930) model according to which sum of the expected inflation rate and expected real return can be expressed as the nominal interest rate. This is used for many other assets (original model of Fisher and its following alteration to other categories of asset have always fixed symmetry assumption in reaction of asset returns to alternative inflation rate levels). If market proceeds the information which is available at the t-1 time period and it is efficient to set price for the present or current time period then nominal returns will compensate the expected inflation and assimilate the expected real return. More explaining,

$E(R_t|\Psi_{t-1}) = E_{t-1}(r_t|\Psi_{t-1}) + E^*_{t-1}(\pi_t|\Psi_{t-1})$ .....(3.7)

$R_t$=assets nominal return

$r_t$=equilibrium of real expected return

$\Psi_{t-1}$ =Information set

$E^*_{t-1}$ =Best and unobservable estimate of expected inflation based on information set

Fisher's Hypothesis said that monetary and real sectors are independent of an economy. Expected real returns can be determined by real factors including time preferences of investor, capital productivity, and risk tastes then there is no relation among expected inflation and expected real return. This assumption allows testing the relationship between inflation and asset's return without the requirement of expected real return equilibrium model (Fama and Schwert, 1977).

To generate expected inflation, expected inflation and nominal stock return relationship testing have processed with some specifications as follows:

$R_t = \alpha + \beta E^*_{t-1}(\pi_t|\Psi_{t-1}) + \mu_t$ .....(3.8)

(3.8) equation estimated that the nominal asset return is the function of expected inflation, $\beta$ is positive and it is unity so it is showing that expected inflation and expected real return is independent furthermore nominal asset return and expected inflation are in one to one relationship. (Fama and Schwert, 1977). Equation (3.8) is used in literature in measuring the magnitude and direction of association between expected inflation and stock returns.

Let $E^*_{t-1}(\pi)_t = E_{t-1} - \omega_{t-1}$ now we substitute it in equation (3.8) and we will get:

$R_{t,i} = \alpha + \beta[E_{t-1}(\pi_t) - \omega_{t-1}] + \mu_t$ .....(3.9)

Or it can be $R_{t,i} = \alpha + \beta E_{t-1}(\pi_t) + (\mu_t - \beta\omega_{t-1})$

Now on the next step is to set up equation (3.12) for testing asymmetric stock return behavior conditional on fluctuations of expected inflation from the trending level inflation as follows:

$$R_t = \alpha + \beta_0 E_{t-1}(\pi_t) + (\mu_t - \beta_0 \omega_{t-1}) \quad if\ E_{t-1}(\pi_t) \geq Trend\ Inflation \ldots.(3.10)$$

$$R_t = \alpha + \beta_1 E_{t-1}(\pi_t) + (\mu_t^* - \beta_1 \omega_{t-1}^*) \quad if\ E_{t-1}(\pi_t) < Trend\ Inflation \ (3.11)$$

Now by multiplying both equations (3.10) and (3.11) with $\delta$ and 1- $\delta$ consecutively and combining both equations

$$R_t = \alpha + \beta_0 \delta E_{t-1}(\pi)_t) + \beta_1 (1-\delta) E_{t-1}(\pi)_t + \delta \eta_{0,t} + (1-\delta)\eta_{1,t} \ldots\ldots\ldots\ldots(3.12)$$

Here $\eta_{0,t} = (\mu_t - \beta_0 \omega_{t-1})$ and $\eta_{1,t} = (\mu_t^* - \beta_1 \omega_{t-1}^*)$

$$R_t = \alpha + \beta_0 \delta E_{t-1}(\pi)_t + \beta_1 (1-\delta) E_{t-1}(\pi)_t + \xi_t \ldots\ldots\ldots\ldots(3.13)$$

While $\xi_t = (\mu_t - \beta_0 \omega_{t-1}) + (\mu_t^* - \beta_1 \omega_{t-1}^*)$

We calculated the stock returns relationship with the expected inflation for both the real returns and nominal returns. While real returns are calculated by taking the dissimilarity between monthly compounded nominal stock returns and monthly compounded expected inflation which is obtained by ARMA and Fama model.

An adaptive expectation filter is used to filter out measurement errors, this filters the errors in model and generated expected inflation estimates. Then filtered estimates are used in asymmetric test specification model to analyze the impact of expected inflation on stock returns. These are used in two settings, first is for in sample estimated forecasts and second is out of sample estimated forecasts.

We conducted two in sample tests. First we generated inflation forecasts using data set only once. This results in one set of forecasts only for whole study period (1998m08__2017m06). This approach is called in sample/non iterative. This is most widespread approach in studies. Then we used in sample/iterative approach to forecast expected inflation. In every iteration we get a new set of variables generating time

series of variable estimations. This approach has the advantage to accommodate volatility of variable.

For out of sample forecasting; we use recursive window method by using one step ahead forecasting. In out of sample we used actual inflation to forecast expected inflation. On every estimation we pick and add one actual value of inflation while the earliest value for inflation is fixed.

### 3.2 Econometric Model

For empirical analysis there are two steps. At first stage for the expected inflation we estimated equation (3.14) obtained from Fama (1981) and equation (3.15) is of ARMA model.

$$\Delta lnp_t = \pi_t = \beta_0 + \beta_1 \Delta lnNM_t + \beta_2 \Delta lnAR_t + \beta_3 \Delta lnAR_{t+12} + \mu_t \quad \text{.....(3.14)}$$

$\Delta lnp_t = \pi_t$ =Actual inflation

$NM_t$ =Nominal Money (M2)

$AR_t$=Anticipated real activity (which can be measured by industrial production)

OLS regression technique is used to estimate the equation (3.14)

$$E_t(\pi)_{t+1} = \alpha_0 + \alpha_1 E_{t-1}(\pi_t) + \alpha_2 \epsilon_{t-1} + \in_t \quad \text{.....(3.15)}$$

Where $E_{t-1}(\pi_t)$ =expected inflation of time period t at the time t-1.

$\pi_{t-1}$= previous time period inflation of t-1.

ARMA technique is used to estimate the equation (3.15).

Once the expected inflation is calculated from both Fama (1981) and ARMA. We divided that expected inflation into two groups (high and low) through asymmetric test specification model which we will calculate from both methods. Dummy variable in the equation divide them in groups by assigning “1” to high and “0” to low inflation group and vice versa.

In second stage we calculated real stock returns through expected inflation which we get in first step. After that we analyzed relationship of expected inflation with real stock returns and then nominal stock returns in order to examine whether there is difference between behaviors of nominal and stock returns or not.

Following model is asymmetric test specification.

$R_t = \alpha + \beta_0 \delta E_{t-1}(\pi_t) + \beta_1 (1-\delta) E_{t-1}(\pi)_t + \xi_t$ .....(3.16)

$R_t$ =Nominal or real return on asset

$\delta$ =Multiplicative dummy variable if expected inflation is greater than or equal to trend inflation rate than 1, otherwise 0 (trend inflation will be calculated by taking mean of expected inflation)

$E_{t-1}(\pi)_t$ =Expected inflation of time period t predicted at the time period t-1.

