Monetary policy, inflation and stock returns: evidence from the United Kingdom

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Monetary Policy, Inflation and Stock Returns: Evidence from the United Kingdom

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Abstract

This thesis analyses the response of aggregate and sectoral stock returns to monetary policy announcements and inflation in the United Kingdom. Given the unique monetary policy framework, the monetary policymaking process and inflation target of the United Kingdom are different from other countries in many aspects, investigating the UK case could add international evidence to the current literature. This thesis contains three main parts: (i) monetary policy and stock returns, examining the impact of monetary policy announcements on stock returns and stock market volatility under different monetary policy regimes, especially before and after the independence of the Bank of England in 1997; (ii) inflation and stock returns, investigating the issues whether common stocks are a hedge against inflation in short, medium and long-term and under different inflationary economies and regimes; (iii) corporate financing mix and inflation exposure, testing how corporate financing mix affects the exposure of common stocks to inflation.

The results suggest that monetary policy announcements negatively affect stock returns and significantly impact stock market volatility. The responses of stock returns and stock market volatility vary before and after May 1997, when the Bank of England gained independence, which suggests that a change in the monetary policymaking process tends to affect the responses of stock markets. The research also uncovers the fact that the UK stock market fails to hedge against inflation in short and medium-term, but provides a good hedge against inflation in long-term. Different inflationary economies or regimes also affect the relationship between inflation and stock returns. In addition, this thesis finds support for the nominal contracting effect suggesting that firms with higher debtors gain while firms with higher creditors lose from higher-than-expected inflation. The empirical mixture of the results found in the relationship between inflation and stock returns is likely to be explained by the nominal contracting hypothesis.

Declaration

The material contained in this thesis has not been submitted in support of an application for another degree or qualification in this or any other University.

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To My Parents and Husband...

Table of Contents

Chapter 1 Introduction 1
1.1 Research Background 1
1.2 The Research Issues and Motivations 4
1.3 Main Findings of the Research 10
1.4 Organization of the Thesis 12
Chapter 2 Monetary policy, Inflation and Stock Returns 14
2.1 Introduction 14
2.2 Monetary Policy and Inflation 16
2.3 The Impact of Monetary Policy on Stock Returns 19
2.4 The Relationship between Inflation and Stock Returns 30
2.4.1 Theoretical Hypothesis 30
2.4.2 Empirical Investigation 32
2.4.3 Interpretations 42
2.5 Nominal Contracting Hypothesis, Corporate Financing Mix and Inflation Exposure 63
2.5.1 Corporate Financing Mix and Inflation Exposure 63
2.5.2 Nominal Contracting Hypothesis 67
2.6 Summary 77
Chapter 3 Monetary Policy and Stock Returns 80
3.1 Introduction 80
3.2 Brief Review of Literature 84
3.3 Data and Descriptive Statistics 87
3.3.1 Data 87
3.3.2 Descriptive Statistics 91
3.4 Methodology and Hypothesis Development 91
3.4.1 Tests for the Effect of Changes in Interest Rate on Stock Returns and Stock Market Volatility 92
3.4.2 Tests for the Effect of Changes in Money Supply on Stock Returns 97
3.5 Empirical Results 100
3.5.1 The Effect of Changes in Interest Rate on Stock Returns 100
3.5.2 The Effect of Changes in Interest Rate on Stock Market Volatility 105
3.5.3 The Effect of Changes in Money Supply on Stock Returns 110
3.6 Summary 113
Chapter 4 Inflation and Stock Returns 133
4.1 Introduction 133
4.2 Brief Review of Literature 137
4.3 Data and Descriptive Statistics 139
4.3.1 Data 139
4.3.2 Data Description 141
4.4 Methodology and Hypothesis Development 142
4.4.1 Announcement Effect Study 143
4.4.2 Short Horizon Study 146

4.4.3 Long-Term Cointegration Study 149
4.5 Empirical Results 153
4.5.1 Effects of Inflation Announcements on Stock Returns 153
4.5.2 The Relationship between Inflation and Stock Returns at Short Horizons 157
4.5.3 The Long-Run Relationship between Inflation and Stock Returns 161
4.6 Summary 165
Chapter 5 Corporate Financing Mix and Inflation Exposure 183
5.1 Introduction 183
5.2 Brief Review of Literature 187
5.3 Data and Descriptive Statistics 189
5.3.1 Data 189
5.3.2 Descriptive Statistics and Correlation Analysis 193
5.4 Methodology and Hypothesis Development 194
5.4.1 Estimation Method 194
5.4.2 The Expanded Models 197
5.4.3 Nominal Contracting Effects 200
5.5 Results 208
5.5.1 Effects of Net Monetary Position 210
5.5.2 Effects of Depreciation Tax Shield 212
5.5.3 Effects of Debt-to-Equity Ratio 214
5.5.4 Joint Effects of Nominal Contracts 214
5.5.5 The Nominal Contracting Effect and the Nominal Capital Gains Tax Effect of Inflation 216
5.5.6 Magnitude of Nominal Contracting Effects 217
5.6 Summary 219
Chapter 6 Summary and Conclusion 240
6.1 Overview and Contributions 240
6.2 Summary 242
6.3 The Implications of Findings 247
6.4 Future Research 249
Reference 251

