Inflation News and Sector Returns: Flow-Through Capability and Market Direction in case of Pakistan

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CERTIFICATE

This is to certify that this thesis entitled **"Inflation news and sector returns: Flow-through capability and market direction in case of Pakistan."** submitted by **Ms. Ayesha Haroon** is accepted in its present form by the Department of Business Studies, 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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Declaration

I Ayesha Haroon hereby state that my MPhil thesis titled **"Inflation News and Sector returns: Flow-Through Capability and Market Direction in case of Pakistan"** is my work and has not been submitted previously by me or any other person before.

At any time if my statement is found to be incorrect even after my Graduation the university has the right to withdraw my MPhil degree.

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DEDICATION

This dissertation is dedicated to my Parents whose love, support, and encouragement enriched my soul and inspired me to pursue and complete this thesis.

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All praises to **ALLAH**, the compassionate, the omnipotent, whose blessing and exaltation flourished my thoughts and thrive my ambitions, provided me a rich environment of learning and cooperative teachers, helping friends, and honored me among those who contribute to the sacred wealth of humanity.

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ABSTRACT

Most of the studies in Pakistan investigated the impact of inflation on the total market returns. We examined the impact of various types of inflation on the Pakistan Stock Market (PSX) sectors, which are classified according to the 'Global Industrial Classification Standard (GICS). To profoundly analyze the inflation news, we consider the 'Flow-Through' and 'Market Direction' hypothesis. Our results were somehow consistent with the two hypotheses. The FTC estimates were different for each sector indicating dissimilar growth and profits among industries. The unexpected inflation affects the sectoral returns depending on the sign of the surprise, economic activity, and flow-through of the sector. An investor needs inflation risk protection so this study would give considerable implications on the behavior of the investor.

Index Terms: Flow-through Capability, Market direction, Inflation news, Abnormal Returns, Inflation Surprises, Economic activity.

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List of Abbreviations:-

ACF	**Autocorrelation Function**
ARMA	**Autoregressive Moving Averages**
ARS	**Abnormal returns for the sector**
FTC	**Flow-Through Capability**
GICS	**Global Industrial Classification Standard**
HP	**Hodrick –Prescott Filter**
MAR	**Mean adjusted Returns**
MMAR	**Market Model Returns**
MSCI	**Morgan Stanley Capital International**
OLS	**Ordinary Least Square**
PACF	**Partial Autocorrelation Function**
PSX	**Pakistan Stock Exchange**
SUR	**Seemingly Unrelated Regressions**

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Chapter 1

Introduction

1.1 Research Background:-

Inflation news affects investor behavior and stock market performance as investor sentiments are vital in managing and hedging the financial risk (Cano et al, 2016). Economic theory states inflation is the rise of prices while the news of inflation is the perception by the financial decision-maker. As per, the market performance depends on how the investor reacts to the news (Veronessi 1999). The condition of the market affects investor perception and they make inefficient decisions due to new information. There has been a long debate in financial literature that explains the relationship between investor behavior and stock market returns. Studies like McQueen and Roley (1993); Docking and Koch; (2005), and Rehman (2013) examined investor behavior quite expressively. They specified that investor behavior depends on the type of news, condition of the economy, and the size of the available portfolio. Several studies examine the inflation announcement and conclude that the impact of the news depends on the business cycle and economic activity.

Countless studies discussed the unexpected inflation movements and their effect on market returns with controversial results. Fama & Schwert (1977) found a significantly negative association between returns of stock and inflation changes. This is due to the correlation between inflation and future output (Bodie, 1976). Whereas Pearce & Rowley (1988), found an insignificant relationship. A review article by Madadpour and Asgari (2019), of 150 research articles explain inflation affects stock returns negatively. The mainstream articles reported the negative impact of inflation & stock returns that inflation reduces the real factor of return and rejected the Fisher hypothesis (1930).

By extending the literature, the relationship between unexpected-inflation and stock returns could be expressed by the flow-through capability (FTC) and market direction (MDH) hypothesis. Generally, FTC represents the inflation sensitivity of companies. Estep and Hanson (1980) define Flow-through capability, as the company's ability to transfer the inflationary shocks to output prices and profits. It is due to causation runs from inflation to stock prices and both variables are crucially related (Rashid; 2008). So higher the FTC coefficient of firms shows lesser sensitivity towards inflation changes. While the market direction hypothesis is the investor or market response towards the news or information (Veronessi 1999). The empirical studies on Spanish and US stock markets show significant differences in FTC among sectors, depending on the inflation news and economic activity (Diaz & Jareno, 2013; Cano et al., 2016). The authors conclude that the inverse relation of inflation and stock price is because of the firm's capability to send inflationary shocks to its prices. Various other studies explain the negative association between stock returns and unexpected inflation in the literature. Fama (1981) introduces the proxy hypothesis for the inverse relationship between inflation and stock returns. The relation was due to spurious inflation which acts as a proxy and the main determining factor was the economic activity. High inflation decreases the ratio of stock price-earnings (Feildstein, 1978).

Rahman (2011), studies the announcement effect on the Pakistan Stock market with significant results. Ahmed and Ullah (2013), investigates the investor's sentiments towards the market that investors respond according to their sentiments. Psychological factors play a vital role in financial decisions. The effect of inflation on stock returns has been an important issue of concern for years. Kibria et al., (2014) state that due to the high inflation rate in Pakistan, this influence becomes more significant and has an adverse influence on economic activities. The latest study of Yasemin (2019), indicates that inflation rates and the state of the economy are two important determinants of market returns. Without considering these, macroeconomic risks cannot capture the impact on returns.

We emphasize the two plausible hypotheses. First, the Veronesi (1999) arguments of investor behavior towards new information. Investor ambiguity typically increases if the news is against the direction of the market. They react more to bad news than good news. Second is the Estep and Hanson (1980) proposition for unexpected inflation and stock returns. In this study, we deal with the unexpected inflation and stock returns relation based on the sector activity of the Pakistan Stock Market (PSX). We classified the PSX sectors according to the Global industrial classification Standard (GICS). The impact of different types of inflation is observed in sector returns. We used Jareno and Navarro's (2010) approach for FTC and the results are consistent with the empirical literature. At long last, we consider the inflation surprises and economic activity to analyze the response of unexpected inflation on sector returns.

Our results somehow corroborate the existing literature. As per the Flow-Through capability, each sector illustrates different growth rates/ profits. Whilst to the Market Direction hypothesis, the returns are affected by economic activity and sign of the news. The negative relation of inflation and sector returns represents higher inflation have lower returns. Being a developing economy, our market is highly affected by inflation surprises either positive or negative.

The Pakistan Stock Market is an emerging market, but unpredictable and sensitive to unexpected news. Existing literature suggests that our capital market is affected by inflationary spikes. Pakistan is a developing country with a significant budget deficit and inflation pressures which ultimately affect the system including our stock market. According to the available literature for Pakistan, as mentioned above, the authors investigated the relationship between stocks and inflation as a whole. Thus, the study aims to analyze the inflation surprises and behavior of investors in the Pakistan stock market (PSX) sectors by applying the FTC and market direction hypothesis. The specified work has been conducted in developed economies like the US and Spain. The study contributes to the context of developing economies. That the sectors of PSX are inflation-sensitive and the unexpected movements of inflation change the investor behavior.

Further, this chapter comprises the problem statement, research gap, objectives, and the significance of the study. Chapter 2 consists of a literature review for the proper understanding of the study. Nonetheless, Chapter 3 briefs about the data, variables, and methodology used for the estimation process. Chapter 4 is about results and discussion while chapter 5 deals with conclusion and policy implications.

1.2 Problem Statement:-

Pakistan Stock Market is volatile and most of the time reacts significantly to unanticipated shocks. In past, studies by Qamari et al., (2015) and Ghani et al., (2016) have shown the significant impact of inflation changes, affecting the returns of stock, which can make the investor ambiguous about the market and they make inefficient decisions. An investor's uncertainty is related to the risk of the stock/portfolio (Ahmed & Ullah, 2013). As sentiments play a vital role in market development. For efficient financial decisions, an investor (either local or international) needs inflation risk protection before investing in any firm/sector. The study investigated the inflation sensitivity and unexpected inflation movements, among the sectors of PSX that explains the investor/market behavior. Developing countries like Pakistan can use such a tool to stimulate portfolio investments. So, sector analysis is important for better investment decisions. The asymmetries (good/bad news) and economic activities like expansion and recession are included in the study to examine the impact more deeply.

1.3 Research Gap:-

Sector study (via FTC & MDH) is a novel contribution to the developing economies academically, as available literature is focused on a few developed economies. According to the valuable study of Cano et al., (2016) an investor needs inflation risk-protection before making investment plans, and Pakistan being a developing country, direly needs inflation risk protection for sustainable growth of the stock market. Sector study hasn't been conducted in our country, so this research covers this. The study not only tests the inflation news impact on stock returns, it further extends the analysis to unexpected and expected inflation to check the impact on the sector-returns. Moreover, the asymmetric effects of inflation and the inflation sensitivity of sectors of PSX is a new input in the existing literature. Furthermore, the sector classification of PSX is done with the help of the 'Global Industrial Classification Standard' (GICS) as previously no study conducted this.

1.4 Objectives of the Study:-

The specific purpose of this research is to examine the impact of inflation news at the industry level. For this, two methods are used to calculate the abnormal returns as a benchmark. Inflation is decomposed as total, expected and unexpected inflation, and their effect is observed on the sector-wise abnormal returns. The second objective is to check the inflation sensitivity of each sector by measuring 'Flow-through capabilities'. FTC for each sector is computed by applying seemingly unrelated regressions. Last is to analyze the inflation news surprises i.e. positive news or negative news on the sectors by taking into account 'news direction', and 'state of the economy' to understand the unexpected inflation movements and investor behavior. For this purpose, we used dummies to examine the asymmetries of inflation in the final model to study the impact more deeply.

1.5 Significance of Study:-

Inflation news plays a significant role before taking or planning investment decisions because it affects the performance of the market and the behavior of financial decision-makers (Cano et al., 2016). It makes them uncertain about taking further actions which leads to inefficient decisions. The study is important to investors, fund managers, and shareholders in making investment decisions and portfolio management, by estimating sector sensitivity towards inflation changes and in which sector they should invest for more profit/returns. An investor needs inflation risk-protection, and Pakistan being a developing country, direly needs inflation risk protection for sustainable growth of the stock market. The flow-through capabilities of each sector enable them about sector sensitivity towards inflation.

This particular area of study has been conducted in a few developed economies. As, the investor seeks protection from inflation risk, to secure his portfolios (Cano et al., 2016). FTC is a noteworthy tool before making financial decisions. Speculators in developing economies can use FTC information to predict the behavior of the market by hedging their returns because inflation and stock prices have a knock-on effect relationship (Rashid; 2008). Pakistan being a developing country, has a significant effect of inflation changes on the PSX (Ahmed and Mustafa, 2012). So this sector-analysis can be beneficial for investment owners and play a vital role in boosting the stock market development.

Furthermore, the 'Pakistan Stock market' sectors are classified according to the 'Global Industrial Classification Standard' for simplicity, long term, and international industry view-point standard. It is beneficial for local as well as foreign portfolio managers while assessing the stocks and taking efficient investment decisions in our stock market.

Chapter 2

Literature Review

Before moving forward to the study, it is necessary to have some knowledge regarding theoretical and empirical literature on inflation news and stock returns. The influence of inflation changes on the value of stock and returns has given rise to extensive literature and has been a topic of concern over the past decades. For better understanding, this chapter is divided into sub-sections regarding different aspects of the study.

Each sub-section is about different dimensions of the topic. Section 2.1 is about the difference between inflation and its news. Section 2.2 shows the theoretical link between inflation and stock returns. How the inflation rate, affects the value of a stock. Section 2.3 deals with the inflation news and the stock returns. Section 2.4 will brief about 'Flow-Through Capability' and 'Market Direction' hypotheses, which will further explain the puzzling relation of 'inflation news & stock returns'. Section 2.5 is further divided into international compilations and reviews related to Pakistan. This section shows the empirical shreds of evidence related to the study. Section 2.6 is about the literature related to methodology.

2.1 Inflation Rate and Inflation News:-

According to basic economics, Inflation is the rise in the price of goods and services over a specific time. An inflationary rise decreases the value of money and purchasing power (Singh et al., 2020). The monetary policies by the central bank impact the overall economy. The State bank of Pakistan (SBP) announces monetary policies every two months, which seldom leads to inflation changes. Inflation news is considered as the perception of inflation by agents. Therefore, here monetary policy declared by SBP, is taken as inflation news while the Consumer Price Index is an indicator of inflation. There are different price indices for measuring inflation. In Pakistan, the Consumer Price Index (CPI), Sensitive Price Index (SPI), and Wholesale Price Index (WPI) are employed. Among these, CPI is the standard one of them all (Subhani et al., 2010). And is frequently used for policy-making and investment decisions (Dawn articles, 2019).

2.2 The Theoretical Framework of Inflation and Stock Returns:-

According to Uwubanmwen & Eghosa (2015) the theoretical link of the inflation rate and stock returns can be explained by succeeding economic theory. The theory states high inflation decreases the value of money and purchasing power. There exists a negative relation between inflation and stock returns. This can be expressed as when there is high inflationary pressure, the purchasing power tends to decrease which reduces the production activities because people think, the stock market is in trouble & looks unprofitable. Consequently, the resources shift from investment to consumption, investors pulled their investments out and stops buying shares due to the low value of money. When the value upon which investors purchase decreases, it affects the trading volume, which ultimately eats up the corporate profit. This makes the expected returns decline and that leads to lower stock returns. Therefore, high inflationary spikes negatively affect the returns of a stock (Fama 1981, Bodie 1976). A review article by Madadpour and Asgari (2019), presented a critical review of more than 150 research articles to survey the association between inflation and stock returns. The mainstream of papers reported a negative relationship meaning inflation reduces the real factor of stock returns.