OLS regression technique is use to estimate (3.18) equation.

### 3.3 Data

For study we used monthly data from August 1998 to June 2017.The variables which are used for the study are consumer price index (CPI), stock prices, industrial production and nominal money. The data sources are IFS for consumer price index, business recorder for stock prices. For stock prices KSE 100 index is used. The data of industrial production is not available directly so we used manufacturing production as proxy. The data source for manufacturing production index is IFS and for nominal money data source is State bank of Pakistan. Data for stock prices is not available before July 1998.For inflation prior studies used CPI proxy following those studies CPI is used to calculate inflation.

To calculate inflation we used this formula

Inflation= $ln(\frac{CPI_t}{CPI_{t-1}})$

Where $CPI_t$showing consumer price index of current is time period and $CPI_{t-1}$ is presenting consumer price index of previous time period.

To calculate stock returns we used following formula

$$\text{Stock returns} = ln(\frac{P_t}{P_{t-1}})$$

While $P_t$ is presenting stock prices of current time period and $P_{t-1}$ is presenting prices of previous time period.

### 3.4 Conclusion:

Two models are enlisted to generate expected inflation first is Fama money demand model and second is ARMA model. After generating expected inflation from them we filtered out their errors through adaptive expectation filter. Then we used those results in asymmetric test specification model with the purpose of analyzing the influence of expected inflation on stock returns during high and low time period.

# CHAPTER 4

# RESULTS AND DISCUSSION

## 4.1 Introduction:

This chapter consists of different sub sections. Results for in-sample/iterative estimations of expected inflation/stock returns model are discussed in section 4.1. Section 4.2 describes the in-sample/non iterative estimations of expected inflation/stock returns model. Section 4.3 describes the out-of-sample/iterative estimate results of expected inflation/stock returns model. Section 4.4 shows the results for in-sample/non iterative expected inflation/stock returns model by sub period.

First we go for time series properties, as we have used data of all variables in log difference form, therefore, we have found them stationary at level.

## 4.2 In-sample/non-Iterative Estimates:

In order to examine the relationship between expected inflation and nominal/real stock return, it is required to estimate expected inflation. Expected inflation is used as independent variable in testing model while stock returns are dependent variable. Extended version of testing model includes the variables which are related to inflation and includes in Fama money demand model. Furthermore, in order to estimate extended version it is also required to generate unexpected inflation and change in expected inflation. Change in expected inflation and unexpected inflation is generated from estimated expected inflation. Estimated expected inflation needs to be filtered out of errors.

As it is mentioned before, adaptive expectations filter is used in concurrence with estimated expected inflation is generated through both ARMA and Fama (F-model) models to estimate inflation in order to filter the errors out.

The results of Fama's model are presented in equation (4.1). In regression of actual inflation series on inflation expectations calculated from Fama's model intercept is 0.0075 which is almost zero and value of expected inflation's coefficient is 0.965 which is near unity this shows that there is unbiasedness in estimated expected inflation. Coefficient of expected inflation shows that there is almost one tone relationship between actual inflation and expected inflation. While Durbin Watson value is 1.98 which is near 2 and showing that there is not existence of autocorrelation. R-square is 0.49 which indicates that model is good. While Rmse is 0.55 which is considered as low which presents model is good forecasted.

These are the results of regression for expected inflation calculated from Fama's model:

$$\pi_t = 0.0075 + 0.96502\, E_t(\pi_{t+1}) + \epsilon_t \quad \text{.....(4.1)}$$

(0.8914) (0.000)

R-square =0.49 , Dw = 1.98, Rmse= 0.55

While these are the results of regression for expected inflation obtained from ARMA model:

$$\pi_t = 0.0628 + 0.9803\, E_t(\pi_{t+1}) + \epsilon_t \quad \text{.....(4.2)}$$

(0.2223) (0.000)

R-square= 0.5049, Dw = 1.84, Rmse = 0.54

Where

$\pi_t$ = Actual inflation

$E_t(\pi_{t+1})$ = Estimated Expected inflation

The results for ARMA model are represented in equation (4.2). These are regression results of actual inflation on expected inflation generated from ARMA model. In equation (4.2) intercept is 0.062 which is near zero and coefficient of expected inflation is 0.980 which is close to 1, this shows unbiasedness of estimated expected inflation from ARMA model. Coefficient is showing that expected inflation and actual inflation has almost one to one relationship. Durbin Watson value is 1.84 which is near 2 and it is showing that there is no problem of auto correlation. R-square is 0.50 which is showing model is fit enough. Rmse is 0.54 which is showing that it is good forecasting.

Following table 4.1 is about descriptive summary of forecasted and actual inflation covering time period August 1998 to June 2017. First we calculated average of inflation and used it as a threshold to identify low and high inflation time period. We divided high and low inflation time period by making dummy variable for above average inflation and low average inflation time period. Table 4.1 is showing that there is not a big difference between predicted and actual inflation's proportion. For Fama's model predicted inflation's below proportion is 0.53 and actual's proportion is 0.56 which is not so different from each other. While Above proportion of expected inflation is 0.48 and for actual inflation it is 0.43 which shows that there is not big difference between them. For ARMA model expected inflation proportion is seen more close to actual inflation. As for predicted below average inflation proportion is 0.55 and actual inflation's proportion is 0.56 while above proportion is 0.44 for expected inflation and 0.43 for actual inflation. While deviation from mean is also not having much difference for actual and expected inflation in both Fama model as well as ARMA model but expected inflation of ARMA model are shown more close to actual inflation. Mean of expected inflation calculated from both Fama and ARMA model found to be close to actual inflation's mean in both above and below inflation time period.

**Table 4.1: Descriptive Summary of Forecasted and Actual Inflation (Time period: 1998m08: 2017m06)**

| Variable | N | Proportion | Standard Deviation (%) | Mean (%) |
|---|---|---|---|---|
| **A. Fama Model** | | | | |
| Predicted Below | 118 | 0.53 | 0.23 | 0.10 |
| Predicted Above | 109 | 0.48 | 0.61 | 0.52 |
| Actual Below | 128 | 0.56 | 0.30 | 0.034 |
| Actual Above | 99 | 0.43 | 0.74 | 0.57 |
| Total | 227 | 100 | | |
| **B. ARMA Model** | | | | |
| Predicted Below | 127 | 0.55 | 0.30 | 0.098 |
| Predicted Above | 100 | 0.44 | 0.56 | 0.45 |
| Actual Below | 128 | 0.56 | 0.30 | 0.034 |
| Actual Above | 99 | 0.43 | 0.74 | 0.57 |
| Total | 227 | 100 | | |

Predicted Below= Forecasted inflation< Mean (trend) Inflation
Predicted Above=Forecasted inflation≥ Mean trend) Inflation
Actual Below= Actual Inflation< Mean (trend) Inflation
Actual Above= Actual Inflation≥ Mean (trend) Inflation
Proportion= occurrence of frequency in percentage
Standard Deviation= standard deviation of inflation rate
Mean= Mean of Inflation rate (actual or predicted)

Mean, standard deviation and proportion of predicted inflation for both models are not too different from actual inflation.