List of Tables and Figures

Tables

3. 1: Unbiasedness Test 117
3. 2: Test of the Weak Form Efficiency 117
3. 3: Summary Statistics for the Announcement of Monetary Policy 118
3. 4: Effects of Changes in Interest Rate on Stock Returns 121
3. 5: Effects of Expected and Unexpected Changes in Interest Rate on Stock Returns 122
3. 6: The Asymmetric Effect of Unexpected Changes in Interest Rate on Stock Returns 125
3. 7: Effects of Unexpected Changes in Interest Rate on Stock Market Volatility on the Announcement Date 126
3. 8: Effects of Unexpected Changes in Interest Rate on Stock Market Volatility around the Announcement dates 127
3. 9: Effects of Unexpected Changes in Interest Rate on Stock Market Volatility before and after May 1997 128
3. 10: The Asymmetric Effect of Unexpected Changes in Interest Rate on Stock Market Volatility 129
3. 11: Effects of Changes in the Money Supply on Stock Returns 130
3. 12: Effects of Expected and Unexpected Changes in Money Supply on Stock Returns 131
3. 13: The Asymmetric Effect of Unexpected Changes in Money Supply on Stock Returns 132
4. 1: Summary Statistics 172
4. 2: Effects of Inflation Announcements on Stock Returns 174
4. 3: The Asymmetric Effect of Inflation Announcement on Stock Returns 176
4. 4: The Relationship between Inflation and Monthly Stock Returns 177
4. 5: The Relationship between Inflation and Monthly Stock Returns with Dummy Variables 178
4. 6: The Relationship between Inflation and Monthly Stock Returns in a Two Regime Market 179
4. 7: Unit Root Tests 180
4. 8: Structure Break Tests 181
4. 9: LR, AIC and HQ for Vector Autoregression (VAR) Lengths Specification 181
4. 10: Cointegration Tests 182
5. 1: The Unbiasedness Test 222
5. 2: The Weak-Form Test of Efficiency 222
5. 3: Structure of the Panel Data 223
5. 4: Summary Statistics 224
5. 5: Correlation Matrix 225
5. 6: Effects of Net Monetary Position on the Sensitivity of Stock Returns to Unexpected Inflation 228
5. 7: Effects of Short-Term Monetary Position on the Sensitivity of Stock Returns

to Unexpected Inflation 229
5. 8: Effects of Long-Term Monetary Position on the Sensitivity of Stock Returns to Unexpected Inflation 230
5. 9: Comparison of the Impact of Short and Long-Term Monetary Position 231
5. 10: Effects of Depreciation Tax Shield on the Sensitivity of Stock Returns to Unexpected Inflation 232
5. 11: Effects of Debt-to-Equity Ratio on the Sensitivity of Stock Returns on Unexpected Inflation 233
5. 12: Joint Effects of Short-Term Monetary Position, Long-Term Monetary Position and Depreciation Tax Shield 234
5. 13: Joint Effects of Depreciation Tax Shield and Debt-to-Equity Ratio 235
5. 14: Joint Tests of the Nominal Contracting Hypothesis and the Nominal Capital Gains Tax Effect of Inflation 236
5. 15: Magnitude Tests of Net Monetary Position 237
5. 16: Magnitude Tests of Net Monetary Position with Depreciation Tax Shield 238
5. 17: Magnitude Tests of Net Monetary Position with Depreciation Tax Shield and Debt-to-Equity ratio 239

Figures

4. 1: Monthly Inflation Rate (Retail Price Index) in Percentages 169
4. 2: Annual Inflation Rate (Retail Price Index) in Percentages 169
4. 3: Monthly Stock Returns (FTSE All Share Index) in Percentages 170
4. 4: Annual Stock Returns (FTSE All Share Index) in Percentages 170
4. 5: Retail Price Index and FTSE All Share Index 171
4. 6: Retail Price Index, FTSE All Share Index and Industry Indices 171