2.3 Inflation News and Stock Returns:-

For determining the inflation news impact on stock returns, a large body of literature explains the relationship. The association of unexpected inflation, expected and inflation changes are very controversial. First, the Fisher Proposition (1930), stated that the real interest rate is independent of changes in expected inflation. Inflation cannot reduce the returns of stock but in empirical analysis, this hypothesis was rejected. Afterward, many papers reported the negative relationship meaning inflation reduces the real factor of stock return.

Schwert (1981) examined the CPI announcement effect on stocks and concluded a negative market association. McQueen and Roley (1993), the stock market reacts adversely to the bad news when the economy is in a good state. This is due to bad news is more effective than good news. Various studies explained that macroeconomic news depends on the size of the portfolio, type of news, and economic condition (Cenesizoglu, 2011). Every asset reacts differently to the same news. Likewise, Knif et al (2008) elaborated on the good and bad news differences. They concluded that the market reaction towards the news depends on the economy’s condition and investor's perception. The inflationist shocks (unexpected movements) can be further explained by (Estep and Hanson, 1980 & Veronesi, 1999).

2.4 ‘Flow-Through Capability’ and ‘Market Direction’:-

Two different hypotheses will enlighten the unexpected inflation movements concerning stock returns. First is, Estep and Hanson (1980) proposed the ‘Flow-through hypothesis’ that the higher the FTC coefficient, the higher will be the chances of firms to transfer inflationary shocks to output prices and profits. Higher the FTC coefficient of firms shows lesser sensitivity towards inflation changes. The reason is if a company can pass (inflation) shocks to the stock prices/profits then there would be less impact of inflation on the prices of stock.

So, the negative relation of inflation is related to the firm's FTC, which means that not all firms/companies have the ability to sustain growth during inflationary time. The second is, ‘Market direction hypothesis’ by Veronessi (1999), which states that when the economy is flourishing, the stock prices overreact to ‘bad news’ and vice versa. It happens because when the news is against the market condition, the investor's ambiguity increases, the market becomes volatile and the investor makes inefficient decisions. Diaz and Jareno (2013) in their work, studied the ‘inflation news’ effect on the Spanish stock market considering the ‘flow-through capability’ and ‘market direction’ arguments. Cano et al., (2016) also inspected the behavior of investors along with FTC in the Stock Market of the USA.

2.5 Empirical Evidence:-

2.5.1. Brief Compilations related to the Study Internationally:-

There has been a lot of literature available for the relation of ‘inflation changes and stock returns’. But here are some summaries related to this specific study.

Schwert (1981), studied the ‘stock price response’ towards inflation news. He investigated daily stock returns response to ‘inflation news announcement’ and found a negative relationship. One of the main conclusive findings was stock market reacts to unexpected inflation when the ‘Consumer price index’ (CPI) was announced. It doesn’t react while the sampling of CPI i.e. before the announcement date.

The ‘Rational Expectations Equilibrium Model’ of Veronessi (1999), explains that investor rationally anticipates their future cash flows and react readily to the available news. The author examined the role of ‘uncertainty and investor's degree of risk aversion’. The investor hedges the changes by their intuition and ‘uncertainty of risk’. By which the market ‘overreacts’ to bad news and ‘underreacts’ to the good news. He concluded that due to increased sensitivity towards the news, the percentage of the volatility of asset prices also rises.

Anari and Kolari (2001), observed the Fisher effect utilizing stock returns and inflation in the long run. The variables were constructed on the first difference of inflation & stock prices which eliminated the effect of long-run information. To overcome this issue, they scrutinized the monthly goods price indices and stock price indices for countries employing co-integration methods. The results of Fisher elasticities of stock prices for goods prices were greater than unity in the long run. They established that there exists a 'negative' short-run relation of stock prices to inflation rise. Furthermore, they disclosed that stock prices have a long memory due to shocks in goods prices, which can be beneficial to investors. As they expect stocks to be a good inflation hedge because of the positive long relation of stocks and inflation over an extended holding time.

Adam et al., (2004) in their study examined the effect of inflation announcements on high-frequency stock returns. They concluded inflation has an impact on stock returns which causes an increase or decrease in wealth. Unexpected rise/fall in PPI or CPI causes stock prices to fall/rise. Additionally, the stock-inflation association is state-dependent. The relationship is stronger when the economy is flourishing and the news is bad for higher stocks and vice versa.

Docking & Koch (2005), studied the 'investors behavior' towards market direction and volatility. Specifically, they examined the stock market's response to dividend change news which was systematically linked with the direction or volatility of the market. They concluded that the lower 'dividend announcement' news affects the stock prices & returns negatively when the market is in good condition. While higher 'dividend announcement' increases the stock prices, during the normal or bad condition of the market.

Díaz & Jareño (2009), in their study of the daily response of the Spanish stock market to 'inflation announcement' news, concluded that there has been a substantial positive response of stock returns, in case of 'bad news' and insignificant negative response of stock returns in case of 'good news'.

Geeta et al., (2011) found the long-run effect of inflation and stock returns in the case of Malaysia, the US, and China. Their findings showed that macroeconomic variables were linked to share prices which affect the stock market. Stock markets were affected by inflationary pressures, reducing the current value of future profits and returns. Additionally, Malaysia, China, and the US need to mend their monetary policy with inflation expectations. This paper emphasized the significance of macroeconomic variables in impelling the stock market along-with the inflation which is a principal issue and the focus of the government. The outcome suggested that Malaysia, the US, and China should utilize the information on inflation components, exchange rate, interest rate, and GDP to predict the stock market.

Aliyu (2012), examined the impact of inflation on stock-market returns and volatility in the Nigerian Stock market (NSM) and Ghana Stock market (GSM) using GARCH models. They concluded bad news has a significantly higher effect on stock volatility than good news in NSM and the opposite in the case of GSM. Second, inflation was one of the main determinants of volatility in the market. The findings can be useful to investors in making good portfolios.

Jareno and Tolentino (2012), examined inflation risk management, by studying the responsiveness of stocks to interest rate variations and the 'Flow-through capability' of Spanish firms. They found a negative affiliation with the stock period and flow-through capability. Firms with a high level of flow-through capability are not as inflation-sensitive as industries with a low FTC. Higher the FTC, lower is the inflation sensitivity and this flow through ability plays a vital role in assessing the stock/asset duration.

Diaz and Jareno (2013), in their work, studied the 'inflation news' effect on the Spanish stock market considering market direction arguments, proposed by Veronessi (1999) and the 'flow-through capability' of firms, hypotheses presented by Estep and Hanson (1980) for sector analysis. They found that sectors having low 'flow-through capability' have a significant impact on inflation changes. The FTC coefficient reveals that not all industries have the same ability to maintain growth during an inflationary period depending on sector/companies, given 'market direction' and 'state of the economy'.

Cano et al., (2016), inspected the behavior of investors and 'Flow through capability' in the Stock Market of the USA. They demonstrated the direct relation of fluctuations in stock prices and Flow-through capability at the sector level. The main objective was to assess the capability of American corporations to transfer inflation shocks to the prices of the products and there was a significant difference of FTC at the sector level per existing literature.

Ferrando et al., (2017) inspected that investor behavior depends on the variations in market activities. For instance, a higher 'dividend announcement' will increase the prices of stocks and vice versa. This established a connection between the nature of firm news either good or bad and the direction and impulsiveness of the market. The conclusion contradicts Veronessi's (1999) inference of the market underreacting in a bad time in case of good news while it was reliable with other inference investors will overdramatize to bad news when the market is up.

Jareno et al., (2019), presented two opposite methods for the estimation of the company's ability to transfer inflation shocks to output prices or FTC and interest rate sensitivity or IRS at a sector level. Both methods can be equally used for the calculation of FTC or IRS. In the end, they concluded that sectors with higher flow-through were less sensitive to interest rate risk and this higher flow-through has a negative relationship with interest sensitivity. Results have pertinent implications for executives and investors before making investment decisions for each sector.

2.5.2. Review Related to Pakistan:-

Few brief reviews of ‘inflation and stock returns’ concerning Pakistan are as follows.

Khan (2004) explained in his case study that Pakistan's stock market is always hampered because of interventionist economic policies, domestic factors, and debt financing. The stock market is a barometer for measuring investment climate and future growth. They concluded that inflation affects the performance of the market. As inflation generates ambiguity about future returns and aggravates the stock market resistances. It could also provide reasons for the government to repress the financial sector to collect inflation tax revenues.

Another case study of Pakistan was conducted by Ahmad and Ullah (2013) where they investigated whether investor’s sentiments have any influence on returns of Karachi Stock Exchange (KSE) returns. Investor sentiment has proven to be a systematic factor in affecting stock prices. They concluded that sentiments do fluctuate according to the economic conditions of the country. Anyhow, the results highlight that inflation, one of the most important issues of our country negatively impacted the stock index returns while the sentiments projecting a positive and significant impact in the short run. So, sentiments play a major role in making an investment decision.

Saleem et al., (2013) in their study demonstrated the long-run association between Karachi Stock Exchange (KSE) 100 index return and inflation in Pakistan. The corroboration of the co-integration test shows the negative relation between both variables because inflation badly affects our economy which as a result affects the stock returns.

Mahmood et al., (2015), in their manuscript of inflation and stock price, inspected the relation between them. According to market hypotheses, prices reflect informational content. So, they concluded that inflation inversely affects stock prices, by pressuring them.

Qamari et al., (2015), in their empirical study, investigated the relation of inflation and prices of stock. They conducted a study on data of the past ten years' prices of KSE-100 and the results were consistent with the literature i.e. negative relationship. Further, they discussed, when low firms couldn’t enter the market then state bank provides them investment plans for investing in the capital market.

The policy announcement study of Ghani et al., (2016) for the banking sector is one of the contributions to finance in Pakistan. The main goal of the study was to check the impact of monetary announcements for the year 2014-2015 on the ‘Pakistan stock market’. They analyzed the impact with the help of an event study by calculating daily abnormal returns. The results were in line with the literature that there has been a visible effect of the announcement on all banking firms of Pakistan.

2.6. Literature Review for Methodology:-

2.6.1. For Abnormal Returns:-

Abnormal returns are an essential valuation tool for investors to check the performance of the company’s stock returns to market returns. It is generally used to study the influence of macroeconomic variables on stock returns. Various methods have been used for the calculation of abnormal returns. According to Dyckman (1984) following five models are generally used. Mean Adjusted Returns, Market Adjusted Returns, Market Model Returns, Scholes William Beta Model, and Dimson Beta Model. Usually, the market model is used as a benchmark analysis for the estimation of abnormal or excess returns. Furthermore, according to the research Capital Asset Pricing Model or CAPM, an alternate to market model, is also used to estimate excess returns. It is said that the CAPM and market model both give quite similar results but due to several restrictions applied to CAPM and simplicity, the market model is more preferred.

2.6.2. For Flow-through Capability (FTC):-

Flow-through capability is significant for investors because it will help in managing inflation and interest risk. Jareno & Navarro's (2010) theoretical model is generally applied to measure FTC. Previously, this model was applied to Spanish and US Stock markets for the estimation of the FTC of each sector. Furthermore, Jareno et al., (2019) proposed two alternate methods for estimating FTC for sectors. Both methods are alike only the company's production proxy variables are changed, instead of the number of employees operating costs were used. Both give quite the same results.

2.6.3. For Components of Inflation:-

Different methods have been used to measure expected inflation by different researchers. Schmeling and Schrimpf (2010) applied a survey method to compute expected inflation. Mankiw (2001); while Fama (1981) used the money demand model. Geske and Roll (1983) used the adaptive expectation model to generate the expected inflation series. Most commonly ARMA model is widely used to generate expected inflation because it provides the best possible estimates. It is dependent on the past of the series.

Chapter 3

Data & Methodology

This chapter is further divided into sub-sections. Section 3.1 deals with data and classification of sectors of PSX. Section 3.2 deals with variables, their construction, or availability with a brief description. While the last section is about the methodology used for finding empirical results of the study.

3.1. Data:-

According to the PSX progress report (2019), there are 536 listed firms in Pakistan's stock market. For research convenience, we selected listed companies under the canopy of **PSX-100** which represent our stock market sectors. Due to the non-availability of variables data, a sample of 74 firms out of 100 is taken while the sample period of **2004-2019** is used for this study.

As of June 2017, Morgan Stanley MSCI elevated the Pakistan index to emerging markets. MSCI Pakistan Index is now reckoned among the leading group of indices[1]. In this study, we classified Pakistan Stock Exchange PSX 35 sectors into 9 sectors according to the Global industrial classification standard (GCIS) developed by MSCI for simplicity, long term, and complete global investment view from an industry standpoint. GCIS is an industry taxonomy beneficial for the international financial community. It is beneficial for assessing stocks while planning an investment decision. Its structure consists of 11 sectors and 24 industry groups[2].

[1] including China and Korea on top among others. It will encourage the investment potential in the Pakistani Capital Market at the global level. The inflow of foreign capital will be beneficial & push the index to new levels.

[2] GICS sectors are Energy, Materials, Consumer discretionary, consumer staples, Health care, Financials, Real estate, Industries, Information Technology, Communication Services, and utilities

To make homogeneous estimations, the technology and communication sectors are combined and the real estate sector is removed[3]. The modified classification of sectors is as follows.