Table 4.2 is presenting estimation results of asymmetric test specification model regression. Part (A) of 4.2 table includes the estimation results of asymmetric test specification model and a version of expansion for the nominal stock returns. Part (B) shows the results for real stock returns. We showed four regressions in every part. Equation (1) in part A includes results for the regression using expected inflation forecasted from Fama's model. While Equation (2) is presenting results for the regression using expected inflation forecasted from ARMA model.

**Table 4.2: Regression Results for in-Sample/non-Iterative Estimates**

**A. For Nominal Stock returns**

Fama:

$$NR_t = 2.1143 + 0.0465HiNR_{t-1} - 0.0945LoNR_{t-1} - 0.8375HiE(\pi_t) - 1.4907LoE(\pi_t) + \xi_t$$

(0.017)*** (0.63) (0.31) (0.39) (0.54)

Dw = 2.00, prob ( F-statistic)= 0.02 ……(1)

ARMA:

$$NR_t = 2.2608 + 0.0910HiNR_{t-1} - 0.085LoNR_{t-1} - 0.764HiE(\pi_t) - 1.322LoE(\pi_t) + \xi_t$$

(0.004)*** (0.27) (0.34) (0.45) (0.47)

Dw= 2.05 prob ( F-statistic)= 0.04 …….(1a)

Fama:

$$NR_t = 2.7932 + 0.041HiNR_{t-1} - 0.083LoNR_{t-1} - 1.061HiE(\pi_t) - 2.346LoE(\pi_t) -$$

(0.018)*** (0.67) (0.36) (0.70) (0.06)*

$$0.094HiUnE(\pi_t) - 1.163LoUnE(\pi_t) + 2.527Hi\Delta E(\pi_t) - 4.373Lo\Delta E(\pi_t) - 0.126Hi\Delta lnAR_{t+12}$$

(0.94) (0.46) (0.10)* (0.006)*** (0.24)

$$+0.086Lo\Delta \ln AR_{t+12} - 0.513HiNM_t + 0.182LoNM_t + \xi_t$$

(0.24) (0.35) (0.70)

Dw= 2.05, prob ( F-statistic)= 0.05 ……..(2)

ARMA:

$$NR_t = 3.063 + 0.125HiNR_{t-1} - 0.0677LoNR_{t-1} - 1.920HiE(\pi_t) - 3.671LoE(\pi_t) -$$

(0.004)*** (0.15) (0.45) (0.14) (0.07)*

$$1.904HiUnE(\pi_t) - 2.402LoUnE(\pi_t) + 2.339Hi\Delta E(\pi_t) - 3.076Lo\Delta E(\pi_t) - 0.019Hi\Delta lnAR_{t+12}$$

(0.15) (0.12) (0.081)* (0.02)** (0.89)

$$+0.037Lo\Delta \ln AR_{t+12} - 0.280HiNM_t + 0.002L0NM_t + \xi_t$$

(0.58) (0.63) (0.99)

Dw= 2.07 prob ( F-statistic)= 0.03 ……(2a)

**B. For Real Returns**

Fama:

$$RR_t = 2.052 + 0.067HiRR_{t-1} - 0.087LoRR_{t-1} + 0.505HiE(\pi_t) - 1.743LoE(\pi_t) + \xi_t$$

(0.01)*** (0.49) (0.35) (0.83) (0.05)**

Dw= 2.02 prob ( F-statistic)= 0.02 …… (3)

ARMA:

$$RR_t = 2.211 + 0.068HiRR_{t-1} - 0.071LoRR_{t-1} - 2.33HiE(\pi_t) - 1.676LoE(\pi_t) + \xi_t$$

(0.005)*** (0.49) (0.42) (0.21) (0.10)*

Dw= 2.03 prob ( F-statistic)= 0.03……(3a)

Fama:

$$RR_t = 2.7932 + 0.041HiRR_{t-1} - 0.083LoRR_{t-1} - 2.145HiE(\pi_t) - 3.304LoE(\pi_t)$$

(0.01)*** (0.67) (0.36) (0.44) (0.009)***

$$-0.094HiUnE(\pi_t) - 1.163LoUnE(\pi_t) + 2.610Hi\Delta E(\pi_t) - 4.332Lo\Delta E(\pi_t)$$

(0.94) (0.46) (0.09)** (0.006)***

$$-0.126Hi\Delta lnAR_{t+12} + 0.086Lo\Delta \text{lnA}R_{t+12} - 0.513HiNM_t + 0.182LoNM_t + \xi_t$$

(0.24) (0.24) (0.35) (0.70)

Dw= 2.05, prob ( F-statistic)= 0.05 …… (4)

ARMA:

$$RR_t = 3.050 + 0.100HiRR_{t-1} - 0.063LoRR_{t-1} + 2.83HiE(\pi_t) - 4.709LoE(\pi_t)$$

(0.005)*** (0.33) (0.48) (0.03)** (0.02)**

$$-1.72HiUnE(\pi_t) - 2.28LoUnE(\pi_t) + 2.416Hi\Delta E(\pi_t) - 3.121Lo\Delta E(\pi_t)$$

(0.20) (0.08)** (0.1)** (0.02)**

$$-0.022Hi\Delta lnAR_{t+12} + 0.037Lo\Delta \text{lnA}R_{t+12} - 0.0294HiNM_t + 0.002LoNM_t + \xi_t$$

(0.87) (0.58) (0.61) (0.99)

Dw= 2.04 , prob ( F-statistic)= 0.04 ……(4a)

Note: Hi and Lo with all variables denote high and low inflation time period respectively. $NR_t$ Denote nominal stock retu while $RR_t$ denotes real stock returns. $UnE(\pi_t)$ is unexpected inflation($\pi_t - E(\pi_t) = UnE(\pi_t)$).

$\Delta E(\pi_t)$ is change in inflation expectations. $\Delta lnAR_{t+12}$ is industrial growth which is twelve months ahead. $NM_t$ is growth of nominal money. $NR_{t-1}$ and $RR_{t-1}$ are lagged nominal and real stock returns. R-square is determination coefficient. Wh Rmse is root mean square error. $NR_{t-1}$ and $RR_{t-1}$ are lagged nominal and real stock returns. Inflation expectations are ma t-1 time period.

***, **, * Shows significance at 1%, 5% and 10% significance level respectively.

Equation (1) and (1a) analyzed the relationship of forecasted inflation with nominal stock returns. As there are insignificance coefficients in Equation (1) and equation (1a) which shows that there is no significant relationship between nominal stock returns and Expected inflation.