List of Abbreviations

AR	autoregressive
ARCH	autoregressive conditional heteroscedasticity
ARIMA	autoregressive integrated moving average
ARMA	autoregressive moving average
BoE	Bank of England
CPI	Consumer Price Index
Fed	Federal Reserve System
FIFO	first in first out
FOMC	Federal Open Market Committee
GARCH	generalized autoregressive conditional heteroskedasticity
GDP	gross domestic product
GMM	generalized method of moments
GMM-DIF	generalized method of moments of first differences
GMM-SYS	system-generalized method of moments
IGM	Informa Global Markets
IVA	inventory valuation adjustment
LIFO	last in first out
MA	moving average
MMS	Money Market Services International
OECD	the Organisation for Economic Co-operation and Development
OLS	ordinary lest square
PPI	Producer Price Index
RPI	Retail Price Index
SUR	seemingly unrelated regression
VAR	vector autoregression
VEC	vector error-correction

Chapter 1 Introduction

1.1 Research Background

Economists have considered the interaction between the monetary policy, inflation and the stock market for a long time. The interaction between monetary policy, inflation and the stock market is inevitably a two-way street. Monetary policy, as the actions undertaken by a central bank to influence the availability and cost of money and credit to help promote national economic goals, has fundamental repercussions for the economic growth by altering investment and consumption demand which in turn affect inflation and the stock market.[1] As a product as well as a determinant of monetary policy, inflation affects all sectors of the economy including the stock market by reducing the purchasing power of money. As common stocks are claims for real assets, the stock market also has an impact on monetary policy and inflation because changes in the investors' financial wealth have an impact on private consumption expenditure, which results in the shifts in real activity and finally leads to the changes in inflation and monetary policy.

In recent years, the importance of monetary policy and inflation to the stock market has been increasingly focused. Monetary economists have been interested in whether the stock market responds to monetary policy. According to Rozeff (1974), in the efficient market, stock prices which full reflect available information including expected monetary policy will respond to unexpected changes in monetary policy since unexpected changes in monetary policy contain unexpected information which has not been reflected in current stock prices. Mishkin (2007, p.155-156) furthermore suggests that in the short run tightening or loosening monetary policy might negatively affect stock prices which are determined by the discounted value of future dividends. This is mainly because monetary policies can alter the path of expected

[1] See http://www.bankofengland.co.uk/monetarypolicy/index.htm (15 March 2009)

dividends, the discount rate or the equity premium. For example, when the central bank uses monetary policy tools to reduce the interest rate, a lower interest rate will encourage investment and consumption, which in turn tend to promote the economy and increase the future dividends of stocks or their growth rates. Meanwhile, a lower interest rate will result in a decline in bond returns, thus, the investors accept a lower return from the investment in equity. The consequence of all the above is a rise in stock prices.

Empirical studies examining the announcements effect of monetary policy on stock market have paid increasing attention to the level of stock returns and the stock market volatility as well, and find mixed results. While some studies provide confirmative results for the negative effects as in Waud (1970), Cornell (1983), Pearce and Roley (1983, 1985), Jensen and Johnson (1993, 1995, 1997), Flannery and Protopapadakis (2002), Bomfim (2003) and Bredin et al. (2007), other studies show the effects are insignificant (Black, 1987; Goodhart and Smith, 1985; Tarhan, 1995; Rangel, 2006 and Serwa, 2006). Some even report that the impact of monetary policy on stock returns could be either significantly negative or insignificant, depending on the sample periods (Hafer, 1986 and Hardouvelis, 1987).

Financial economists have ardently debated whether common stocks are a hedge against inflation. According to the Fisher hypothesis (1930), expected nominal rates of returns should move one-to-one with expected inflation. Therefore, common stocks representing a claim over real assets of which real values are assumed to be independent of the changes in the commodity price level are expected to hedge against inflation (Bodie, 1976).

However, empirical evidence suggests, for the relationship between inflation and stock returns, it could be positive, negative or insignificant; or it may vary with different time horizons, inflationary economies and regimes. Thus the relationship is more complicated than what is suggested by the Fisher hypothesis (1930). While a few exceptions claim the effect is insignificant (Joyce and Read, 2002), most studies document a negative impact of inflation on stock returns using the event study method (Schwert, 1981; Goodhart and Smith, 1985; Pearce and Roley, 1985; Cutler et al., 1989; Amihud, 1996 and Adams et al., 2004). In particular, studies using short-horizon data tend to find a significantly negative correlation between inflation and stock returns (Bodie, 1976; Fama, 1981; French et al., 1983, Osamah, 2004; Samer, 2005, *etc*). Studies with different sample periods show either positive or negative and some studies find varying effects over different time horizons (Boudouht and Richarson, 1993; Schotman and Schweitzer, 2000; Ryan, 2006). This relationship is also found to be dependent on monetary policy regimes, inflationary economies or regimes (Kaul, 1987, 1990; Graham, 1996; Barnes et al., 1999). Most studies using the long-horizon data or analyzing the long-term cointegration relation, find a positive relationship between inflation and stock returns (Boudoukh et al., 1994; Anari and Kolari, 2001; Luintel and Paudyal, 2006, *etc*) with one exception, Laopodis (2006), which finds a weak negative relationship.