Table 3.1 Sector Classification

GICS		**Pakistan Stock Market Sectors**		**No. of firms**
Sector 1	**Energy**	Oil & gas exploration companies	Vanaspati & allied industries	**10**
Sector 2	**Materials**	Oil & gas marketing companies	Refinery	**9**
		Chemical	Fertilizer	
		Paper & board		
Sector 3	**Consumer Discretionary**	Textile composite	Leather & tanneries	**17**
		Synthetic & rayon	Textile spinning	
		Automobile assembler	Textile weaving	
		Automobile parts & accessories	Woolen	
Sector 4	**Consumer Staples**	Food & personal care products	Tobacco	**6**
		Sugar and allied industries		
Sector 5	**Health Care**	Pharmaceuticals		**4**
Sector 6	**Financials**	Commercial banks	Closed-end mutual fund	**14**
		Inv. Banks / inv. Cos. / securities cos.	Modarabas	
		Insurance	Leasing companies	
Sector 7	**Industries**	Cement	Engineering	**10**
		Glass & ceramics	Transport	
		Cable & electrical goods		
Sector 8	**Technology and Communication**	Technology & communication		**2**
Sector 9	**Utilities**	Power generation & distribution		**2**
Total				**74**

Table 1 shows the grouping of PSX 35 sectors into 9 GICS groups under the canopy of PSX-100

[3] Due to non-availability of data of real estate firm, this sector is excluded.

3.2. Variables and their Description:-

The following variables are required for the estimation of inflation news among sectors of PSX. Some will be constructed while others are available directly. There sources and availability is mentioned below.

Table 3.2 List of Variables

Sr. no	**Variables**	**Notation**	**Construction**	**Availability**	**Frequency**	**Source**
1	Abnormal Returns	**AR**	Constructed from Market model Returns & Mean Adjusted Returns with the help of stock prices	Stock prices are Available	Monthly	investing.com
2	Total Inflation	$\boldsymbol{\pi}^t$	Constructed from CPI	CPI is available on IFS		IFS
3	Expected Inflation	$\boldsymbol{\pi}^e$	Obtained from the ARMA model			
4	Unexpected Inflation	$\boldsymbol{\pi}^u$	The difference between total & expected inflation			
5	Net Sales/Turnover	**NS**		Directly available from Annual Reports	Annually	psx.dps/BR
6	Number of employees	**EM**				
7	Industrial production Index	**IPI**		Directly available from IFS	Monthly	IFS

Variables are required to check the response of ARS to inflation news.

Now variables description is defined as follows:-

3.2.1. Abnormal Returns:-

For the construction of abnormal returns, first, we need to calculate stock returns of companies under the canopy of PSX-100 and market returns (PSX-100) from their respective share prices. Later these stock and market returns are used in the model to obtain abnormal returns as explained in methodology later.

***Stock Returns**:* Stock returns are not available directly so we will construct them from their share prices. We obtained monthly share prices of the companies and overall monthly PSX-100 share price data. By using formula returns will be generated:

$$\text{Stock returns} = \ln\left(\frac{P_t}{P_{t-12}}\right) \tag{1}$$

Where P_t represents the share price at the current period while P_{t-12} denotes the share price in the previous time.

3.2.2. Components of Inflation:-

The components of inflation i.e. total inflation, expected, and unexpected inflation are used to check the impact on abnormal returns. To obtain these, firstly, CPI is used to calculate the inflation rate as a proxy for inflation. CPI is the standard indicator to measure the inflation rate (Subhani et al., 2010).

Total Inflation: From CPI, the total or actual monthly inflation rate is obtained by using the formula:

$$\pi_t = \ln\left(\frac{CPI_t}{CPI_{t-12}}\right) \quad (2)$$

Where CPI_t shows the consumer price index in the current time and CPI_{t-12} is the consumer price index of the previous period.

Expected inflation: ARMA modeling is used to calculate expected inflation. It depends on lagged values and gives the best possible results, (Diaz and Jareno, 2013).

Unexpected inflation: The unexpected component is derived from the difference between observed total inflation and the expected inflation rate (Diaz and Jareno 2013).

$$\pi^u = \pi^t - \pi^e \quad (3)$$

3.2.3. For Flow-through Capability:-

The following variables are required for estimating the inflation sensitivity or ‘flow-through capability’ for each sector. The frequency for FTC variables is annual. FTC is just a *coefficient* that expresses the inflation sensitivity of the sectors. A brief discussion of variables for computing FTC is given below.

Net Sales: Net sales are the accurate presenter of the company’s overall sales. They are relevant to the decision-making process (Evah Kungu 2018). Some represent them as the revenue/turnover of firms. Moreover, the sales variable is used instead of profit because profit is a volatile variable (Jareno and Navarro 2010). We also are using the sales variable for computing FTC.

Inflation rate: According to the given FTC model, the inflation rate is used as a proxy for the increase in prices for the company's goods/ services provided (Jareno and Diaz 2013). We used the consumer price index to calculate the inflation rate.

Number of employees: Jareno and Diaz (2013) used the number of employees as proxy variables for company production. We also adopted this in our study for estimating 'Flow-through capabilities'.

3.2.4. Industrial Production Index:-

The industrial production index or IPI is required to classify the economic activity into different levels for examining inflation surprises.

3.3. Research Methodology:-

3.3.1. Introduction:-

After, a brief variable description here comes the process for the sector analysis. The step-wise precise description of the whole procedure is given. Afterward, the techniques and the methodology for each step is elaborated.

1: Abnormal returns for each sector are attained using the mean adjusted returns and the market model returns utilizing the monetary policy dummy as inflation news.

2: In this step, the components of inflation are obtained.

3: The abnormal returns are regressed using the seemingly unrelated regressions (SUR) technique over three different specifications of inflation to check the impact of news in each sector.

4: The sector inflation sensitivity is checked by the 'Flow-Through Capability' methodology with the help of the SUR technique.

5: After obtaining the FTC coefficients for each sector, the abnormal returns by employing the SUR technique is regressed over the unexpected inflation movements by taking into consideration the 'state of the economy' and 'market direction'.

Seemingly Unrelated Regressions Technique:-

'Seemingly Unrelated Regressions' (SUR) technique was developed by Zelner (1962) and is an extensively used model after linear regressions. It is usually applied to analyze two or more than two regression relations simultaneously. Every equation of the model has its dependent variable. Apparently, each equation looks different but there exists some kind of relationship among them. Correspondingly, the error terms are correlated across all equations (Baltagi, 2011).

In this study, the dependent variable abnormal returns for all sectors (ARS) are regressed over the components of inflation and inflation surprises to examine the relationship. Each sector has its distinct abnormal returns. Moreover, the Flow-Through Capabilities of all sectors are also obtained utilizing SUR. Seemingly unrelated regressions are best to apply for analyzing the inflation news effect on stock returns among all sectors because each equation has its dependent variable. They are related to error terms only and simultaneously analyze the relationship between inflation and stock returns for all sectors.

3.3.2 Estimation Process:-

The sequence of estimation is elaborated. In the first step, abnormal returns for each sector will be obtained. Their methodology is as follows:-

1: Abnormal Returns:-

Abnormal or excess returns are the difference in expected returns and actual returns of security due to market activities over a certain time (Abnormal returns, n.d.). These are important in determining the risk-adjusted performance of the portfolio and are important tools for the valuation of stocks and investment decisions. Certain methods have been used to estimate abnormal returns. The abnormal returns for each sector are obtained by using the following benchmarks/methods for risk-control and added effects isolated to "inflation news".

a. Mean Adjusted Returns (MAR): The first benchmark is the mean adjusted return which is the expected return of the sector obtained by averaging the returns of the firms of each sector monthly. It is a naïve model as market and risk factors are not included. The formula is:

$$AR = R_t - \overline{R} \tag{4}$$

R_t: Firm's stock return on given time, R_j: Average return on the stock (Firm)

The stock returns for each firm are calculated using the stock price formula as explained in the variable description while the average return is obtained by averaging the firm's return.

b. Market Model Returns (MMAR): The second benchmark is the market model returns where returns are estimated by using expected company/firm return, which is the linear function of the market i.e. PSX-100 using ordinary least squares beta. Besides, for "inflation news" we introduce a dummy variable in the model. The monetary announcement by SBP is taken as inflation news. The dummies (0, 1) will represent the monetary announcement in the model. The traditional market model is transformed as follows:

$$AR = R_t - \left\{\alpha + \left((\beta_{1i}R_m) + (\beta_{2i}D)\right)\right\} \tag{5}$$

α and β are intercept and slope estimated by OLS.

D: Dummy for Monetary announcement (1: Monetary announcement in the specific month, 0: No Monetary announcement), R_m: market return (PSX-100), $R_{t:}$ the return of the stock (firm), R_m and $R_{t:}$ are calculated by using stock returns formula.

2: Estimation of Components of Inflation:-

In this step, total inflation, expected and unexpected components of inflation are generated. Total inflation is obtained from CPI while for the calculation of the expected inflation (π^e), we use the time series Autoregressive Moving Averages Model (ARMA). Several methodologies are available in literature but this method is usually applied because it gives the best possible outcomes (Diaz & Jareno, 2013). This component is dependent on the past series of the inflation period. The lowest approximate lags are ideal because it offers the lowest Akaike Information Criterion & Schwartz Information Criterion, Gazali et al (2015) which is important for the parsimony of the model. The optimal lag length is determined according to the Box-Jenkins ARIMA time series methodology. The method is suitable for at least 50 observations.
The unexpected-inflation (π^u) part is obtained by subtracting the total inflation (π^t) from expected inflation (π^e).

$$\pi^u = \pi^t - \pi^e$$

3: Inflation News Impact on Sector Returns:-

Now, the abnormal returns for each sector are regressed over inflation components considering three different models. The first model consists of the total inflation rate, the second model comprises expected and unexpected inflation while the third one consists of the unexpected inflation component. These different models will explain the relationship between stock returns and inflation news. The Seemingly Unrelated Regressions technique is applied. The models are.

MODEL 1: For Total Inflation rate:

$$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi^{t} + \varepsilon_{it} \quad (6)$$

MODEL 2: For Expected and Unexpected Inflation rate:

$$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^e + \alpha_{2i}\pi_t^u + \varepsilon_{it} \quad (7)$$

MODEL 3: For Unexpected Inflation rate:

$$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^u + \varepsilon_{it} \quad (8)$$

Where ARS represents abnormal returns for each sector, π^t as the total inflation rate at period t, π^e as the expected inflation, π^u as the unexpected component of inflation while ε_t is the error term. These models are estimated through seemingly unrelated regressions (SUR) taking heteroscedasticity and same period correlation in the error term. SUR is commonly applied for panel data regressions. These are called seemingly unrelated because these equations are related to error terms (only).

4: Estimation of Flow-Through Capabilities:-

After regressing ARS over inflation components, the FTC of the sectors is acquired using the theoretical model of (Jareno and Navarro, 2010). FTC is the company's ability to transmit inflationary shocks to stock prices and it reflects in their profits & dividends. The sectors having higher FTC are less sensitive towards inflation changes. The theoretical model is represented as:

$$V_t = p_{t+1}\ q_{t+1} - p_t\ q_t$$

Where V_t represented as the revenue of the firm during the t time, they used sales variable instead of profit because profit is a volatile variable, while P_t is the average price of firm outputs & Q_t is the number of physical production units sold by the firm.

As data of goods/services sold/provided by the firm and prices of these goods/services are not available, so there was a need for proxies to continue the estimation process. Hence, the authors used the number of employees for variable q_t because this variable provides a good approximation for productivity whereas the previous inflation period is p_t (Diaz and Jareno, 2013). After all, the company's goods/services sold/provided have a linear association with the economy's past inflation period. Thereby, the transformed model is as follows:

$$RT_{it} = \beta_0 + \beta_1 \Delta NE_{it} + \beta_2 \Delta IR_t + \varepsilon_{it} \qquad (9)$$

Whereas RT_{it} is the relative turnover of companies (sector-wise) or the sales variable, β_0 is the independent term, β_1 is the turnover coefficient of the number of employees by sector, IR_t is the inflation rate and ε_{it} is the error term while β_2 is the flow-through coefficient. The turnover/sales are regressed over the sector's number of employees and the inflation rate. The FTC of PSX sectors is obtained using the Seemingly Unrelated Regression technique.

5: Final Econometric Model and Depiction:-

In the last step, our final econometric model is estimated. The ARS is regressed over inflation surprises to check the unexpected movements of inflation. For this, two important aspects are employed i.e. 'news direction' and 'state of the economy'.

The Direction of News: The available research shows that stock returns don't react highly to unexpected inflation but there is a consideration of positive or negative surprises. Andersen et al., (2003) explain that macroeconomic news is categorized by sign effect and bad news has a greater impact than good news. Diaz and Jareno (2013) stated when total inflation is greater than the expected inflation, it is reflected as bad news or positive shock whereas when total inflation is lesser than expected inflation, it is reflected as good news or negative inflation shock. For this, dummies will be introduced in the model. D^+ represents positive inflation news while D^- represents negative inflation news.

State of the Economy: According to behavioral finance, the interpretation of news depends on how the news is perceived. Moreover, the economic condition may or may not influence the investor's response to the news (Docking & Koch, 2005). In our study, we observed the impact of abnormal returns of sectors to inflation surprises depending on the economy's condition which helps in examining the investor's response under different scenarios. For this purpose, the methodology for identifying the economic activity, Hodrick Prescott (HP) filter is applied (Marcet and Ravn 2004). The filter decomposes time series into two components from raw data and gives a smoothened curve representation. Thus allowing the classification of economic activity into two distinct levels i.e. expansionary and recessionary period which is as follows:

$$Ln(IPI) = {y_t}^{trend} + {y_t}^{cyc} \tag{10}$$

The general equation for the HP filter is

$$min = \sum(Y_t - Y_t^{tr})^2 + \lambda\sum[(Y_{t+1}^{tr} - Y_t^{tr}) - (Y_t^{tr} - Y_{t-1}^{tr})^2]$$

The following dummies represent the state of the economy i.e. D_E, for the expansionary period and D_R for the recessionary period. Incorporating dummies of news direction and state of the economy, model 8 is modified as follows:

$$ARS_{it} = \alpha_0 + \alpha_{1i}\, D_E^+\, |\pi_t^U| + \alpha_{2i}\, D_R^+\, |\pi_t^U| + \alpha_{3i}\, D_E^-\, |\pi_t^U| + \alpha_{5i}\, D_R^-\, |\pi_t^U| + \varepsilon_t \quad (11)$$

The above four dummies represent all possible combinations between two factors i.e. the direction of news (inflation surprise) and condition of the economy, $|\pi^u|$: an absolute value of the unexpected component. The superscripts (+, −) on the dummies in the model: D^+ represent inflation is higher than expected while D^- indicate inflation is lower than expected. The subscript (E and R) on the dummies shows the high (expansionary) and low (recessionary) state of the economy. If both conditions occur simultaneously then each dummy variable is equal to 0ne otherwise it is zero.