Equation (2) which is expended version of asymmetric testing model in which variables of Fama money demand are also added. In this Equation all variables found to have insignificant coefficients except low expected inflation and change in expected inflation during low and high expected inflation time period. During low expected inflation time period change in expected inflation has negative significant relationship with nominal stock returns results shows it is has strong impact on nominal stock returns during low inflation by two fold. These results are consistent with Crsoby (2001) results. While during high inflation time period change in expected inflation has positive relation with nominal stock returns. Expected inflation has negative significant relationship with nominal stock returns at significance level of 10% during low inflation time period So Fama's expended model results present that low expected inflation impacts negatively nominal stock returns. Equation (2a) presents results for expended version of asymmetric testing model in which expected inflation calculated from ARMA model and nominal stock returns are used. Results of 2(a) shows that there is impact of expected inflation and change in expected inflation on nominal stock returns during low expected inflation time period. Coefficient of expected inflation and change in expected inflation is significant at 10% and 5% significance level respectively so they are inversely related to Nominal stock returns. These results are agreeing Sellin (2001) and Adrangi et al. (2001). Change in expected inflation is also showing positive relation with nominal stock returns for the

duration of high inflation time period at 10% significance level. While other all variables are insignificant.

Equation (3) is presenting negative relation of expected inflation with real stock returns during low forecasted inflation time periods, as its coefficient is significant at 5% significance level and it is delivering protection of 1.7 fold. Regression results are showing stocks are delivering positive returns during low inflation time period. Equation (3a) is also showing an inverse relationship between real stock returns and expected inflation during low inflation time period at 10% significance level. It is showing that stocks are providing protection against inflation by 1.6 fold.

Equation (4) has consistent regression results with equation (2). It is showing inverse relationship between real stock returns and expected inflation and change in expected inflation during low inflation time period at 5% significance. Moreover there is positive relationship of real stock returns with change in expected inflation during high inflation time period at 10% significance level. While other variables are insignificant. Equation (4a) has also consistent results with above regression results. Results presents that expected inflation, change in expected inflation and unexpected inflation has inverse relationship with real stock returns only during low inflation time period. An inverse relationship is also found between low unexpected inflation and real stock returns during low inflation time period at significance level 10%.These results are in accordance with the above results for nominal stock returns. Results show that stocks performed well in both cases (nominal and real stock returns) when forecasted inflation is low.

Equation (2), (2a), (4), (4a) includes extra variables like industrial growth rate, nominal money growth rate, change in expected inflation and unexpected inflation.

### 4.3 In-sample/Iterative Estimates:

We estimated equation by using expected inflation data which is generated iteratively, by moving forward with a month at a time by using data of ten years every time. First set of data includes first ten years (m06-1988__07-1998) of data. After generating first value we included new forecasted value then after generating second value we included this newly forecasted value and keep on repeating the procedure by adding new value until we get the whole data, then we got 227 recursive estimations from August 1998 to June 2017. Then we used these forecasted inflation observations to estimate asymmetric test specification model.

Table 4.3 is descriptive summary of expected inflation calculated from Fama's model and ARMA model which is calculated through in sample/iterative estimations. Estimations calculated from Fama's model and ARMA model proportions are close to the high and low time period proportions of actual inflation. Which shows that forecasted expected inflation is close to actual inflation.

**Table 4.3: Descriptive Analysis of in-Sample/Iterative Estimates**

| Variable | N | Proportion | Standard Deviation (%) | Mean (%) |
|---|---|---|---|---|
| **A. FAMA Model** | | | | |
| Predicted Below | 117 | 0.51 | 0.2331 | 0.0926 |
| Predicted above | 110 | 0.48 | 0.6118 | 0.5121 |
| Actual Below | 128 | 0.56 | 0.30 | 0.034 |
| Actual Above | 99 | 0.43 | 0.74 | 0.57 |
| Total | 227 | 100 | | |
| **B. ARMA Model** | | | | |
| Predicted below | 106 | 0.533 | 0.265 | 0.081 |
| Predicted Above | 121 | 0.466 | 0.553 | 0.478 |
| Actual below | 128 | 0.56 | 0.30 | 0.034 |
| Actual Above | 99 | 0.43 | 0.74 | 0.57 |
| Total | 227 | | | |

Predicted Below= Forecasted inflation< Mean (trend) Inflation
Predicted Above=Forecasted inflation≥ Mean trend) Inflation
Actual Below= Actual Inflation< Mean (trend) Inflation
Actual Above= Actual Inflation≥ Mean (trend) Inflation
Proportion= occurrence of frequency in percentage
Standard Deviation= standard deviation of inflation rate
Mean= Mean of Inflation rate (actual or predicted)

Table 4.3. is showing that descriptive analysis of expected inflation calculated from both models is close to the values of actual inflation which we get from descriptive analysis. Deviation from mean and mean of both below and high inflation time period are too close to actual inflation values.

Table (4.4) shows regression results for in-sample/iterative forecasted inflation with nominal and real stock returns.

**Table 4.4: In sample/Iterative Estimates**

**(A).For Nominal stock returns**

$$NR_t = \alpha + \beta_0 NR_{t-1} + \beta_1 HiE(\pi_t) + \beta_2 LoE(\pi_t) + \xi_t$$

Fama:

$$NR_t = \underset{(0.01)***}{2.636} - \underset{(0.62)}{0.032} NR_{t-1} - \underset{(0.26)}{2.520} HiE(\pi_t) - \underset{(0.2)}{1.18} LoE(\pi_t) + \xi_t$$

Dw= 2.02, prob ( F-statistic)= 0.051 …….(5)

ARMA:

$$NR_t = \underset{(0.002)***}{2.498} - \underset{(0.67)}{0.028} NR_{t-1} - \underset{(0.20)}{1.318} HiE(\pi_t) - \underset{(0.55)}{1.283} LoE(\pi_t) + \xi_t$$

Dw= 2.02, prob ( F-statistic)= 0. 062 ……(5a)

**(B): For real Stock Returns**

Fama:

$$RR_t = \underset{(0.001)***}{2.636} - \underset{(0.62)}{0.032} RR_{t-1} - \underset{(0.14)}{3.338} HiE(\pi_t) - \underset{(0.02)**}{2.16} LoE(\pi_t) + \xi_t$$

Dw= 2.02, prob ( F-statistic)= 0.04 ……...(6)

ARMA:

$$RR_t = \underset{(0.02)**}{2.498} - \underset{(0.67)}{0.028} RR_{t-1} - \underset{(0.28)}{2.283} HiE(\pi_t) - \underset{(0.02)**}{2.318} LoE(\pi_t) + \xi_t$$

Dw= 2.02, prob ( F-statistic)= 0. 04 ……. (6a)

Note: $HiE(\pi_t)$ and $LoE(\pi_t)$ are high and low expected inflation respectively. Rmse= root mean square error, while R-square= determination coefficient. $NR_{t-1}$ =lagged nominal stock returns, $RR_{t-1}$= lagged real stock returns.