There are various explanations attempting to interpret the empirical mixture of results found in the relationship. These include the proxy hypothesis (Fama, 1981), general equilibrium models (Danthine and Donaldson, 1986), the tax-effects hypothesis (Feldstein, 1980), the money illusion hypothesis (Modigliani and Cohn, 1979), the nominal contracting hypothesis (Kessel, 1956), the capital management hypothesis (Lintner, 1975), the tax-augmented hypothesis (Anari and Kolari, 2001; Luintel and Paudyal, 2006) and the agency problem hypothesis (Jovanovic and Ueda, 1998).

Amongst existing explanations, the nominal contracting hypothesis put forward by Kessel (1956) is one of the most influential. Different from other explanations which focus on the aggregate market, the nominal contracting hypothesis provides a micro-firm level explanation focusing on the inflation exposure that firms are faced with. Kessel (1956) explains that firms normally hold different kinds of nominal contracts, such as debts, which are all set at fixed nominal interest rate. The dealing prices of nominal contracts agreed by the parties involved in are only estimated depending on the future payment by considering inflation that is expected to occur over the course of the contract. Thus when unexpected inflation occurs it causes the nominal interest rate changes, the former interest rates or returns of the nominal contracts agreed by the parties at the beginning might later be lower or higher than the current interest rate. When this estimated bias happens, the value of the nominal contract might be lower or higher than the primary value. Hence, for two parties holding these nominal contracts, there is a wealth transfer between them: when positive unexpected inflation occurs, the interest rate will rise and the present value of nominal contracts will drop, therefore, the creditor will lose while the debtor will gain. Furthermore, since most firms that have many nominal contracts on both the asset side and the liability side are debtors and creditors at the same time, net debtor firms or markets will gain and the gains are positively related to inflation, but net creditor firms or markets lose and the losses are negatively related to inflation.

Debate on this wealth redistribution effect caused by unexpected inflation in the presence of nominal contracts has been intense in the past decades. Some studies find support for the nominal contracting hypothesis (Bernard, 1986; Pearce and Roley, 1988; Dokko, 1989) although many studies find little or no confirmative evidence (Bradford, 1974; French et al., 1983; Chang et al., 1992). Therefore, the development of the literature in this area shows that, despite the fact that the responses of stock returns to monetary policy and inflation has attracted an increasing number of studies, the results are mixed and often contradictory.

1.2 The Research Issues and Motivations

The primary focus of this thesis is on the response of stock returns to monetary policy and inflation in the UK. The changes in monetary policymaking process, the importance of monetary policy tools and inflation risk to the economy and the stock market have motivated this research. In the 1980s and 1990s, many countries, such as New Zealand, Chile, Canada, and the UK made their central banks independent. This meant that central banks were effectively given the power to make monetary policies autonomously. The world-wide independence of central banks affects the process of monetary policymaking and the consequent inflation outcome. Therefore, economists have been interested in whether this would in turn influence the stock market. In addition, inflation risk is one of the biggest fears for the stock market. Investors and firm managers face the formidable task of hedging inflation risk. Thus more and more attention has been paid to whether the stock market provides a good hedge against inflation or whether it is possible to control inflation risk. Moreover, due to current financial crisis, central banks frequently used monetary policy tools to stimulate economic growth. Consequently, there is increasing focus on how monetary policy and inflation affects the stock market and what proper policies should be framed in the future.

The focus of this thesis is on the UK stock market because the existing literature in this field, including theoretical and empirical studies, is mostly concerned with the US market and scant research has been undertaken on non-US countries, such as UK. As the developed countries, the US and the UK share many similarities. However, the UK monetary policymaking process and inflation target is different from those in the US. Compared with the US Fed, the Bank of England is less goal-independent and has more obligations for the inflation stability (Mishkin, 2007, p.326). The Bank of England make its monetary policy decisions independently after May 1997 and the inflation target required to be met by monetary policy is set by the Chancellor of the Exchequer. Interest rate decisions are made by the Monetary Policy Committee (MPC) comprising nine members (five governors and four experts) in order to maintain price stability-low inflation target of 2% Annual Consumer Price Index and to support the Government's economic goals including growth and employment. In the mid of each month, the UK Statistics Authority announces the preceding months inflation rate. Missing the inflation target by more than 1% will force the Governor of the Bank of

England to write an open letter to the Chancellor explaining the reasons for losing control of inflation and the Bank proposes to draw inflation back to the target. Therefore, it can be seen that the Bank of England has been given limited independence and has more obligations for the government's inflation target compared with the US Federal Reserve System. Furthermore, its monetary policy making committee-the Federal Open Market Committee (FOMC) can independently make monetary policy without democratic control from the government setting the target inflation rate (Buckle and Thompson, 2004, p.352-357). Due to the differences in monetary policymaking process and inflation target between the UK and the US, the US evidence found in previous studies might be inapplicable for the UK market, which highlights the importance of the UK evidence.