Chapter 4

Empirical Results and Discussion

4.1 Introduction:-

This chapter consists of different sub-sections. Results for abnormal returns and inflation components with their descriptive stats will be discussed in section 4.2. Section 4.3 will show the results of the flow-through capabilities of each sector while section 4.4 describes the estimations of abnormal returns regression on inflation components. Section 4.5 will be about the estimations and discussion of the final model.

4.2 Abnormal Returns and Inflation Components:-

In this sub-section, the descriptive statistics of abnormal returns and inflation components are discussed. But first here is a brief explanation of the construction of abnormal returns and inflation components.

We estimated abnormal returns with two methods. The first is in presence of an inflation announcement (monetary policy declaration) i.e. the market model returns and the second is in the absence of inflation i.e. mean adjusted returns. The monthly abnormal returns by sector are obtained by these methods. We created monthly sector base portfolio returns. The market return (PSX-100 returns) is acquired by using MMAR and MAR as elaborated in chapter 3.

Monthly actual or total inflation is obtained from CPI by the mentioned formula in chapter 3. The expected component of inflation is obtained from ARMA modeling. With the visual analysis and comparing ACF (autocorrelation) and PACF (Partial-autocorrelation) tests with theoretical model patterns, we achieved the expected part of inflation. We used monthly data of CPI from 2005 to 2019. The Durbin-Watson value is 1.98 which shows no autocorrelation and R^2 is 0.67 which represents the model is a good fit[4]. By subtracting the expected component from actual inflation the unexpected part is estimated.

4.2.1 Descriptive Analysis of Abnormal returns:-

In this sub-section, descriptive stats of abnormal returns by sectors is implemented. We computed normality tests and equality tests (mean, median, and variance) among sectors for understanding the behavior of abnormal returns.

From this primary analysis, several results are achieved. In Tables 4.1 and 4.2, the average of abnormal returns from the market model and mean adjusted model are obtained. The main objective of these tests is to check the difference or variation among samples across sectors in both methods. The results show that the average returns are not different from zero, interpreting the same average across all sectors. The equality tests of mean and median depict means and medians cannot reject the null hypothesis statistically. The test proves, there is no variation among sample means and medians in both methods.

Table 4. 1: Abnormal Returns from MMAR

	ARS1	**ARS2**	**ARS3**	**ARS4**	**ARS5**	**ARS6**	**ARS7**	**ARS8**	**ARS9**
Mean	0.0012	0.0006	-.001	0.001	0.001	-.000	0.0006	-.002	0.004
Median	0.014	0.003	0.005	-.018	-0.01	0.024	-0.026	-.011	-0.007
Std. Dev.	0.347	0.305	0.431	0.321	0.219	0.276	0.392	0.355	0.251
Obs.	342	342	342	342	342	342	342	342	342
EQUALITY TESTS		**Value**	**Prob**			**Interpretation**			
KW		4.423	0.81	Medians:		Not rejected			
Van-der W		2.665	0.95						
Levene		47.14	0.01	Variance:		Rejected			
BF		46.03	0.01						
ANOVA		0.012	1.00	Means:		Not rejected			

ARS: Abnormal returns for sector. Main statistics and inter-sector equality tests. KW: Kruskal-Wallis, BF: Brown-Forsythe test, Van-der W: Van-der Waerdern test.

[4] Applied Schwarts Information Criterion, Lowest SBC shows best model for forcasting

Table 4. 2: Abnormal returns from MAR

	ARS1	ARS2	ARS3	ARS4	ARS5	ARS6	ARS7	ARS8	ARS9
Mean	0.002	0.001	-.0000	0.003	0.002	0.001	0.002	-.001	0.005
Median	0.024	-.009	-0.006	-.020	0.032	0.061	-.006	-.017	-.005
Std. Dev.	0.47	0.371	0.500	0.411	0.377	0.490	0.550	0.569	0.337
Obs.	342	342	342	342	342	342	342	342	342
EQUALITY TESTS		**Value**	**Prob**			**Interpretation**			
KW		2.783	0.94	Medians:		Not rejected			
Van-der W		0.523	0.99						
Levene		14.04	0.00	Variance:		Rejected			
BF		13.85	0.00						
ANOVA		0.005	1.00	Means:		Not rejected			

ARS: Abnormal returns for sector. Main statistics and inter-sector equality tests. KW: Kruskal-Wallis, BF: Brown-Forsythe test, Van-der W: Van-der Waerdern test.

The BF and Levene test for equality of variance shows that the risk level is different among sectors[5]. This is mainly because each firm in the sector endures different risk levels. There seem to be no significant inter-sector differences in both models. There seem to be not many appealing results from two different points of view. It can be interpreted as abnormal returns that do not have additional information on inflation.

4.2.2 Descriptive Analysis of Inflation Components:-

In this sub-section, the descriptive statistics of inflation components are computed. Monthly actual inflation, expected inflation, and unexpected inflation mean, median, and normality values are given in the following table.

Table 4. 3 Descriptive stats of Inflation components

	INF	EXPINF	UNEXPINF
Mean	0.089	0.073	0.016
Median	0.082	0.071	0.006
Std. Dev.	0.050	0.006	0.047
Skewness	1.199	0.498	1.270
Kurtosis	4.687	2.047	4.746
Jarque-Bera	61.30	13.55	67.75
Probability	0.000	0.001	0.000
Observations	171	171	171

INF: Total Inflation, EXPINF: Expected Inflation UNEXPINF: Unexpected Inflation

[5] Different industries has different volatility across sectors.

Table 4.3 shows a descriptive analysis of each inflation component. The skewness and kurtosis represent the normality of each variable. The expected inflation is close to the normal distribution and is fairly symmetrical while the total and unexpected inflation are unsymmetrical with a positively skewed distribution. The standard deviation shows the volatility of each variable. The total inflation is highly volatile while the expected inflation is less volatile among all three components.

4.3 Flow-Through Capabilities of Sectors:-

In this section, the FTC's of all sectors classified by GICS is estimated. The turnover of firms/sectors is regressed over the inflation rate and the number of employees by sector using the Seemingly Unrelated Regressions model. Under the assumption of keeping other factors constant, the coefficients reveal that all sectors don't have equal growth. The FTC coefficient values and their ranking is written in Table 4.4 below respectively.

Table 4. 4 FTC of sectors and their ranking according to their coefficients

Sectors	FTC	Ranking
Energy (S1)	2.899	1st
Materials (S2)	1.663	3rd
Consumer Discretionary (S3)	0.807	6th
Consumer Staples (S4)	2.245	2nd
Health Care (S5)	-0.010	7th
Financials (S6)	-0.812	9th
Industries (S7)	1.185	4th
Technology & Communications (S8)	-0.513	8th
Utilities (S9)	0.944	5th

Estimates of flow- through coefficients of sectors of PSX classified by GICS.

Energy and Consumer Staples have higher and positive FTC than other sectors indicating that they are less sensitive to inflation shocks. FTC is associated with higher stock prices. Higher the FTC coefficient, higher is the stock price. Energy (S1), Consumer Staples (S4), Materials (S2), and Utilities (S9) exhibits positive and higher FTC coefficients, indicating positive variation in turnover among sectors to transfer inflation shocks to their prices. It demonstrates that investor is willing to pay a higher price in those sectors which transmits shocks to their prices and products, meaning high profits/dividends in the end. Those shocks are a function of economic activity. On the other side, Financials (S6) and Technology & Communication (S8) have a negative value of coefficients indicate that higher inflation decreases the turnover in those sectors.

The FTC of sectors and inflation exhibits a positive relationship in some sectors while negative in other sectors of PSX. A positive relationship demonstrates higher inflation will lead to higher FTC and higher stock prices. Each sector has a different risk level and has shown different values of FTC's. According to Jareno and Navarro (2010) and estimated results shows that FTC and stock price has a positive relationship in most sectors. Therefore, investors are willing to pay higher prices to those firms, which can transfer shocks to output prices.

4.4 Sector Abnormal Returns Response on Inflation Components:-

After finding FTC's of all sectors, in this section, the models for inflation news analysis on the abnormal returns (ARS) of sectors are considered. The models differentiate between total inflation, expected inflation, and unexpected inflation. We regressed the ARS on these three models using seemingly unrelated regressions. Tables 4.5 and 4.6 depict the estimated coefficients of the models (6, 7, and 8) with their probability values.

Table 4. 5 Response to Inflation Components by Sector (MMAR)

	Energy (S1)	Materials (S2)	Cons. Discretionary S3	Cons. Staples (S4)	Health Care (S5)	Financials (S6)	Industries (S7)	Tech & Com (S8)	Utilities (S9)
Obs	**1710**	**1539**	**2907**	**1026**	**684**	**2394**	**1710**	**342**	**342**
$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi^t$									
$\boldsymbol{\pi^t}$	0.116	0.262	-0.385	0.2896	-0.766	-0.824	-1.751	-1.120	-0.612
	(0.431)	(0.088)***	(0.009)*	(0.268)	(0.002)*	(0.000)*	(0.000)*	(0.003)*	(0.022)**
Adj R^2	-0.0002	0.0014	0.0018	-7E-05	0.006	0.0172	0.0379	0.0241	0.010
$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^e + \alpha_{2i}\pi_t^u$									
$\boldsymbol{\pi_t^e}$	-1.461	-0.395	-4.126	-2.535	-5.712	5.875	-3.148	-14.56	0.731
	(0.206)	(0.7426)	(0.000)*	(0.214)	(0.003)*	(0.000)*	(0.047)**	(0.000)*	(0.726)
$\boldsymbol{\pi_t^u}$	0.21947	0.30632	-0.145	0.470	-0.449	-1.254	-1.660	-0.2521	-0.698
	(0.184)	(0.0753)***	(0.381)	(0.106)	(0.112)	(0.000)*	(0.000)*	(0.538)	(0.019)**
Adj R^2	0.000	0.001	0.00517	0.00179	0.0127	0.0358	0.0381	0.07992	0.009
$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^u$									
$\boldsymbol{\pi_t^u}$	0.149	0.287	-0.338	0.3528	-0.713	-0.979	-1.810	-0.929	-0.664
	(0.337)	(0.077)***	(0.031)**	(0.201)	(0.008)*	(0.000)*	(0.000)*	(0.020)**	(0.018)**
Adj R^2	7E-06	0.001	0.001	0.000	0.004	0.0218	0.035	0.0145	0.0116

The values in parenthesis are p-values of the estimated coefficients. π^t is the total inflation or the actual inflation, π_t^e is the expected part and $\pi_t^u$is the unexpected component. *Significant at 1% (Highly), **Significant at 5%, ***Significant at 10% (low).

Table 4. 6 Response to Inflation by Sector by MAR

	Energy (S)	Materials (S2)	Cons. Dis S3	Cons. Staples (S4)	Health (S5)	Financials (S6)	Industries (S7)	Tech& Com (S8)	Utilities (S9)
Obs	**1710**	**1539**	**2907**	**1026**	**684**	**2394**	**1710**	**342**	**342**
$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi^t$									
$\boldsymbol{\pi^t}$	-1.871	-1.289	-2.59	-1.546	-3.042	-3.158	-4.842	-4.417	-2.258
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
Adj R^2	0.049	0.028	0.060	0.020	0.089	0.116	0.151	0.133	0.099
$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^e + \alpha_{2i}\pi_t^u$									
$\boldsymbol{\pi_t^e}$	9.308	7.930	6.940	5.863	3.940	18.950	12.979	-2.020	7.953
	(0.000)*	(0.000)*	(0.000)*	(0.011)**	(0.106)	(0.000)*	(0.000)*	(0.645)	(0.002)*
$\boldsymbol{\pi_t^u}$	-2.595	-1.887	-3.206	-2.016	-3.480	-4.578	-6.000	-4.567	-2.910
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
Adj R^2	0.0752	0.0487	0.0729	0.0275	0.101	0.206	0.180	0.132	0.138
$ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^u$									
$\boldsymbol{\pi_t^u}$	-2.155	-1.512	-2.881	-1.746	-3.304	-3.692	-5.385	-4.664	-2.542
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
Adj R^2	0.058	0.034	0.0666	0.0236	0.097	0.141	0.166	0.1353	0.114

The values in parenthesis are p-values of the estimated coefficients. π^t is the total inflation or the actual inflation, π_t^e is the expected part and $\pi_t^u$is the unexpected component. . *Significant at 1% (Highly), **Significant at 5%, ***Significant at 10% (low).

We compute several results. First, the results of actual and unexpected inflation are quite identical. Most of the coefficients are negative and statistically significant indicating higher the inflation lower will be the returns for each sector. Second, there are significant results mainly in the case of Mean adjusted Returns. While the market model returns response to inflation news is somewhat varied among sectors. The results of MAR are highly significant in all sectors with negative coefficients indicating the negative relation of inflation and abnormal returns in PSX.