***,**,* shows significance level at 1%, 5% and 10%.

Equation (5) and (5a) is showing that there is no significant relationship between nominal stock returns and in sample/iterative expected inflation.

Equation (6) and (6a) are regression results for expected inflation calculated from FAMA and ARMA with real stock returns. Equation (6) is representing inverse relationship of forecasted inflation with real stock returns during only low inflation time period at 5% significance level. Equation (6) is showing that if expected inflation during low inflation time period increase by one percent there will be decrease in real stock returns by 2.16 percent and vice versa. Equation (6a) is presenting inverse relationship between real stock returns and forecasted inflation during low inflation time period at significance level 5%. Equation (6a) is showing that is expected inflation increase by 1% during low inflation time period then stock returns will increase decrease by 2.31 and vice versa. When investors expect low inflation in future time period they discount dividends by adjusting low inflation which causes real stock returns to decrease. These results are consistent with Rapach (2002) and Caporale and Jung (1997).

### 4.4 Out of Sample/Iterative Estimates:

Estimates for asymmetric testing model using out of sample/Iterative forecasts are presented in table 4.5. Part A of table (4.5) is presenting the results for effect of out of sample/iterative forecasted inflation on Nominal stock returns. First we analyze effect of forecasted inflation generated from Fama's model then we analyze it using forecasted out of sample/iterative estimates generated through ARMA model. These results show that the Expected inflation has significant positive relationship with nominal stock returns during high inflation time period. Which is consistent with Lee *et al*., (2000) who investigated impact of hyperinflation on stock returns of Germany during 1920s and found positive relationship between variables.

While coefficients for low inflation time period are insignificant. While part (b) shows an inverse relationship of real stock returns with expected inflation only during low inflation time period. Equation (8) is showing that if during low expected inflation it increases by one percent then there will be decrease in real stock returns by 1.8 percent and vice versa. While equation (8a) is showing that one present increase in expected inflation will cause real stock returns to decrease by 1.7 percent and vice versa. These results supports findings of Yeh and chi (2009) and Spyros (2001).

**Table 4.5: Out of Sample/Iterative Estimates**

**A. For nominal Stock Returns**

**Fama:**

$$\underset{(0.01)***}{NR_t = 2.064} \underset{(0.6)}{- 0.0623NR_{t-1}} + \underset{(0.03)**}{0.885HiE(\pi_t)} + \underset{(0.9)}{0.262LoE(\pi_t)} + \xi_t$$

Dw= 2.04 , prob ( F-statistic)= 0. 07 ……. (7)

**ARMA:**

$$\underset{(0.007)*}{NR_t = 2.160} \underset{(0.6)}{- 0.027NR_{t-1}} + \underset{(0.03)**}{0.785HiE(\pi_t)} + \underset{(0.5)}{1.299LoE(\pi_t)} + \xi_t$$

Dw= 2.00 , prob ( F-statistic)= 0.07 ……(7a)

**B. For Real Stock Returns**

**Fama:**

$$\underset{(0.01)***}{RR_t = 2.0439} \underset{(0.77)}{- 0.019RR_{t-1}} \underset{(0.72)}{- 0.755HiE(\pi_t)} \underset{(0.06)*}{- 1.88LoE(\pi_t)} + \xi_t$$

Dw= 2.01, prob ( F-statistic)= 0.031 ……...(8)

**ARMA:**

$$\underset{(0.008)*}{RR_t = 2.134} \underset{(0.7)}{- 0.018RR_{t-1}} + \underset{(0.9)}{0.272HiE(\pi_t)} \underset{(0.05)**}{- 1.78LoE(\pi_t)} + \xi_t$$

Dw= 2.01, prob ( F-statistic)= 0.026 ……(8a)

Note: $HiE(\pi_t)$ and $LoE(\pi_t)$ are high and low expected inflation respectively. Rmse= root mean square error, while R-square= determination coefficient. $NR_{t-1}$ =lagged nominal stock returns, $RR_{t-1}$= lagged real stock returns.

***,**,* shows significance level at 1%, 5% and 10%.

Results for part (a) shows that inflation provides a good hedge for nominal stock returns and so that it corrects the Fisher's hypothesis of hedging the stock market. High inflation time period is that time when hedging is needed and results shows that during that time nominal stock returns increase when there is increase in expected inflation. This relationship holds only when inflation is higher than its trend line. These results are compatible with the findings of Lee *et al*., (2000) and Antonakakis *et al*., (2017) which shows a positive relationship between two variables during hyperinflation.

While part (b) is presenting an inverse relationship between real stock returns and expected inflation during low inflation time period. These results are consistent with Rapach (2002) Caporale and Jung (1997) , Modigliani *et al*. (1979) and Feldstein (1980).

By dividing expected inflation into two time periods we showed that expected inflation and stock returns hold inverse relationship when there is low inflation time period. Asymmetric testing model was able to divide the regimes of low and high inflation. So study could analyze the different behavior of stock returns during high and low inflation time period. There is a significant positive relationship found between stock returns and expected inflation when inflation is high and inverse relationship found when inflation is below than its trend level. The first finding is compatible with the Fisher's Hypothesis that when inflation is higher than its trend level it provides a good hedge against stock market. While the second finding shows that on average stock deliver good returns when inflation is lower than its trend level.

### 4.5 Results for Sub Periods:

Descriptive analysis for sub periods shows that there slight difference between frequency of actual and predictive inflation values. Standard deviation and mean is also not so different. Table (4.6) is presenting descriptive summary of expected inflation calculated through Fama's money demand model and actual inflation by dividing it into some periods in part (A). While in part (b) descriptive summary of expected inflation calculated through ARMA model is presented by sub periods of expected inflation and actual inflation.