Therefore, exploring the UK case, this thesis attempts to fill some of the void left in the existing literature and enrich the field. Firstly, this thesis aims to extend previous analyses of the effect of the monetary announcements on stock returns by focusing on the level of stock returns as well as the stock market volatility, and the effects before and after the independence of the Bank of England. The response of stock market volatility to the monetary policy is as important as the response of stock returns because volatility is perceived as time-varying risk associated with the asset, enabling investors to value the maximum to lose over a given time period and is important for risk managements (Harris and Sollis, 2003, p.214). However, to the best of the author's knowledge, there is lack of study that examines the response of stock price volatility to monetary policy announcements on the UK stock market. Only a limited number of studies have investigated announcement effect of monetary policy on the stock returns in the context of the UK, such as Goodhart and Smith (1985), MacDonald and Torrance (1987), Peel et al. (1990), Gregoriou et al. (2006) and Berdin et al. (2007).

In the empirical examination by this thesis, the monetary announcements will involve both the interest rates and money supply announcement. While some studies have examined the case of the effects of the US announcements of money supply and the discount rate, e.g. Pearce and Roley (1985), the literature on the UK market only investigates either the effect of the Bank of England official bank rate announcement or money supply announcements, not both. Since the Bank of England's official bank rate and broad money supply are both very important indicators for the UK monetary policy and suggested to be good proxies for policy changes (See Berdin et al., 2007; Goodhart and Smith, 1985; MacDonald and Torrance, 1987; Clare and Courtenay, 2001; and Burrows and Wetherilt, 2004), it is necessary to investigate both of the impacts of the Bank of England official bank rate and broad money supply announcements on stock returns to cover a wider area of monetary policy than previous studies do.

Moreover, the monetary announcement effects before and after the independence of the Bank of England are worth considering. Until now, there is lack of study that has ever compared the monetary announcement effects before and after the independence of the Bank of England. Before the independence, the UK monetary policy was decided by the Chancellor of the Exchequer following a monthly consultation with the Governor of the Bank of England. Since May 1997, the Bank of England has been able to make its monetary policy decisions independently with regard to the determination of interest rates to achieve the inflation target set by the Chancellor of the Exchequer. The independence of the Bank of England directly affects the monetary policymaking process and the way that monetary policy is announced. Therefore comparing the announcement effects before and after the Bank's independence may uncover interesting evidence of how stock market responds to a shift in the UK's regimes of monetary policy formulation.

Secondly, this thesis attempts to provide a general picture for the relationship between inflation and stock returns. As far as the author knows, there is lack of research that generally examines the relation between inflation and stock returns for the UK market in short, medium and long-term at a variety of time horizons and under different inflationary economies and regimes. Results of existing research show that the inflation-and-stock returns relation is complex and may display diverse signs. This complex relationship and the horizon sensitivity will tend to vary, under different inflationary economies or regimes. Investigating the horizon sensitivity for the relationship between inflation and stock returns is very important for investors who have to deal with inflation risk. Based on short, medium and long term performance, investors might like to change the holding period to deal with the inflation risk.

A few studies have examined such relations in the UK (Goodhart and Smith, 1985; Peel and Pope, 1985, 1988; Joyce and Read, 2002). Some previous studies have displayed comparative performance, but only between the short horizon and long horizon as in Boudouht and Richarson (1993), Schotman and Schweitzer (2000), Wong and Wu (2003), Kim and In (2005) and Ryan (2006) provide a richer performance comparison between horizons, but most of them focus on the US markets. Thus, little evidence of the horizon sensitivity for the relationship between inflation and stock returns for the UK market has been provided by the existing literature. Similarly, although some studies show that the inflation-stock return relation is not stable and may vary across different inflationary regimes, such as De Alessi (1975) and Barnes et al. (1999), there is lack of study that conducts such investigation for the UK market. In the 1970s, the UK's annual inflation rate was over 20% while most developed countries' inflation rates were only over 10%, therefore, UK's inflation rate was higher than most developed countries in 70s. It is interesting to see whether this high inflation economy affects the response of stock returns to inflation and this thesis of the UK will cover the sample period from 1962/1955 to 2007 to investigate the relationship.