The unexpected component of Materials (S2) is positive and statistically significant especially in the case of MMAR indicating higher returns due to an unexpected increase in inflation. The expected inflation is significant in both cases but positive in the case of MAR while negative in the case of MMAR.

In terms of the Flow-Through hypothesis, the results are indecisive. In the above tables 4.5 & 4.6, those sectors having highly significant results are characterized by low FTC are Health Care (S5) & Financials (S6) and high FTC sectors are Materials (S2) and Industries (S7). In general, the results suggest that inflation does not affect the behavior of the investor independent of its sign and value. Due to mixed results and to deeply analyze the effect of inflation news on ARS, market direction and FTC arguments are considered. For this purpose direction of news and the state of the economy are included in the final model to examine the unexpected inflation movements.

4.5 Response of ARS to the State of the Economy and the Inflation Direction Surprises:-

In this section, the final model 11 is estimated using seemingly unrelated regressions. For inflation news movements two important factors are incorporated, i.e. state of the economy and inflation surprise. For a profound analysis of inflation movements, these asymmetric effects are counted in and their description is explained in chapter 3 of the methodology.

Tables 4.7 and 4.8 represent the responses/ estimation results of ARS to inflation surprise and state of the economy with MMAR and MAR respectively. We compute several results. The negative coefficients indicate that there is an inverse relation of inflation news with abnormal returns.

Table 4. 7: ARS response by sector 'MMAR'

	Energy (S1)	**Materials (S2)**	**Cons. Discretionary S3**	**Cons. Staples (S4)**	**Health (S5)**	**Fin (S6)**	**Industries (S7)**	**Tech & Com (S8)**	**Utilities (S9)**
Obs	**1710**	**1539**	**2907**	**1026**	**684**	**2394**	**1710**	**342**	**342**
D_E^-	-1.405	-0.521	-0.243	2.281	-2.979	-1.391	-5.976	-0.278	-1.867
	(0.044)**	(0.473)	(0.729)	(0.064)***	(0.012)**	(0.019)**	(0.000)*	(0.8753)	(0.1402)
D_R^-	-0.806	-0.555	-1.528	1.506	-3.671	-1.050	-5.146	-4.866	-0.943
	(0.135)	(0.323)	(0.005)*	(0.114)	(0.000)*	(0.022)**	(0.000)*	(0.000)*	(0.335)
D_E^+	0.655	0.972	0.0468	-0.173	-0.280	-0.9375	-1.4293	-0.892	-0.994
	(0.020)**	(0.001)*	(0.870)	(0.729)	(0.561)	(0.0001)*	(0.000)*	(0.215)	(0.053)***
D_R^+	0.133	0.106	-0.317	0.247	-0.265	-0.796	-0.950	-0.3891	-0.234
	(0.479)	(0.588)	(0.096)***	(0.458)	(0.410)	(0.000)*	(0.000)*	(0.417)	(0.493)
AdjR^2	0.005	0.006	0.002	0.002	0.023	0.019	0.058	0.034	0.009

The values in parenthesis are p-values of the estimated coefficients. D_E^- Negative inflation surprise and expansionary period. D_R^- Negative inflation surprise and recessionary period. D_E^+ Positive inflation surprise and expansionary period. D_R^+ Positive inflation surprise and recessionary period. *Significant at 1%, Highly **Significant at 5%, ***Significant at 10% (Low).

Table 4. 8: ARS response by sector. 'MAR'

	Energy (S1)	**Materials (S2)**	**Cons. Discretionary S3**	**Cons. Staples (S4)**	**Health Care (S5)**	**Financials (S6)**	**Industries (S7)**	**Tech & Com (S8)**	**Utilities (S9)**
Obs	**1710**	**1539**	**2907**	**1026**	**684**	**2394**	**1710**	**342**	**342**
D_E^-	-2.858	-1.709	-1.855	0.699	-4.786	-3.257	-8.193	-3.098	-3.219
	(0.001)*	(0.051)***	(0.031)**	(0.612)	(0.001)*	(0.000)*	(0.000)*	(0.245)	(0.044)**
D_R^-	-1.153	-0.880	-2.133	0.888	-4.511	-1.469	-5.823	-7.017	-1.816
	(0.097)***	(0.195)	(0.001)*	(0.405)	(0.000)*	(0.017)**	(0.000)*	(0.000)*	(0.143)
D_E^+	-0.986	-0.312	-1.744	-1.664	-2.1786	-2.782	-3.984	-3.530	-2.303
	(0.007)*	(0.381)	(0.000)*	(0.003)*	(0.000)*	(0.000)*	(0.000)*	(0.001)	(0.000)
D_R^+	-2.358	-1.823	-3.046	-1.964	-2.9731	-3.756	-4.795	-4.195	-2.185
	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*	(0.000)*
Adj R	0.056	0.036	0.061	0.026	0.089	0.130	0.152	0.119	0.094

The values in parenthesis are p-values of the estimated coefficients. D_E^- Negative inflation surprise and expansionary period. D_R^- Negative inflation surprise and recessionary period. D_E^+ Positive inflation surprise and expansionary period. D_R^+ Positive inflation surprise and recessionary period. *Significant at 1% (Highly), **Significant at 5%, ***Significant at 10% (low).

Negative Inflation Surprise and Expansionary period: when inflation is lower than expected (negative inflation surprise) and there is economic recovery the sectors Energy (S1), Health care (S5), Financials (S6), and Industries (S7) are significant in both cases. While Materials (S2), Consumer discretionary (S3), and Utilities (S9) are significant only in the case of MAR.

Negative Inflation Surprise and Recessionary period: when the economy is in depression and inflation is lower than the expected sectors Consumer discretionary (S3), Health Care (S5), Financials (S6), Industries (S7), and Technology and Communication (S8) are highly significant in both cases.

Positive Inflation and Expansionary period: when the economy is booming and inflation is higher than the expected sectors Energy (S1), Materials (S2), Financials (S6), Industries (S7), and Utilities (S9) are significant in the case of MMAR while all the results are significant except Materials (S2) in MAR.

Positive Inflation and Recessionary period: when the economy is in recession and inflation is higher than the expected only Consumer discretionary (S3), Financials (S6), and Industries (S7) showed significant results while in MAR all estimated results are highly significant.

4.6 Summary Conclusion:-

Most of the results are consistent with the findings of Diaz and Jareno (2013). First, according to the 'Flow-Through hypothesis' FTC depends on the economic cycle. Sectors having low FTC would have significant coefficients. For instance, the sectors as Health care (S5), Financials (S6), and Technology and Communication (S8) have low FTC and have the most significant results in both cases. Low FTC refers to high sensitivity to inflationary shocks meaning lower stock prices. So the above-mentioned sectors are sensitive towards unexpected inflation dependent on the economic cycle. Moreover, the positive inflation surprise in the expansionary situation is considered good news. Therefore, sector Energy (S1), Materials (S2), and Industries (S7) have significant coefficients with high Flow-Through Capabilities as mentioned in Table 4.4.

Second, according to the 'Market Direction Hypothesis', when the inflation is higher than expected in good times (expansionary period) it is considered bad news. The bad news is concerned with investor's increased ambiguity and inefficient decisions. In that case, Financials (S6), and Industries (S7) are significant in the case of MMAR indicating firms do not earn excess returns due to increased uncertainty. While all sectors except Materials (S2) in MAR are highly significant. According to the hypothesis, a positive inflation surprise in the period of recession is considered good news, so, sectors as Financials (S6) and Industries (S7) are significant in the case of MMAR while all are significant in the case of MAR. Additionally, when the economy is expanding/ growing and inflation is lower than expected, firms earn abnormal returns and are considered good news according to the hypothesis. The positive coefficients reveal the sign of earning abnormal returns but according to the given theory, only Consumer Staples (S4) with a positive coefficient is consistent with MDH.

Third, the sign of nearly all coefficients is negative reflecting the inverse association of Abnormal Returns for Sector to inflation news or unexpected inflation. The higher inflation, the lower will be the returns. Our stock market is hampered by inflation which affects the returns negatively (Saleem et al., 2013). The unexpected rise in inflation affects investment and investor's sentiments. Ahmad and Ullah (2013) also concluded that investor sentiment has proven to be a systematic factor in affecting stock prices. They concluded that sentiments fluctuate according to the economic conditions of the country. The news sign has a significant effect on the returns of the firms.

Chapter 5

Conclusion and Policy Implications

5.1 Conclusion:-

The objective of the study is to analyze the inflation news impact on sector abnormal returns. We examined the monthly PSX sector returns as a response to unexpected inflation surprises considering arguments of the 'Flow-Through Capability' (1980) hypothesis and 'Market Direction hypothesis' (1999). The estimated results show the response of sectors depends on the direction of news and economic condition. Likewise, FTC plays a major role in investment decisions.

The preliminary analysis of abnormal returns response to inflation components gave mixed results. The results can be biased due to the sign of news in different economic conditions that compensate each other (Diaz and Jareno, 2013). For in-depth analysis, signs of news, and the state of the economy with the help of dummies are included.

We observe that unexpected inflation significantly affects the returns in several sectors. The effects are dependent on the sign of the news and the condition of the economy. Being a developing economy, our results show that the relationship of inflation news to stock returns is more damaging than developed economies. Either positive or negative inflation surprises our stock market is hampered. The relation between inflation and returns is negative. It shows when inflation is higher, the returns are lower. Moreover, the market efficiency in Pakistan is also Weak / semi-strong, that firms generally do not earn abnormal returns (Khan & Khan, 2016). While in developed economies positive inflation surprises affect more than negative inflation surprises along with the efficient market (Diaz and Jareno, 2013).

The inflation surprises hurt the returns which make investor uncertain about making investment decisions. Investors pay more for less. The FTC differs in each sector depending on the volatility of the sector and economic condition. It depicts not all firms/companies in the stock market grow equally during inflationary surprises. Therefore, our study is somehow consistent with Veronesi’s (1999) and Estep and Hanson's (1980) hypothesis.

5.2 Policy Implications:-

Investor sentiments play a significant role in decision making and planning investments. This study will be vital for investors, fund managers, and financial decision-makers to plan or make investment decisions. The investor who needs inflation risk protection should consider the flow-through capabilities before investing in any firm/sector. As higher inflation harms the investor and the investor pays more for less. Therefore, Flow-Through Capability can act as a tool for risk management for firms. Investors, portfolio managers, and financial decision-makers should consider the Flow-Through Capability of companies/Sectors before making investment plans. Since FTC enables the investor about sector sensitivity towards inflation so that they can earn more profits by investing in the profitable sector because not all industries have equal ability to earn excess profits/ returns during an inflationary period. Also, it will allure portfolio investment which is significant for the effectiveness of the equity market which may facilitate the development & growth of the economy.

Second, inflation affects our economy and the performance of the stock market. Even the study confirms that inflation surprises have an inverse impact on firm returns. The unexpected increase in inflation cause policymakers to react by altering the monetary/fiscal policies. Such actions affect investment and make inflation bad for business. The policymakers can take current findings to frame relevant monetary policies during inflationary trends for sustainable growth of the stock market. As the stock market is a leading indicator of a healthy economy. It is suggested that to accomplish growth and maintain lower inflation, the government needs to control budget deficits with contractionary monetary and effective fiscal policies. Additionally, investors should deeply analyze market behavior before making decisions or entering the market.

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Appendices:-

In this section, supplementary information on the research is given. Appendix 1 represents the Seemingly unrelated regression results of flow-through capabilities of the sectors, from where the ranking of each sector is held. Appendix 2,3 and 4 represent the estimation results from Market model returns (MMAR) while Appendix 6,7 and 8 are the estimation results from Mean Adjusted Returns (MAR) i.e. Sector abnormal returns response to inflation components. Each above-mentioned appendices represents the separate models (Equations 6, 7, and 8) as mention in chapter 3 of the study. Appendices 5 and 9 show the results of the final model (Equation 11) with MMAR and MAR methods respectively. All these estimations are carried out by Seemingly Unrelated Regressions.