**Table 4.6: Descriptive Summary of Monthly Forecasted and Actual Data by Sub Period**

| Variable | N | Proportion | Standard Deviation (%) | Mean (%) |
|---|---|---|---|---|
| **A. Fama Model** | | | | |
| Estimation Period: August 1998__December 2001 | | | | |
| Predicted | 33 | 0.80 | 0.285 | 0.157 |
| Below | 8 | 0.19 | 0.306 | 0.146 |
| Predicted | 33 | 0.80 | 0.292 | 0.120 |
| Above | 8 | 0.19 | 0.350 | 0.168 |
| Actual Below | 41 | 1 | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2002__December 2004 | | | | |
| Predicted | 26 | 0.722 | 0.277 | 0.101 |
| Below | 10 | 0.277 | 0.359 | 0.214 |
| Predicted | 22 | 0.611 | 0.322 | 0.043 |
| Above | 14 | 0.388 | 0.527 | 0.393 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2005__December2007 | | | | |
| Predicted | 18 | 0.50 | 0.232 | 0.144 |
| Below | 18 | 0.50 | 0.459 | 0.438 |
| Predicted | 18 | 0.50 | 0.286 | 0.096 |
| Above | 18 | 0.50 | 0.658 | 0.600 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2008__December 2010 | | | | |
| Predicted | 2 | 0.05 | 0.11 | 0.02 |
| Below | 34 | 0.94 | 0.53 | 1.32 |
| Predicted | 11 | 0.30 | 0.210 | 0.006 |

| Variable | N | Proportion | Standard Deviation (%) | Mean (%) |
|---|---|---|---|---|
| Above | 25 | 0.69 | 1.019 | 1.247 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2011__December 2013 | | | | |
| Predicted | 9 | 0.25 | 0.164 | 0.072 |
| Below | 27 | 0.75 | 0.483 | 0.744 |
| Predicted | 15 | 0.41 | 0.329 | -0.041 |
| Above | 21 | 0.58 | 0.700 | 0.755 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2014__June 2017 | | | | |
| Predicted | 30 | 0.714 | 0.277 | 0.093 |
| Below | 12 | 0.285 | 0.601 | 0.344 |
| Predicted | 29 | 0.690 | 0.359 | -0.020 |
| Above | 13 | 0.309 | 0.614 | 0.367 |
| Actual Below | 42 | | | |
| Actual Above | | | | |
| Total | | | | |
| **C. ARMA Model** | | | | |
| Estimation Period: August 1998__December 2001 | | | | |
| Predicted | 32 | 0.780 | 0.263 | 0.145 |
| Below | 9 | 0.219 | 0.355 | 0.183 |
| Predicted | 33 | 0.80 | 0.292 | 0.120 |
| Above | 8 | 0.19 | 0.350 | 0.168 |
| Actual Below | 41 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2002__December 2004 | | | | |
| Predicted | 29 | 0.805 | 0.274 | 0.152 |
| Below | 7 | 0.194 | 0.354 | 0.168 |
| Predicted | 22 | 0.611 | 0.322 | 0.043 |
| Above | 14 | 0.388 | 0.527 | 0.393 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2005__December2007 | | | | |
| Predicted | 18 | 0.5 | 0.275 | 0.184 |
| Below | 18 | 0.5 | 0.467 | 0.435 |
| Predicted | 18 | 0.50 | 0.286 | 0.096 |
| Above | 18 | 0.50 | 0.658 | 0.600 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2008__December 2010 | | | | |
| Predicted | 5 | 0.138 | 0.291 | 0.087 |
| Below | 31 | 0.861 | 0.568 | 1.072 |

| Variable | N | Proportion | Standard Deviation (%) | Mean (%) |
|---|---|---|---|---|
| Predicted | 11 | 0.30 | 0.210 | 0.006 |
| Above | 25 | 0.69 | 1.019 | 1.247 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2011__December 2013 | | | | |
| Predicted | 10 | 0.277 | 0.272 | 0.026 |
| Below | 26 | 0.722 | 0.529 | 0.728 |
| Predicted | 15 | 0.41 | 0.329 | -0.041 |
| Above | 21 | 0.58 | 0.700 | 0.755 |
| Actual Below | 36 | | | |
| Actual Above | | | | |
| Total | | | | |
| Estimation Period: January 2014__June 2017 | | | | |
| Predicted | 33 | 0.785 | 0.398 | 0.005 |
| Below | 9 | 0.214 | 0.480 | 0.232 |
| Predicted | 29 | 0.690 | 0.359 | -0.020 |
| Above | 13 | 0.309 | 0.614 | 0.367 |
| Actual Below | 42 | | | |
| Actual Above | | | | |
| Total | | | | |

Predicted Below= Forecasted inflation< Mean (trend) Inflation
Predicted Above=Forecasted inflation≥ Mean trend) Inflation
Actual Below= Actual Inflation< Mean (trend) Inflation
Actual Above= Actual Inflation≥ Mean (trend) Inflation
Proportion= occurrence of frequency in percentage
Standard Deviation= standard deviation of inflation rate
Mean= Mean of Inflation rate (actual or predicted)

In descriptive summary of sub periods, almost all sub periods shows resemblance in results but during the estimation period of January 2008 to December 2010 there are unusual results then previous time periods. These unusual results are because of global crisis which took place in 2008. Because of these global crisis inflation increases then its trend level.

Table (4.7) is included results for expected inflation/stock returns relationship by sub periods. Part (A) is for relationship of expected inflation with nominal stock returns and Part (b) includes regression results for relationship between real stock returns and expected inflation by sub period.

**Table 4.7: In Sample/non-Iterative Estimations Through Asymmetric Test Specification Model. Extended Results by sub Periods of Study.**

**A. For Nominal Stock Returns**

Estimation Period: August 1998__December 2001

**Fama:**

$$NR_t = 1.050 - 0.502HiNR_{t-1} - 0.272LoNR_{t-1} - 2.245HiE(\pi_t) - 1.223LoE(\pi_t) + \xi_t$$

(0.66) (0.34) (0.13) (0.73) (0.05)**

Dw= 1.94, prob ( F-statistic)= 0.05 ……(1)

**ARMA:**

$$NR_t = 2.441 - 0.473HiNR_{t-1} - 0.264LoNR_{t-1} - 1.463HiE(\pi_t) - 6.173LoE(\pi_t) + \xi_t$$

(0.30) (0.36) (0.15) (0.80) (0.04)**

Dw= 2.0, prob ( F-statistic)= 0.04 ……(1a)

Estimation Period: January 2002__December 2004

**Fama:**

$$NR_t = 3.365 + 0.587HiNR_{t-1} + 0.026LoNR_{t-1} + 0.937HiE(\pi_t) - 2.122LoE(\pi_t) + \xi_t$$

(0.07)* (0.26) (0.88) (0.80) (0.65)

Dw= 2.12, prob ( F-statistic)= 0.08 ……(2)

**ARMA:**

$$NR_t = 4.510 + 0.562HiNR_{t-1} + 0.002LoNR_{t-1} - 1.291HiE(\pi_t) - 5.281LoE(\pi_t) + \xi_t$$

(0.01)* (0.33) (0.98) (0.75) (0.26)

Dw= 1.99, prob ( F-statistic)= 0.03 ……(2a)

Estimation Period: January 2005__December 2007

**Fama:**

$$NR_t = 0.928 - 0.226HiNR_{t-1} + 0.261LoNR_{t-1} + 0.230HiE(\pi_t) + 8.531LoE(\pi_t) + \xi_t$$

(0.71) (0.46) (0.26) (0.94) (0.20)

Dw= 1.99, prob ( F-statistic)= 0.02 …….....(3)

**ARMA:**

$$NR_t = 2.827 - 0.269HiNR_{t-1} + 0.303LoNR_{t-1} - 1.812HiE(\pi_t) + 1.473LoE(\pi_t) + \xi_t$$