Thirdly, this thesis also attempts to provide up-to-date evidence for the nominal contracting hypothesis and extend previous models to the linear dynamic panel data model with an estimation method of two-step system-generalised method of moments (GMM-SYS) to test this hypothesis. To the best of the author's knowledge, there is lack of study that empirically tests the nominal contracting hypothesis for a non-US market. This hypothesis concerns the wealth transfer effect caused by nominal contracts due to unexpected inflation. All previous studies investigated only the US market. However, the empirical evidence from the US market may not necessarily represent the other markets such as the UK. In addition, the latest investigation into nominal contracting hypothesis was conducted by Change et al (1992) and Wei and Wong (1992). No more research has been done after 1992. Thus, these highlight a need for more up-to-date evidence of the nominal contracting hypothesis for a non-US market.

Moreover, previous studies focus on only some specific firm characteristics, such as short and long-term monetary position, depreciation tax shield, inventories, long-term debt-to-equity ratio, net property, plant and equipment, short-term debt and long-term debt, etc. (French et al., 1983; Bernard, 1986; Pearce and Roley, 1988; Wei and Wong, 1992 and Dokko, 1989). Some of these influences are found to not be significant for the US market, but they may be important nominal contracting effects for the UK market. Thus the empirical investigation should be conducted with as many pertinent variables as possible to provide a framework that encompasses the influences as suggested by competing theories in the area, i.e. the nominal contracting hypothesis and the capital gains tax effect of inflation.

As an investigative tool, the methodology used in previous studies, Seemingly Unrelated Regression (SUR) or Ordinary Least Square (OLS), are not entirely suitable for the firm-level data since, for firm-level data, the large cross-sections of firms observed for a short time period tend to have problems of heteroscedasticity, simultaneity, endogeneity and random measurement errors (Arellano, 2003, p.1-2). Hence there is the motivation for adopting a recent method suggested by Paudyal et al. (2008) which applies the linear dynamic panel data model of Arellano (2003) and two-step system-generalised method of moments (GMM-SYS) due to Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). Therefore, the linear dynamic panel data model with an estimation method of two-step system-generalised method of moments (GMM-SYS) might be more suitable to test the nominal contracting effect. Methodologically, this represents an important extension of previous techniques used in examining the nominal contracting hypothesis.

Hence with the UK case in focus, this thesis attempts to specifically explore the following questions: (i) whether monetary policy announcements affect the level of stock returns and stock market volatility and whether the independence of the Bank of England affect the response of the stock market to monetary policy? (ii) whether common stocks provide a good hedge against inflation in short, medium and long term, across different time horizons or depending on different inflationary economies and regimes? (iii) whether the effect of nominal contracts on the sensitivity of stock returns to unexpected inflation exist and that the empirical mixed results found in the relationship between inflation and stock returns could be explained by the nominal contracting hypothesis?

1.3 Main Findings of the Research

The current study uncovers evidence that monetary policy announcements negatively affect the level of stock returns and significantly impact stock market volatility. Stock returns are found to significantly and negatively respond to announcements of both changes in interest rate and changes in money supply, and unexpected changes in interest rate also affect the stock market volatility. The unexpected changes in monetary policy would induce the effects, while the expected changes in monetary policy has little impact, consistent with the efficient market hypothesis. In addition, this study provides confirmative evidence of the asymmetric effect of bad news and good news. This study finds that the announcements of monetary tightening translates to bad news for the stock while the announcements of a loosening of monetary policy will on the contrary be good news. Moreover, the responses of stock returns or stock market volatility are different before and after the independence of the Bank of England, suggesting that changing the monetary policymaking process affects the response of the stock market.

It is also revealed that the relationship between inflation and stock returns are mixed and vary across different time horizons. While being negative in event studies, the correlation could be either positive or negative in the short horizon study and positive in long-term cointegration analysis. Results show that announcements of unexpected inflation on stock returns have a negative impact on stock returns whereas announcements of expected inflation display negligible impact. In terms of time horizons, there is a negative relationship between unexpected inflation and stock returns and a positive relationship between expected inflation and stock returns in the short-horizon study. And the study that tests for the long-term cointegration find a positive relationship and shows an elasticity of greater than unity. These are all consistent with most previous studies. The study ascertains the preannouncement effect and the delay effect of the inflation news, but the directional asymmetry effect of the inflation announcements is not determined.