Appendix 1

Flow-Through Capabilities of the PSX Sectors:-

Method: Seemingly Unrelated Regression				
Sample: 2005 2019				
Included observations: 255				
Total system (unbalanced) observations 1110				
Linear estimation after one-step weighting matrix				
	Coefficient	Std. Error	t-Stat	Prob.
C(1)	-0.015	0.668	-0.022	0.982
C(2)	7.654	2.382	3.214	0.001
C(3)	2.899	6.609	0.439	0.066
C(4)	0.000	0.041	-0.005	0.996
C(5)	-0.032	0.129	-0.252	0.801
C(6)	1.664	0.409	4.065	0.000
C(7)	0.083	0.057	1.443	0.149
C(8)	0.176	0.132	1.333	0.183
C(9)	0.807	0.570	1.415	0.157
C(10)	-0.048	0.054	-0.881	0.379
C(11)	0.480	0.165	2.901	0.004
C(12)	2.245	0.547	4.104	0.000
C(13)	0.125	0.032	3.889	0.000
C(14)	0.342	0.161	2.128	0.034
C(15)	-0.010	0.304	-0.033	0.974
C(16)	-0.122	0.135	-0.906	0.365
C(17)	4.300	0.107	40.081	0.000

C(18)	-0.812	1.340	-0.606	0.545
C(19)	0.074	0.053	1.409	0.159
C(20)	-0.134	0.145	-0.922	0.357
C(21)	1.185	0.510	2.323	0.020
C(22)	0.123	0.066	1.858	0.063
C(23)	0.465	0.191	2.438	0.015
C(24)	-0.513	0.647	-0.793	0.428
C(25)	0.029	0.058	0.496	0.620
C(26)	0.023	1.002	0.023	0.981
C(27)	0.944	0.581	1.626	0.104
Determinant residual covariance		1.80E-09		
Equation: NS1=C(1)+C(2)*NE1+C(3)*I1				
Observations: 150				
R-squared	0.0640	Mean		0.469685
Adjusted R-squared	0.0513	S.D.		3.780878
S.E. of regression	3.682604	SSR		1993.551
Durbin-Watson stat	2.028388			
Equation: NS2=C(4)+C(5)*NE2+C(6)*I2				
Observations: 135				
R-squared	0.112004	Mean		0.150417
Adjusted R-squared	0.098549	S.D.		0.228263
S.E. of regression	0.216724	SSR		6.199939
Durbin-Watson stat	1.964005			
Equation: NS3=C(7)+C(8)*NE3+C(9)*I3				
Observations: 255				
R-squared	0.013997	Mean		0.164179
Adjusted R-squared	0.006172	S.D.		0.413308
S.E. of regression	0.412031	SSR		42.78188
Durbin-Watson stat	2.151601			
Equation: NS4=C(10)+C(11)*NE4+C(12)*I4				
Observations: 90				
R-squared	0.241519	Mean		0.170973
Adjusted R-squared	0.224082	S.D.		0.266914
S.E. of regression	0.235115	SSR		4.809269
Durbin-Watson stat	2.666933			
Equation: NS5=C(13)+C(14)*NE5+C(15)*I5				
Observations: 60				
R-squared	0.070992	Mean		0.1411
Adjusted R-squared	0.038395	S.D.		0.11084
S.E. of regression	0.108692	SSR		0.673392
Durbin-Watson stat	1.875528			

Equation: NS6=C(16)+C(17)*NE6+C(18)*I6				
Observations: 210				
R-squared	0.882025	Mean		0.288228
Adjusted R-squared	0.880886	S.D.		2.554378
S.E. of regression	0.881591	SSR		160.8811
Durbin-Watson stat	1.645344			
Equation: NS7=C(19)+C(20)*NE7+C(21)*I7				
Observations: 150				
R-squared	0.04181	Mean		0.170835
Adjusted R-squared	0.028773	S.D.		0.287928
S.E. of regression	0.283755	SSR		11.83601
Durbin-Watson stat	2.12935			
Equation: NS8=C(22)+C(23)*NE8+C(24)*I8				
Observations: 30				
R-squared	0.185997	Mean		0.10573
Adjusted R-squared	0.1257	S.D.		0.179715
S.E. of regression	0.168041	SSR		0.762417
Durbin-Watson stat	1.376983			
Equation: NS9=C(25)+C(26)*NE9+C(27)*I9				
Observations: 30				
R-squared	0.095767	Mean		0.113619
Adjusted R-squared	0.028787	S.D.		0.153075
S.E. of regression	0.150856	SSR		0.614454
Durbin-Watson stat	2.317928			

NS: Net sales, NE: Number of Employees, I: Inflation rate, i: 1, 2…9 Sectors

Appendix 2

MMAR: $ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi^{t}$

Method: Seemingly Unrelated Regression				
Sample: 2005M10 2019M12				
Included observations: 2907				
Total system (unbalanced) observations 12654				
Linear estimation after one-step weighting matrix				
	C	SE	t-Stat	Prob.
C(1)	-0.010	0.0151	-0.666	0.505
C(2)	0.116	0.1479	0.7874	0.431
C(3)	-0.022	0.0157	-1.413	0.157
C(4)	0.262	0.1542	1.7032	0.088
C(5)	0.034	0.0152	2.2377	0.025
C(6)	-0.385	0.1491	-2.5865	0.009
C(7)	-0.025	0.0267	-0.935	0.349
C(8)	0.289	0.2615	1.1075	0.268
C(9)	0.068	0.0260	2.6413	0.008
C(10)	-0.766	0.2544	-3.0109	0.002
C(11)	0.073	0.0128	5.6745	0
C(12)	-0.824	0.1259	-6.5458	0
C(13)	0.156	0.0208	7.5401	0
C(14)	-1.751	0.2036	-8.6014	0
C(15)	0.097	0.0386	2.5276	0.011
C(16)	-1.120	0.3785	-2.9593	0.003
C(17)	0.059	0.0274	2.1661	0.030
C(18)	-0.612	0.2683	-2.281	0.022
Determinant residual covariance		3.22E-09		
Equation: AB1=C(1)+C(2)*I1				
Observations: 1710				
R-squared	0.00041	Mean		0.000316
Adjusted R-squared	-0.00017	S.D.		0.307197
S.E. of regression	0.30722	SSR		161.211
Durbin-Watson stat	0.20942			
Equation: AB2=C(3)+C(4)*I2				
Observations: 1539				
R-squared	0.00209	Mean		0.001151
Adjusted R-squared	0.00144	S.D.		0.303029
S.E. of regression	0.30281	SSR		140.9331
Durbin-Watson stat	0.20897			
Equation: AB3=C(5)+C(6)*I3				
Observations: 2907				
R-squared	0.002208	Mean		-0.0003
Adjusted R-squared	0.001865	S.D.		0.404554

S.E. of regression	0.404176	SSR		474.5563
Durbin-Watson stat	0.265751			
Equation: AB4=C(7)+C(8)*I4				
Observations: 1026				
R-squared	0.000904	Mean		0.000921
Adjusted R-squared	-7.1E-05	S.D.		0.421142
S.E. of regression	0.421157	SSR		181.6302
Durbin-Watson stat	0.176423			
Equation: AB5=C(9)+C(10)*I5				
Observations: 684				
R-squared	0.008056	Mean		0.000375
Adjusted R-squared	0.006602	S.D.		0.335692
S.E. of regression	0.334583	SSR		76.34684
Durbin-Watson stat	0.182646			
Equation: AB6=C(11)+C(12)*I6				
Observations: 2394				
R-squared	0.017614	Mean		-0.00048
Adjusted R-squared	0.017203	S.D.		0.310565
S.E. of regression	0.307882	SSR		226.741
Durbin-Watson stat	0.222455			
Equation: AB7=C(13)+C(14)*I7				
Observations: 1710				
R-squared	0.038494	Mean		0.000702
Adjusted R-squared	0.037931	S.D.		0.431953
S.E. of regression	0.423681	SSR		306.5961
Durbin-Watson stat	0.146487			
Equation: AB8=C(15)+C(16)*I8				
Observations: 342				
R-squared	0.02700	Mean		-0.00219
Adjusted R-squared	0.02414	S.D.		0.355062
S.E. of regression	0.35075	SSR		41.8287
Durbin-Watson stat	0.26483			
Equation: AB9=C(17)+C(18)*I9				
Observations: 342				
R-squared	0.013602	Mean		0.004865
Adjusted R-squared	0.010701	S.D.		0.251157
S.E. of regression	0.24981	SSR		21.21773
Durbin-Watson stat	0.258061			

AB_i: Abnormal returns (per sector), I_i: Total Inflation, i: 1,2.. 9 Sectors

Appendix 3

MMAR: $ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^e + \alpha_{2i}\pi_t^u$

Method: Seemingly Unrelated Regression				
Sample: 1/10/2005 1/12/2019				
Included observations: 2907				
Total system (unbalanced) observations 12654				
Linear estimation after one-step weighting				
	C	SE	t-Stat	Prob.
C(1)	0.1036	0.0839	1.2340	0.217
C(2)	-1.4619	1.1559	0.1165	0.206
C(3)	0.2194	0.1651	1.3285	0.184
C(4)	0.0251	0.0875	0.2871	0.774
C(5)	-0.3958	1.2051	-0.3284	0.742
C(6)	0.3063	0.1722	1.7785	0.075
C(7)	0.3035	0.0845	3.5918	0.000
C(8)	-4.1263	1.1635	-3.5461	0.000
C(9)	-0.1455	0.1662	-0.8752	0.381
C(10)	0.1785	0.1482	1.2045	0.228
C(11)	-2.5354	2.0404	-1.2425	0.214
C(12)	0.4707	0.2916	1.6144	0.106
C(13)	0.4249	0.1438	2.9542	0.003
C(14)	-5.7120	1.9805	-2.8840	0.003
C(15)	-0.4492	0.2830	-1.5870	0.112
C(16)	-0.4096	0.0707	-5.7885	0
C(17)	5.8759	0.9743	6.0308	0
C(18)	-1.2540	0.1392	-9.0058	0
C(19)	0.2575	0.1155	2.2295	0.025
C(20)	-3.1488	1.5905	-1.9797	0.047
C(21)	-1.6607	0.2273	-7.3058	0
C(22)	1.0658	0.2082	5.1184	0
C(23)	-14.559	2.8669	-5.0784	0
C(24)	-0.2520	0.4097	-0.6152	0.538
C(25)	-0.0374	0.1522	-0.2457	0.805
C(26)	0.7319	2.0956	0.3492	0.726
C(27)	-0.6986	0.2995	-2.3327	0.019
Determinant residual covariance		2.90E-09		
Equation: AB1=C(1)+C(2)*E1+C(3)*U1				
Observations: 1710				
R-squared	0.0014	Mean		0.0003
Adjusted R-squared	0.0002	S.D.		0.3071
S.E. of regression	0.3071	SSR		161.04
Durbin-Watson stat	0.2101			
Equation: AB2=C(4)+C(5)*E2+C(6)*U2				

Observations: 1539				
R-squared	0.0023	Mean		0.0011
Adjusted R-squared	0.0010	S.D.		0.3030
S.E. of regression	0.3028	SSR		140.89
Durbin-Watson stat	0.2090			
Equation: AB3=C(7)+C(8)*E3+C(9)*U3				
Observations: 2907				
R-squared	0.0058	Mean		-0.0003
Adjusted R-squared	0.0051	S.D.		0.4045
S.E. of regression	0.4035	SSR		472.82
Durbin-Watson stat	0.2671			
Equation: AB4=C(10)+C(11)*E4+C(12)*U4				
Observations: 1026				
R-squared	0.0037	Mean		0.0009
Adjusted R-squared	0.0017	S.D.		0.4211
S.E. of regression	0.4207	SSR		181.11
Durbin-Watson stat	0.1767			
Equation: AB5=C(13)+C(14)*E5+C(15)*U5				
Observations: 684				
R-squared	0.01568	Mean		0.0003
Adjusted R-squared	0.01278	S.D.		0.3356
S.E. of regression	0.33353	SSR		75.760
Durbin-Watson stat	0.17907			
Equation: AB6=C(16)+C(17)*E6+C(18)*U6				
Observations: 2394				
R-squared	0.036648	Mean		-0.0004
Adjusted R-squared	0.035842	S.D.		0.3105
S.E. of regression	0.304949	SSR		222.34
Durbin-Watson stat	0.226847			
Equation: AB7=C(19)+C(20)*E7+C(21)*U7				
Observations: 1710				
R-squared	0.039254	Mean		0.000702
Adjusted R-squared	0.038129	S.D.		0.431953
S.E. of regression	0.423638	SSR		306.3538
Durbin-Watson stat	0.146478			
Equation: AB8=C(22)+C(23)*E8+C(24)*U8				
Observations: 342				
R-squared	0.085315	Mean		-0.00219
Adjusted R-squared	0.079919	S.D.		0.355062
S.E. of regression	0.340579	SSR		39.32188

Durbin-Watson stat	0.264947			
Equation: AB9=C(25)+C(26)*E9+C(27)*U9				
Observations: 342				
R-squared	0.015069	Mean		0.004865
Adjusted R-squared	0.009258	S.D.		0.251157
S.E. of regression	0.249992	SSR		21.18617
Durbin-Watson stat	0.258805			

AB_i: Abnormal returns (per sector), E_i: Expected Inflation, U_i: Unexpected Inflation, i: 1,2,…9 Sectors

Appendix 4

MMAR: $ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^u$

Method: Seemingly Unrelated Regression				
Sample: 1/10/2005 1/12/2019				
Included observations: 2907				
Total system (unbalanced) observations 12654				
Linear estimation after one-step weighting				
	C	SE	t-Stat	Prob.
C(1)	-0.00209	0.0078	-0.2683	0.788
C(2)	0.14966	0.1561	0.9583	0.337
C(3)	-0.00348	0.0081	-0.428	0.668
C(4)	0.287079	0.1628	1.7633	0.077
C(5)	0.005163	0.0078	0.6564	0.511
C(6)	-0.33869	0.1574	-2.151	0.031
C(7)	-0.00485	0.0137	-0.3519	0.724
C(8)	0.352888	0.2759	1.27876	0.201
C(9)	0.011862	0.0134	0.88325	0.377
C(10)	-0.71357	0.2688	-2.6542	0.008
C(11)	0.015302	0.0066	2.3103	0.020
C(12)	-0.97929	0.1325	-7.3863	0
C(13)	0.029896	0.0107	2.78220	0.005
C(14)	-1.81052	0.2150	-8.4173	0
C(15)	0.012862	0.0200	0.64139	0.521
C(16)	-0.92932	0.4014	-2.3151	0.020
C(17)	0.015535	0.014144	1.0983	0.272
C(18)	-0.6649	0.283131	-2.3483	0.018
Determinant residual covariance		3.24E-09		
Equation: AB1=C(1)+C(2)*U1				
Observations: 1710				
R-squared	0.000592	Mean		0.000316
Adjusted R-squared	0.000007	S.D.		0.307197
S.E. of regression	0.307196	SSR		161.1828
Durbin-Watson stat	0.209501			
Equation: AB2=C(3)+C(4)*U2				
Observations: 1539				
R-squared	0.002257	Mean		0.001151
Adjusted R-squared	0.001607	S.D.		0.303029
S.E. of regression	0.302785	SSR		140.9104
Durbin-Watson stat	0.209027			
Equation: AB3=C(5)+C(6)*U3				
Observations: 2907				
R-squared	0.001511	Mean		-0.0003
Adjusted R-squared	0.001167	S.D.		0.404554