(0.29) (0.38) (0.19) (0.60) (0.80)

Dw= 2.10, prob ( F-statistic)= 0.04 ……(3a)

Estimation Period: January 2008__December 2010

**Fama:**

$$\mathrm{NR_t} = 1.513 + 0.158HiNR_{t-1} + 0.166LoNR_{t-1} + 1.73HiE(\pi_t) - 11.473LoE(\pi_t) + \xi_t$$

(0.72) (0.22) (0.20) (0.04)** (0.50)

Dw=1.99 , prob ( F-statistic)=0.03 …… (4)

**ARMA:**

$$\mathrm{NR_t} = -1.530 + 0.164HiNR_{t-1} + 2.977LoNR_{t-1} + 1.352HiE(\pi_t) - 12.165LoE(\pi_t) + \xi_t$$

(0.77) (0.20) (0.13) (0.02)** (0.20)

Dw= 1.92 , prob ( F-statistic)=0.04 …… (4a)

Estimation Period: January 2011__December 2013

**Fama:**

$$\mathrm{NR_t} = 3.828 - 0.195HiNR_{t-1} - 0.061LoNR_{t-1} - 1.814HiE(\pi_t) - 2.457LoE(\pi_t) + \xi_t$$

(0.17) (0.37) (0.84) (0.51) (0.75)

Dw= 1.92 , prob ( F-statistic)= 0.04 ……(5)

**ARMA:**

$$\mathrm{NR_t} = 1.5407 - 0.243HiNR_{t-1} + 0.135LoNR_{t-1} + 0.917HiE(\pi_t) - 1.586LoE(\pi_t) + \xi_t$$

(0.36) (0.26) (0.68) (0.61) (0.64)

Dw= 1.88, prob ( F-statistic)= 0.03……(5a)

Estimation Period: January 2014__June 2017

**Fama:**

$$\mathrm{NR_t} = 0.733 - 0.331HiNR_{t-1} - 0.026LoNR_{t-1} + 2.154HiE(\pi_t) - 0.274LoE(\pi_t) + \xi_t$$

(0.46) (0.29) (0.89) (0.10)* (0.92)

Dw= 1.86, prob ( F-statistic)= 0.04 …… (6)

**ARMA:**

$$\mathrm{NR_t} = 0.9320 - 0.3879 - 0.080LoNR_{t-1} + 3.090HiE(\pi_t) + 0.326LoE(\pi_t) + \xi_t$$

(0.30) (0.27) (0.67) (0.09)* (0.64)

Dw= 1.88, prob ( F-statistic)= 0.07 …… (6a)

---

Note: Hi and Lo with all variables denote high and low inflation time period respectively. $NR_t$ Denote nominal stock returns while $RR_t$ denotes real stock returns. $UnE(\pi_t)$ is unexpected inflation($\pi_t - E(\pi_t) = UnE(\pi_t)$).

$\Delta E(\pi_t)$ is change in inflation expectations. $\Delta lnAR_{t+12}$ is industrial growth which is twelve months ahead. $NM_t$ is growth rate of nominal money. $NR_{t-1}$ and $RR_{t-1}$ are lagged nominal and real stock returns. R-square is determination coefficient. While Rmse is root mean square error. $NR_{t-1}$ and $RR_{t-1}$ are lagged nominal and real stock returns. Inflation expectations are made at t-1 time period.

***, **, * Shows significance at 1%, 5% and 10% significance level respectively.

Table 4.7 is presenting results of sub periods to analyze correlation between nominal stock returns and expected inflation by means of expected inflation generated from the in sample/non-iterative estimations as this method is prior in previous studies. Results are showing that there is insignificance association between stock returns and expected inflation but this is not surprising as stock returns behave noisy during short time span. These results are consistent with the results of Kolluri & Wahab (2008) and Oxman (2012). In some sub periods it is showing significance relationship which is consistent with previous results that there is positive significance relationship amid stock returns and expected inflation during high inflation time period and opposite relationship throughout low inflation time period. Flow of new information in short time period or rumors are the cause of noisy behavior of stock returns in short run. People do have private information but over confidence of investor cause the under valuation of new information in the market. Other investors start herding them and it cause short term fluctuation in the stock market. When there are rumors of increase in stock returns in near future, some investors start buying stocks and others start herding them. As a results there is occurrence of increase in stocks demand which lead to increase in their price and at once that bubble cracks which lead to decrease their prices. The investors who started that rumor they get profit but the investors who are herding them bear the loss in short time span. Because this illusion is for short time period.

## 4.6 Conclusion:

Results are consistent with the findings of Ahmed and Mustafa (2012) as the concluded that there is inverse relationship between stock returns and inflation in Pakistan. Results show that overall there is existence of negative relationship between real stock returns and expected inflation during low inflation time period. While some results show a positive relationship during high inflation time period between stock returns and expected inflation which is consistent with Lee *et al*., (2000) results which shows positive impact of hyperinflation of Germany on stock returns. But mostly results are showing insignificant relationship of stock returns with expected inflation during high inflation time period.

# CHAPTER 5

# CONCLUSION AND POLICY RECOMMENDATIONS

## 5.1 Conclusion:

In this study, it is analyzed the effect of expected inflation on stock returns (real and nominal), and relationship of stock returns with different measures of inflation including changes in inflation and unexpected inflation through asymmetric specification model which is capable of divide stock returns response during low and high inflation time period. To generate expected inflation we used two methods Fama's (1981) money demand model and ARMA model. We used two models instead of one to check the vigorousness of results. We estimated two models in two contexts first is in sample and second is out of sample estimates.

We divided the study period of August 1998 to June 2017 into two parts. First is period of high inflation which is defined as greater than or equal to mean of forecasted inflation and second part is period of low inflation time period which is defined as inflation time period when forecasted inflation is below than forecasted inflation. To reduce measurement errors we used adaptive expectation filter, and we pick fitted values.

We have found that the relationship amid expected inflation and stock returns is conditioned on predicted inflation and its trend in the long run. In sample forecasts results show that there is significant negative relationship between stock returns and expected inflation during only low inflation regimes. But mostly significant inverse relationship is found between real stock returns and expected inflation. Inflation decreases real economic activity which leads to the decrease in money demand which effects corporate profits negatively and so equity prices decreases which became the cause of inverse relationship between inflation and stock price. But when inflation

increases than its trend level profitability increases and so stock returns also increases. In sample/non iterative estimations shows that there is significant inverse relationship between real and nominal stock returns between real/nominal stock returns and expected inflation.

In sample/iterative forecasted inflation and expected inflation estimations shows that there is no significance relationship among nominal stock returns and expected inflation during low inflation time period. While real stock returns have significant inverse relationship with in sample/iterative forecasted inflation in the course of low inflation time period. These results show that during low inflation time period stocks deliver good returns by two fold.