The relationship between inflation and stock returns varies across different inflationary economies and regimes. In the announcement study, the inflation news is found to negatively affect the aggregate stock returns in the low inflation economy but has no impact in the high inflation economy. Similarly, in the short-horizon study, expected inflation positively affects aggregate stock returns in the high inflation economy but has no effect in the low inflation economy. But, on the contrary, unexpected inflation strongly and negatively affects the aggregate stock returns in the low inflation economy but has no impact when inflation is high. Inflation, either expected or unexpected, is found to significantly affect stock returns only in the high inflationary regime but not in the low inflationary regime.

Furthermore, this study finds evidence of the nominal contracting effect under which debtor firms gain while creditor firms lose from higher-than-expected inflation, and the more debts a debtor firms holds, the more it gains. Net monetary position and its two sub-categories: short-term monetary position and long-term monetary position, defined in terms of nominal assets, are found to have a strong negative effect on the sensitivity of stock returns to unexpected inflation. Debt-to-equity ratio however has little nominal contracting effect and the depreciation tax shield has the opposite effect.

It is confirmed that with positive unexpected inflation, the more net monetary assets a firm has, the more it loses. On the other hand, firms that have more debts can gain more. These results are consistent with the magnitude impact suggested by the nominal contracting hypothesis, but, inconsistent with the nominal contracting hypothesis regarding the difference of impact magnitudes between short- and long-term monetary position because this study finds that firms have a lot of short-term debts gain more than do the firms that have a lot of long-term debts. The results are also consistent with the nominal capital gains tax effect of inflation. Therefore our findings suggest that the empirical mixed results found in the relationship between inflation and stock returns is likely to be explained by the nominal contracting hypothesis.

1.4 Organization of the Thesis

This thesis is organized as follows. Chapter 2 provides a review of the literature on the interaction between monetary policy, inflation and stock returns, with special emphasises on the impact of monetary policy announcements on stock returns, the relationship between inflation and stock returns and the nominal contracting hypothesis for a firm's decision on corporate financing mix and on dealing with inflation exposure.

Chapter 3 empirically examines the response of the stock market to monetary policy announcements. Specially, it investigates the responses of the level of stock returns and the market volatility to the Bank of England's official bank rates over the period of January 1978 to December 2007 and the effect of broad money supply M4 on stock returns from January 2000 to December 2007, using the event study methodology and the extended GARCH (1, 1) model. The aggregate market and ten individual industries are considered, respectively. It also examines the effects in the sub-sample periods of before and after the independence of the Bank of England in May1997.

Chapter 4 concerns the relation between inflation and stock returns in the aggregate market and in ten separate industries across different time horizons. This chapter conducts the empirical examination of the announcements effect from December 1962 to December 2007 with hand-collected inflation announcement data, a short horizon study and long-term cointegration analysis both from January 1955 to December 2007, and an investigation of varying relations between inflation and stock returns in different inflationary economies and regimes. The event study methodology, Two Stage Least Square methodology and Johansen technique of cointegration with structure breaks are applied in this chapter, respectively.

Chapter 5 examines the sensitivity of aggregate and sectoral stock returns to unexpected inflation in presence of nominal contracts, along the lines suggested by the nominal contracting hypothesis using the linear dynamic panel data model with an estimation method of two-step GMM-SYS. The nominal contracting hypothesis is examined on available non-financial and non-utility firms from 1982 to 2006. Summary and conclusion is presented in Chapter 6.

Chapter 2 Monetary policy, Inflation and Stock Returns

2.1 Introduction

The interaction between monetary policy, inflation and stock returns is an important issue in financial economics. A large body of studies suggest that monetary policy and inflation interact with each other. There are a considerable number of studies show that monetary policy and inflation have an effect on the stock market, some evidence displays that developments in the stock market tend to have an effect on monetary policy and inflation as well.

Increasingly more and more studies in this field are focusing on the responses of the stock market to monetary policy and inflation. Common stocks as a claim on real assets are affected by states of the economy and macroeconomic factors such as monetary policy and inflation. Rozeff (1974) theoretically explains the effect of monetary policy on stock market in an efficient market. Stock prices which full reflect available information including expected monetary policy will respond to unexpected changes in monetary policy since unexpected changes in monetary policy contain unexpected information which has not been reflected in current stock prices. Mishkin (2007) further explains that monetary policy negatively affects stock returns in the short run. Studies examining the impact of monetary policy announcements on stock market have paid increasing attention to the level of stock returns and the stock market volatility and find mixed evidence. For example, Goodhart and Smith (1985) find no empirical evidence of the impact of monetary policy announcements on the UK stock returns, while Waud (1970) shows that stock returns respond significantly to the monetary policy announcements. Monetary economists have provided some explanations of the negative relation between monetary policy and stock returns.