S.E. of regression	0.404317	SSR		474.8878
Durbin-Watson stat	0.265658			
Equation: AB4=C(7)+C(8)*U4				
Observations: 1026				
R-squared	0.001366	Mean		0.000921
Adjusted R-squared	0.000391	S.D.		0.421142
S.E. of regression	0.42106	SSR		181.5462
Durbin-Watson stat	0.176477			
Equation: AB5=C(9)+C(10)*U5				
Observations: 684				
R-squared	0.006048	Mean dep Var		0.000375
Adjusted R-squared	0.00459	S.D.		0.335692
S.E. of regression	0.334921	SSR		76.50141
Durbin-Watson stat	0.182794			
Equation: AB6=C(11)+C(12)*U6				
Observations: 2394				
R-squared	0.022285	Mean		-0.00048
Adjusted R-squared	0.021876	S.D.		0.310565
S.E. of regression	0.307149	SSR		225.6629
Durbin-Watson stat	0.223406			
Equation: AB7=C(13)+C(14)*U7				
Observations: 1710				
R-squared	0.03643	Mean		0.000702
Adjusted R-squared	0.03587	S.D.		0.431953
S.E. of regression	0.42413	SSR		307.2525
Durbin-Watson stat	0.14638			
Equation: AB8=C(15)+C(16)*U8				
Observations: 342				
R-squared	0.01741	Mean		-0.00219
Adjusted R-squared	0.01452	S.D.		0.355062
S.E. of regression	0.35247	SSR		42.2411
Durbin-Watson stat	0.26233			
Equation: AB9=C(17)+C(18)*U9				
Observations: 342				
R-squared	0.01454	Mean		0.004865
Adjusted R-squared	0.01165	S.D.		0.251157
S.E. of regression	0.24969	SSR		21.19736
Durbin-Watson stat	0.25842			

AB_i: Abnormal returns (per sector), U_i: Unexpected Inflation, i: 1,2,..9 Sectors

Appendix 5

The results of Abnormal returns response to the state of the economy and inflation direction surprises (Eq 11) by the Market model is mentioned below. D_E^- show Expansionay negative inflation surprises, D_R^- show Recessionary negative inflation surprise, D_E^+ show Expansionary positive inflation surprises and D_R^+ show Recessionary positive inflation surprises.

MMAR: $\boldsymbol{ARS_{it} = \alpha_0 + \alpha_{1i}\, D_E^-\, |\pi_t^U| + \alpha_{2i}\, D_R^-\, |\pi_t^U| + \alpha_{3i}\, D_E^+\, |\pi_t^U| + \alpha_{5i}\, D_R^+\, |\pi_t^U| + \varepsilon_t}$

Method: Seemingly Unrelated Regression				
Date: 08/09/20 Time: 01:51				
Sample: 2005M10 2019M12				
Included observations: 2907				
Total system (unbalanced) observations 12654				
Linear estimation after one-step weighting				
	Coefficient	Std. Error	t-Stat	Prob.
C(1)	-1.40503	0.697627	-2.01402	0.044
C(2)	-0.80651	0.540341	-1.49275	0.1355
C(3)	0.65516	0.28329	2.312691	0.0208
C(4)	0.13342	0.188655	0.707238	0.4794
C(5)	-0.52180	0.727239	-0.71752	0.4731
C(6)	-0.55575	0.563276	-0.98665	0.3238
C(7)	0.97255	0.295314	3.293294	0.001
C(8)	0.10648	0.196662	0.541435	0.5882
C(9)	-0.24329	0.704735	-0.34523	0.7299
C(10)	-1.52824	0.545846	-2.79976	0.0051
C(11)	0.046817	0.286176	0.163594	0.8701
C(12)	-0.31727	0.190577	-1.66481	0.0960
C(13)	2.281692	1.233497	1.849775	0.0644
C(14)	1.506479	0.955394	1.576815	0.1149
C(15)	-0.17301	0.500893	-0.34541	0.7298
C(16)	0.247507	0.333566	0.742003	0.4581
C(17)	-2.979503	1.191341	-2.50097	0.0124
C(18)	-3.671764	0.922742	-3.97919	0.0001
C(19)	-0.280649	0.483775	-0.58012	0.5618
C(20)	-0.265332	0.322166	-0.82359	0.4102
C(21)	-1.391770	0.594484	-2.34114	0.0192
C(22)	-1.050857	0.460452	-2.28223	0.0225
C(23)	-0.937474	0.241406	-3.8834	0.0001
C(24)	-0.796841	0.160762	-4.95664	0
C(25)	-5.975964	0.952048	-6.27696	0
C(26)	-5.146809	0.7374	-6.97967	0
C(27)	-1.429325	0.386604	-3.69713	0.0002
C(28)	-0.950299	0.257456	-3.69112	0.0002

C(29)	-0.278570	1.774611	-0.15698	0.8753
C(30)	-4.866847	1.374509	-3.54079	0.0004
C(31)	-0.892639	0.720627	-1.2387	0.2155
C(32)	-0.389056	0.479896	-0.81071	0.4175
C(33)	-1.867222	1.265732	-1.47521	0.1402
C(34)	-0.943937	0.980361	-0.96285	0.3356
C(35)	-0.994203	0.513983	-1.93431	0.0531
C(36)	-0.234463	0.342283	-0.685	0.4934
Determinant residual covariance		2.95E-09		
Eq AB1=C(1)*DNE1+C(2)*DNR1+C(3)*DPE1+C(4)*DPR1				
Observations: 1710				
R-squared	0.006978	Mean		0.000316
Adjusted R-squared	0.005154	S.D.		0.307197
S.E. of regression	0.306404	SSR		160.1654
Durbin-Watson stat	0.213399			
Eq: AB2=C(5)*DNE2+C(6)*DNR2+C(7)*DPE2+C(8)*DPR2				
Observations: 1539				
R-squared	0.008165	Mean		0.001151
Adjusted R-squared	0.006226	S.D.		0.303029
S.E. of regression	0.302084	SSR		140.0759
Durbin-Watson stat	0.211758			
AB3=C(9)*DNE3+C(10)*DNR3+C(11)*DPE3+C(12)*DPR3				
Observations: 2907				
R-squared	0.003599	Mean		-0.0003
Adjusted R-squared	0.002569	S.D.		0.404554
S.E. of regression	0.404034	SSR		473.895
Durbin-Watson stat	0.266239			
AB4=C(13)*DNE4+C(14)*DNR4+C(15)*DPE4+C(16)*DPR4				
Observations: 1026				
R-squared	0.005263	Mean		0.000921
Adjusted R-squared	0.002343	S.D.		0.421142
S.E. of regression	0.420648	SSR		180.8379
Durbin-Watson stat	0.176488			
AB5=C(17)*DNE5+C(18)*DNR5+C(19)*DPE5+C(20)*DPR5				
Observations: 684				
R-squared	0.027544	Mean		0.000375
Adjusted R-squared	0.023253	S.D.		0.335692
S.E. of regression	0.331767	SSR		74.84695
Durbin-Watson stat	0.190431			
AB6=C(21)*DNE6+C(22)*DNR6+C(23)*DPE6+C(24)*DPR6				
Observations: 2394				

R-squared	0.020603	Mean		-0.00048
Adjusted R-squared	0.019373	S.D.		0.310565
S.E. of regression	0.307542	SSR		226.0511
Durbin-Watson stat	0.222908			
AB7=C(25)*DNE7+C(26)*DNR7+C(27)*DPE7+C(28)*DPR7				
Observations: 1710				
R-squared	0.060029	Mean		0.000702
Adjusted R-squared	0.058376	S.D.		0.431953
S.E. of regression	0.419156	SSR		299.7294
Durbin-Watson stat	0.152016			
AB8=C(29)*DNE8+C(30)*DNR8+C(31)*DPE8+C(32)*DPR8				
Observations: 342				
R-squared	0.043356	Mean		-0.00219
Adjusted R-squared	0.034865	S.D.		0.355062
S.E. of regression	0.348818	SSR		41.12571
Durbin-Watson stat	0.286862			
AB9=C(33)*DNE9+C(34)*DNR9+C(35)*DPE9+C(36)*DPR9				
Observations: 342				
R-squared	0.018508	Mean		0.004865
Adjusted R-squared	0.009797	S.D.		0.251157
S.E. of regression	0.249924	SSR		21.11219
Durbin-Watson stat	0.262341			

AB_i: Abnormal returns, DNE: Expansionary negative inflation, DNR: Recessionary negative inflation surprise, DPE: Expansionary positive Inflation Surprise, DPR: Recessionary positive Inflation Surprise, i: 1,2..9 Sectors.

Appendix 6

MAR: $ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi^t$

Method: Seemingly Unrelated Regression				
Sample: 2005M10 2019M12				
Included observations: 2907				
Total system (unbalanced) observations 12654				
Linear estimation after one-step weighting matrix				
	Coefficient	Std. Error	t-Stat	Prob.
C(1)	0.1685	0.019512	8.6407	0
C(2)	-1.871	0.190902	-9.8043	0
C(3)	0.117297	0.019065	6.1523	0
C(4)	-1.28975	0.186537	-6.9142	0
C(5)	0.232475	0.018713	12.423	0
C(6)	-2.59312	0.183089	-14.163	0
C(7)	0.139985	0.029942	4.6751	0
C(8)	-1.54605	0.292956	-5.2774	0
C(9)	0.273085	0.032083	8.5118	0
C(10)	-3.04265	0.313901	-9.6930	0
C(11)	0.282851	0.017436	16.222	0
C(12)	-3.15866	0.170594	-18.515	0
C(13)	0.434715	0.0267	16.281	0
C(14)	-4.84293	0.261238	-18.538	0
C(15)	0.393599	0.057437	6.8527	0
C(16)	-4.41755	0.561965	-7.8608	0
C(17)	0.207177	0.034685	5.9730	0
C(18)	-2.25826	0.339362	-6.6544	0
Determinant residual covariance		1.24E-07		
Equation: AB1=C(1)+C(2)*I1				
Observations: 1710				
R-squared	0.050082	Mean		0.001706
Adjusted R-squared	0.049526	S.D.		0.422389
S.E. of regression	0.411797	SSR		289.6371
Durbin-Watson stat	0.177296			
Equation: AB2=C(3)+C(4)*I2				
Observations: 1539				
R-squared	0.028739	Mean		0.002238
Adjusted R-squared	0.028107	S.D.		0.384361
S.E. of regression	0.378921	SSR		220.6844
Durbin-Watson stat	0.158339			
Equation: AB3=C(5)+C(6)*I3				
Observations: 2907				

R-squared	0.060697	Mean		0.001203
Adjusted R-squared	0.060374	S.D.		0.523246
S.E. of regression	0.507204	SSR		747.3297
Durbin-Watson stat	0.180178			
Equation: AB4=C(7)+C(8)*I4				
Observations: 1026				
R-squared	0.021483	Mean		0.002097
Adjusted R-squared	0.020527	S.D.		0.487453
S.E. of regression	0.482424	SSR		238.3183
Durbin-Watson stat	0.135447			
Equation: AB5=C(9)+C(10)*I5				
Observations: 684				
R-squared	0.091012	Mean		0.001831
Adjusted R-squared	0.089679	S.D.		0.449528
S.E. of regression	0.428898	SSR		125.4564
Durbin-Watson stat	0.138581			
Equation: AB6=C(11)+C(12)*I6				
Observations: 2394				
R-squared	0.116439	Mean		0.001221
Adjusted R-squared	0.116069	S.D.		0.46083
S.E. of regression	0.433261	SSR		449.015
Durbin-Watson stat	0.160176			
Equation: AB7=C(13)+C(14)*I7				
Observations: 1710				
R-squared	0.152259	Mean		0.002798
Adjusted R-squared	0.151763	S.D.		0.61233
S.E. of regression	0.563954	SSR		543.2202
Durbin-Watson stat	0.113685			
Equation: AB8=C(15)+C(16)*I8				
Observations: 342				
R-squared	0.136132	Mean		-0.00019
Adjusted R-squared	0.133591	S.D.		0.56949
S.E. of regression	0.530087	SSR		95.53743
Durbin-Watson stat	0.157996			
Equation: AB9=C(17)+C(18)*I9				
Observations: 342				
R-squared	0.102022	Mean		0.005924
Adjusted R-squared	0.099381	S.D.		0.337597
S.E. of regression	0.320383	SSR		34.8993
Durbin-Watson stat	0.220773			

Appendix 7

MAR: $ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^e + \alpha_{2i}\pi_t^u$

Method: Seemingly Unrelated Regression				
Sample: 2005M10 2019M12				
Included observations: 2907				
Total system (unbalanced) obs 12654				
Linear estimation after one-step weighting				
	Coefficient	Std. Error	t-Stat	Prob.
C(1)	-0.637	0.107	-5.939	0.000
C(2)	9.308	1.476	6.307	0.000
C(3)	-2.595	0.211	-12.304	0.000
C(4)	-0.547	0.105	-5.207	0.000
C(5)	7.930	1.446	5.485	0.000
C(6)	-1.888	0.207	-9.137	0.000
C(7)	-0.454	0.103	-4.403	0.000
C(8)	6.940	1.420	4.887	0.000
C(9)	-3.207	0.203	-15.799	0.000
C(10)	-0.394	0.166	-2.377	0.018
C(11)	5.864	2.282	2.570	0.010
C(12)	-2.017	0.326	-6.184	0.000
C(13)	-0.230	0.177	-1.298	0.194
C(14)	3.940	2.441	1.614	0.107
C(15)	-3.481	0.349	-9.979	0.000
C(16)	-1.310	0.092	-14.225	0.000
C(17)	18.950	1.268	14.948	0.000
C(18)	-4.579	0.181	-25.273	0.000
C(19)	-0.849	0.146	-5.813	0.000
C(20)	12.979	2.011	6.455	0.000
C(21)	-6.000	0.287	-20.879	0.000
C(22)	0.221	0.319	0.693	0.488
C(23)	-2.020	4.387	-0.460	0.645
C(24)	-4.567	0.627	-7.285	0.000
C(25)	-0.528	0.188	-2.805	0.005
C(26)	7.954	2.594	3.066	0.002
C(27)	-2.910	0.371	-7.849	0.000
Determinant residual covariance		9.89E-08		
Equation: AB1=C(1)+C(2)*E1+C(3)*U1				
Observations: 1710				
R-squared	0.07636	Mean		0.001706
Adjusted R-squared	0.07527	S.D.		0.422389
S.E. of regression	0.40618	SSR		281.625
Durbin-Watson stat	0.18169			
Equation: AB2=C(4)+C(5)*E2+C(6)*U2				