Out of sample/iterative estimations results show significant inverse relationship among real stock returns during low inflation time and expected inflation while it is showing positive relationship between nominal stock returns and expected inflation during high inflation period which is aligned with hypothesis presented by Fisher.

Results for the estimations of stock returns/expected inflation model for sub period are presenting insignificant relationship between them which is because of noisy behavior of stock returns in short time span. If relationship found it is consistent with earlier findings that negative relationship during low inflation time period and positive relationship during high inflation time period.

## 5.2 Policy Recommendations:

This study will help the foreign investors to take investment decisions by taking in account expected inflation. Our study has implication for policy makers to capture the full effect of expected inflation on stock returns. First underlying the causes of change in expected inflation is compulsory to capture the full effect of expected inflation on stock returns. Secondly our study shows that by observing impact of expected

inflation on stock returns covering short time span will not give authentic results. So policy makers have to consider this finding that short time period results are not accurate to analyze relationship between stock returns and expected inflation.

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# APPENDIX

**Table A: Beaulieu and Miron Test for testing unit root**

| | $\pi_t$ (C D NT) | $ln\Delta NM_t$ (C D NT) | $ln\Delta AR_t$ (C D NT) | Critical value | $R_t$ (C ND NT) | Critical Value |
|---|---|---|---|---|---|---|
| **Π1** | -3.540 | -3.27 | -5.44 | -2.76 | -3.87 | -2.79 |
| **Π2** | -5.70 | -3.09 | -3.39 | -2.76 | -4.46 | -1.88 |
| **Π3= Π4** | 35.09 | 9.03 | 9.732 | 6.27 | 20.84 | 3.03 |
| **Π5= Π6** | 28.42 | 7.89 | 9.015 | 6.28 | 16.45 | 2.99 |
| **Π7= Π8** | 42.08 | 13.32 | 8.187 | 6.21 | 18.61 | 3.02 |
| **Π9= Π10** | 32.72 | 13.04 | 12.06 | 6.22 | 23.02 | 3.04 |
| **Π11= Π12** | 23.92 | 9.93 | 8.31 | 6.21 | 19.50 | 3.06 |

**Table B: Additional Results for sub periods**

**For Real Stock Returns:**

Estimation Period: August 1998__December 2001

**Fama:**

$$RR_t = 0.995 - 0.282HiRR_{t-1} - 0.294LoRR_{t-1} - 2.842HiE(\pi_t) - 0.207LoE(\pi_t) + \xi_t$$

(0.68) (0.57) (0.10) (0.69) (0.97)

Dw= 1.94, prob ( F-statistic)= 0. 05 …….....(1)

**ARMA:**

$$RR_t = 1.1412 - 0.479HiRR_{t-1} + 0.182LoRR_{t-1} + 4.263HiE(\pi_t) - 13.069LoE(\pi_t) + \xi_t$$

(0.54) (0.34) (0.30) (0.44) (0.10)*

Dw= 2.15, prob ( F-statistic)= 0.04 ……..(1a)

Estimation Period: January 2002__December 2004

**Fama:**

$$RR_t = 3.337 + 0.213HiRR_{t-1} + 0.068LoRR_{t-1} + 0.329HiE(\pi_t) - 2.357LoE(\pi_t) + \xi_t$$

(0.08)* (0.63) (0.70) (0.93) (0.61)

Dw= 2.02, prob ( F-statistic)= 0.02 …… (2)

**ARMA:**

$$RR_t = 4.510 + 0.562HiRR_{t-1} + 0.002LoRR_{t-1} - 2.291HiE(\pi_t) - 6.281LoE(\pi_t) + \xi_t$$

(0.01)* (0.33) (0.98) (0.57) (0.18)

Dw= 2.2, prob ( F-statistic)= 0.05 …….. (2a)

Estimation Period: January 2005__December 2007

**Fama:**

$$\mathrm{RR_t} = 0.323 - 0.234HiRR_{t-1} + 0.316LoRR_{t-1} - 2.211HiE(\pi_t) + 9.316LoE(\pi_t) + \xi_t$$
(0.89) (0.32) (0.16) (0.95) (0.15)

Dw= 2.08, prob ( F-statistic)= 0.03 …….(3)

**ARMA:**

$$\mathrm{RR_t} = 2.827 - 0.269HiRR_{t-1} + 0.303LoRR_{t-1} - 2.812HiE(\pi_t) + 0.473LoE(\pi_t) + \xi_t$$
(0.29) (0.38) (0.19) (0.42) (0.02)**

Dw= 1.98, prob ( F-statistic)= 0.03 …… (3a)

Estimation Period: January 2008__December 2010

**Fama:**

$$\mathrm{RR_t} = -5.503 + 0.23HiRR_{t-1} - 0.280LoRR_{t-1} + 2.78HiE(\pi_t) + 22.04LoE(\pi_t) + \xi_t$$
(0.40) (0.19) (0.94) (0.54) (0.52)

Dw=1.84, prob (F-statistics)= 0.05 …… (4)

**ARMA:**

$$\mathrm{RR_t} = -1.530 + 1.64HiRR_{t-1} + 2.977LoRR_{t-1} + 0.352HiE(\pi_t) - 13.16LoE(\pi_t) + \xi_t$$
(0.77) (0.20) (0.13) (0.93) (0.16)

Dw=1.92, Prob (F-statistics)=0.04 …….(4a)

Estimation Period: January 2011__December 2013

**Fama:**

$$\mathrm{RR_t} = 1.91 - 0.20HiRR_{t-1} + 0.96LoRR_{t-1} - 1.12HiE(\pi_t) - 1.97LoE(\pi_t) + \xi_t$$
(0.47) (0.24) (0.13) (0.67) (0.78)

Dw=1.86, Prob (F-statistics)=0.02 ……...(5)

**ARMA:**

$$\mathrm{RR_t} = 1.540 - 0.243HiRR_{t-1} + 0.135LoRR_{t-1} - 0.082HiE(\pi_t) - 2.586LoE(\pi_t) + \xi_t$$
(0.36) (0.26) (0.68) (0.96) (0.45)

Dw=1.88, Prob (F-statistics)=0.04 …….(5a)

Estimation Period: January 2014__June 2017

**Fama:**

$$\mathrm{RR_t} = 0.847 - 0.218HiRR_{t-1} - 0.093LoRR_{t-1} + 1.145HiE(\pi_t) - 01.401LoE(\pi_t) + \xi_t$$
(0.41) (0.50) (0.62) (0.39) (0.62)

Dw=1.88, Prob (F-statistics)=0.04 …….(6)

**ARMA:**

$$\mathrm{RR_t} = 0.932 - 0.387HiRR_{t-1} - 0.08LoRR_{t-1} + 2.09HiE(\pi_t) - 0.67LoE(\pi_t) + \xi_t$$
(0.30) (0.27) (0.67) (0.25) (0.73)

Dw=1.89, prob (F-statistics)= 0.03 ……(6a)