Observations: 1539				
R-squared	0.04996	Mean		0.002238
Adjusted R-squared	0.04872	S.D.		0.384361
S.E. of regression	0.37488	SSR		215.8626
Durbin-Watson stat	0.16270			
Equation: AB3=C(7)+C(8)*E3+C(9)*U3				
Observations: 2907				
R-squared	0.07356	Mean		0.001203
Adjusted R-squared	0.07292	S.D.		0.523246
S.E. of regression	0.50380	SSR		737.0938
Durbin-Watson stat	0.18254			
Equation: AB4=C(10)+C(11)*E4+C(12)*U4				
Observations: 1026				
R-squared	0.029464	Mean		0.002097
Adjusted R-squared	0.027567	S.D.		0.487453
S.E. of regression	0.480687	SSR		236.3744
Durbin-Watson stat	0.137398			
Equation: AB5=C(13)+C(14)*E5+C(15)*U5				
Observations: 684				
R-squared	0.104481	Mean		0.001831
Adjusted R-squared	0.101851	S.D.		0.449528
S.E. of regression	0.426021	SSR		123.5975
Durbin-Watson stat	0.145932			
Equation: AB6=C(16)+C(17)*E6+C(18)*U6				
Observations: 2394				
R-squared	0.206734	Mean		0.001221
Adjusted R-squared	0.206071	S.D.		0.46083
S.E. of regression	0.410612	SSR		403.1281
Durbin-Watson stat	0.181495			
Equation: AB7=C(19)+C(20)*E7+C(21)*U7				
Observations: 1710				
R-squared	0.181130	Mean		0.002798
Adjusted R-squared	0.180171	S.D.		0.61233
S.E. of regression	0.554430	SSR		524.7202
Durbin-Watson stat	0.120086			
Equation: AB8=C(22)+C(23)*E8+C(24)*U8				
Observations: 342				
R-squared	0.137681	Mean		-0.00019
Adjusted R-squared	0.132593	S.D.		0.56949
S.E. of regression	0.530392	SSR		95.36615

Durbin-Watson stat	0.159715			
Equation: AB9=C(25)+C(26)*E9+C(27)*U9				
Observations: 342				
R-squared	0.143145	Mean		0.005924
Adjusted R-squared	0.13809	S.D.		0.337597
S.E. of regression	0.313422	SSR		33.30111
Durbin-Watson stat	0.234632			

AB_i: Abnormal returns (per sector), E_i: Expected Inflation, U_i: Unexpected Inflation

Appendix 8

MAR: $ARS_{it} = \alpha_{0i} + \alpha_{1i}\pi_t^u$

Method: Seemingly Unrelated Regression				
Sample: 2005M10 2019M12				
Included observations: 2907				
Total system (unbalanced) observations 12654				
Linear estimation after one-step weighting matrix				
	C	SE	t-Stat	Prob
C(1)	0.0364	0.0100	3.6300	0.0003
C(2)	-2.1557	0.2007	-10.736	0
C(3)	0.0266	0.00981	2.7154	0.006
C(4)	-1.5125	0.19644	-7.6999	0
C(5)	0.0476	0.00962	4.9511	0
C(6)	-2.8812	0.19260	-14.959	0
C(7)	0.0302	0.01542	1.9607	0.0499
C(8)	-1.7463	0.30877	-5.6556	0
C(9)	0.0549	0.01649	3.3325	0.0009
C(10)	-3.3045	0.33026	-10.005	0
C(11)	0.0606	0.00887	6.8320	0
C(12)	-3.6925	0.17772	-20.776	0
C(13)	0.0895	0.01367	6.5544	0
C(14)	-5.3859	0.27363	-19.682	0
C(15)	0.0747	0.02961	2.5255	0.0116
C(16)	-4.6644	0.59278	-7.8686	0
C(17)	0.0467	0.01774	2.6346	0.0084
C(18)	-2.5428	0.35524	-7.158	0
Determinant residual covariance		1.16E-07		
Equation: AB1=C(1)+C(2)*U1				
Observations: 1710				
R-squared	0.058919	Mean		0.001706
Adjusted R-squared	0.058368	SD		0.422389
S.E. of regression	0.409877	SSR		286.9427
Durbin-Watson stat	0.178823			
Equation: AB2=C(3)+C(4)*U2				
Observations: 1539				
R-squared	0.034911	Mean		0.002238
Adjusted R-squared	0.034272	S.D.		0.384361
S.E. of regression	0.377717	SSR		219.2844
Durbin-Watson stat	0.159304			
Equation: AB3=C(5)+C(6)*U3				
Observations: 2907				
R-squared	0.067011	Mean		0.001203
Adjusted R-squared	0.066690	S.D.		0.523246
S.E. of regression	0.505497	SSR		742.3067

Durbin-Watson stat	0.181177			
Equation: AB4=C(7)+C(8)*U4				
Observations: 1026				
R-squared	0.024586	Mean		0.002097
Adjusted R-squared	0.023634	S.D		0.487453
S.E. of regression	0.481658	SSR		237.5625
Durbin-Watson stat	0.136065			
Equation: AB5=C(9)+C(10)*U5				
Observations: 684				
R-squared	0.098928	Mean		0.001831
Adjusted R-squared	0.097599	S.D.		0.449528
S.E. of regression	0.427028	SSR		124.365
Durbin-Watson stat	0.142222			
Equation: AB6=C(11)+C(12)*U6				
Observations: 2394				
R-squared	0.142047	Mean		0.001221
Adjusted R-squared	0.141688	S.D.		0.46083
S.E. of regression	0.426936	SSR		436.0012
Durbin-Watson stat	0.164979			
Equation: AB7=C(13)+C(14)*U7				
Observations: 1710				
R-squared	0.16713	Mean		0.002798
Adjusted R-squared	0.166642	S.D		0.61233
S.E. of regression	0.558986	SSR		533.6915
Durbin-Watson stat	0.116177			
Equation: AB8=C(15)+C(16)*U8				
Observations: 342				
R-squared	0.137927	Mean		-0.00019
Adjusted R-squared	0.135392	S.D.		0.56949
S.E. of regression	0.529536	SSR		95.33887
Durbin-Watson stat	0.160888			
Equation: AB9=C(17)+C(18)*U9				
Observations: 342				
R-squared	0.117519	Mean		0.005924
Adjusted R-squared	0.114923	S.D		0.337597
S.E. of regression	0.317606	SSR		34.29705
Durbin-Watson stat	0.225299			

AB_i: Abnormal returns (per sector), U_i: Unexpected Inflation

Appendix 9

The results of Abnormal returns response to the state of the economy and inflation direction surprises (Eq 11) by the Mean Adjusted returns model is mentioned below. D_E^- show Expansionay negative inflation surprises, D_R^- show Recessionary negative inflation surprise, D_E^+ show Expansionary positive inflation surprises and D_R^+ show Recessionary positive inflation surprises.

MAR: $\boldsymbol{ARS_{it} = \alpha_0 + \alpha_{1i}\, D_E^- \left|\pi_t^U\right| + \alpha_{2i}\, D_R^- \left|\pi_t^U\right| + \alpha_{3i}\, D_E^+ \left|\pi_t^U\right| + \alpha_{5i}\, D_R^+ \left|\pi_t^U\right| + \varepsilon_t}$

Estimation Method: Seemingly Unrelated Regression				
Sample: 2005M10 2019M12				
Included observations: 2907				
Total system (unbalanced) observations 12654				
Linear estimation after one-step weighting matrix				
	C	SE	t-Stat	Prob.
C(1)	-2.8587	0.8995	-3.17786	0.001
C(2)	-1.1531	0.6967	-1.65501	0.097
C(3)	-0.9859	0.3653	-2.69909	0.007
C(4)	-2.3584	0.2432	-9.69489	0
C(5)	-1.7090	0.8782	-1.9459	0.051
C(6)	-0.8801	0.6802	-1.29386	0.195
C(7)	-0.3121	0.3566	-0.87507	0.381
C(8)	-1.8233	0.2375	-7.67675	0
C(9)	-1.8551	0.8644	-2.14596	0.031
C(10)	-2.1330	0.6695	-3.18561	0.001
C(11)	-1.7446	0.3510	-4.96976	0
C(12)	-3.0465	0.2337	-13.032	0
C(13)	0.6995	1.3791	0.507251	0.612
C(14)	0.8880	1.0681	0.831364	0.405
C(15)	-1.6642	0.5600	-2.97164	0.003
C(16)	-1.9648	0.3729	-5.26843	0
C(17)	-4.7868	1.4820	-3.22991	0.001
C(18)	-4.5111	1.1479	-3.92991	0.000
C(19)	-2.1786	0.6018	-3.62007	0.000
C(20)	-2.9730	0.4007	-7.4182	0
C(21)	-3.2574	0.7999	-4.07203	0
C(22)	-1.4699	0.6196	-2.37232	0.017
C(23)	-2.7828	0.3248	-8.56678	0
C(24)	-3.7568	0.2163	-17.3664	0
C(25)	-8.193	1.2331	-6.64393	0
C(26)	-5.8234	0.9551	-6.09698	0
C(27)	-3.9840	0.5007	-7.95615	0

C(28)	-4.7949	0.3334	-14.3788	0
C(29)	-3.0982	2.6700	-1.16036	0.2459
C(30)	-7.0171	2.0680	-3.39309	0.0007
C(31)	-3.5304	1.0842	-3.25611	0.0011
C(32)	-4.1957	0.7220	-5.81087	0
C(33)	-3.2191	1.6037	-2.00733	0.0447
C(34)	-1.8159	1.2421	-1.46199	0.1438
C(35)	-2.3035	0.6512	-3.5372	0.0004
C(36)	-2.18513	0.4336	-5.0386	0
Determinant residual covariance		1.18E-07		
Equation: AB1=C(1)*DNE1+C(2)*DNR1+C(3)*DPE1+C(4)*DPR1				
Observations: 1710				
R-squared	0.058315	Mean		0.001706
Adjusted R-squared	0.056659	S.D.		0.422389
S.E. of regression	0.410249	SSR		287.127
Durbin-Watson stat	0.184131			
Equation: AB2=C(5)*DNE2+C(6)*DNR2+C(7)*DPE2+C(8)*DPR2				
Observations: 1539				
R-squared	0.03842	Mean		0.002238
Adjusted R-squared	0.036541	S.D.		0.384361
S.E. of regression	0.377273	SSR		218.4846
Durbin-Watson stat	0.164221			
Equation: AB3=C(9)*DNE3+C(10)*DNR3+C(11)*DPE3+C(12)*DPR3				
Observations: 2907				
R-squared	0.062903	Mean		0.001203
Adjusted R-squared	0.061934	S.D.		0.523246
S.E. of regression	0.506783	SSR		745.5751
Durbin-Watson stat	0.182202			
Equation: AB4=C(13)*DNE4+C(14)*DNR4+C(15)*DPE4+C(16)*DPR4				
Observations: 1026				
R-squared	0.029021	Mean		0.002097
Adjusted R-squared	0.026171	S.D.		0.487453
S.E. of regression	0.481032	SSR		236.4823
Durbin-Watson stat	0.137053			
Equation: AB5=C(17)*DNE5+C(18)*DNR5+C(19)*DPE5+C(20)*DPR5				
Observations: 684				

R-squared	0.093718	Mean		0.001831
Adjusted R-squared	0.08972	S.D.		0.449528
S.E. of regression	0.428889	SSR		125.083
Durbin-Watson stat	0.142575			
Equation: AB6=C(21)*DNE6+C(22)*DNR6+C(23)*DPE6+C(24)*DPR6				
Observations: 2394				
R-squared	0.13155	Mean		0.0012
Adjusted R-squared	0.13046	S.D.		0.4608
S.E. of regression	0.42972	SSR		441.33
Durbin-Watson stat	0.16547			
Equation: AB7=C(25)*DNE7+C(26)*DNR7+C(27)*DPE7+C(28)*DPR7				
Observations: 1710				
R-squared	0.15411	Mean		0.00279
Adjusted R-squared	0.15263	S.D.		0.61233
S.E. of regression	0.56366	SSR		542.029
Durbin-Watson stat	0.11585			
Equation: AB8=C(29)*DNE8+C(30)*DNR8+C(31)*DPE8+C(32)*DPR8				
Observations: 342				
R-squared	0.12678	Mean		-0.0001
Adjusted R-squared	0.11903	S.D.		0.5694
S.E. of regression	0.53452	SSR		96.570
Durbin-Watson stat	0.15854			
Equation: AB9=C(33)*DNE9+C(34)*DNR9+C(35)*DPE9+C(36)*DPR9				
Observations: 342				
R-squared	0.102781	Mean		0.005924
Adjusted R-squared	0.094817	S.D.		0.337597
S.E. of regression	0.321193	SSR		34.86984
Durbin-Watson stat	0.221555			

AB_i: Abnormal returns, DNE: Expansionary negative inflation, DNR: Recessionary negative inflation surprise, DPE: Expansionary positive Inflation Surprise, DPR: Recessionary positive Inflation Surprise, i: 1,2..9 Sectors.