Financial economists also claim that stocks should be a good hedge against inflation as postulated by Fisher (1930). However, large amount of studies suggest, for the relationship between inflation and stock returns, it could be positive, negative or insignificant; or it may vary with different time horizons, inflationary economies and regimes, which is more complicated than what the Fisher hypothesis implies. For example, while Bodie (1976) finds that the stock returns are negatively related to both expected and unexpected inflation, Boudoukh and Richardson (1993) show that the relationship between inflation and stock returns displays the horizon sensitivity: it is negative at short horizons but positive at long horizons. Financial economists also provide many theoretical explanations attempting to explain the empirical mixture of the results found in the relationship. Different from most existing explanations that focus on the aggregate market level to provide the interpretations, the Nominal contracting hypothesis (Kessel, 1956), provides a micro-firm level explanation and is one of the most influential. However, present studies show that empirical results regarding the nominal contracting hypothesis are also mixed.

This, therefore, reflects the fact that existing literature does not provide convincing theoretical explanations that fit the empirical evidence. The effect of monetary policy and inflation on stock market is still a critical issue and far from conclusive. Generally, there is some of the void left in the existing literature and following chapters attempt to fill them. Firstly, most existing literature in this field is concerned with the US market and research that has been undertaken on non-US countries, such as UK, is inadequate. Secondly, with the UK case in focus, this is lack of study that examines the effect of the monetary announcements on both the level of stock returns and stock market volatility. Thirdly, little research generally investigates the relation between inflation and stock returns at a variety of time horizons including announcements, short horizons, and long-term cointegration analysis and across different inflationary economies and regimes with the UK case. Fourthly, as far as the author knows, there is lack of study that has empirically tested the nominal contracting hypothesis in a non-US market.

This chapter aims to provide a review of the literature on the interaction between monetary policy, inflation and stock returns, with a special emphasis on the impact of monetary policy announcements on stock returns, the relationship between inflation and stock returns, and the nominal contracting hypothesis. The remainder of this chapter is organized as follows: Section 2 briefly reviews the relative literature on the relationship between monetary policy and inflation. Section 3 considers the literature on the relationship between monetary policy and stock returns. Section 4 discusses the relationship between inflation and stock returns. Section 5 focuses on the nominal contracting hypothesis, corporate financing mix and inflation exposure. Finally, the conclusion is presented in Section 6.

2.2 Monetary Policy and Inflation

The interest rate, defined by Fisher (1930) as the compensatory effect with which giving up today's consumption of goods and services must be compensated by the increase in consumption in the future, is the percentage of premium paid on money which is traded between present and future. Since the investor is mainly concerned with the purchasing power of money, he distinguishes the nominal interest rate into the real interest rate and the rate of expected inflation. He also hypothesizes that the real and monetary sectors are largely independent which results in the hypothesis that the expected real rate is determined by real factors such as the productivity of capital and time preference of savers, and is unrelated to the expected inflation rate. This is known as the Fisher hypothesis (1930) on interest rate, which can be summarized in equation (2.1).

$$r = (1 + r^e)(1 + P^e) - 1 \tag{2.1}$$

where

r: nominal interest rate;

r^e: expected real interest rate;

P^e: expected inflation.

As indicated by equation (2.1), an expected change in the nominal interest rate might be due to changes in either the expected real rates or expected inflation rates. The real interest rate is affected by the changes in supply or demand due to, for example, states of the economy, government expenditure and monetary policy, while inflation can be affected by either demand shocks such as changes in investment, government expenditure, monetary policy and net export, or supply shocks such as wages, oil prices, food prices and the exchange rate. In this light, high real rates may indicate a rapidly expanded economy, high government deficits or tightened monetary supply. On the other hand, high inflation may be caused by a rapidly expanding economy, high government deficits, rapid expansion of money supply, high oil prices or other shocks from the demand or supply side (Bodie et al., 2006, p.503). Thus, the Fisher hypothesis suggests that there is an interaction between monetary policy and inflation.

The existing literature shows that monetary policy affects inflation. According to Friedman's proposition (1963), inflation is always a monetary phenomenon, which suggests a relationship between money growth and inflation. Monetary policy affects macroeconomic variables largely through its impact on interest rate. The central bank uses monetary policy tools to manipulate the money supply and interest rates, which influence indicators like output, exchange rates, and unemployment rate which consequently affect inflation and the overall economy. As a result, expansionary monetary policy will encourage investment and consumption demand leading to higher inflation, while tightening monetary policy will cool down the economy resulting in lower inflation. This proposition is supported by a significant number of empirical studies. Examples include Lee (1992) who investigates the causal relation and dynamic interaction between asset returns, real activity, and inflation and finds that interest rates explain a substantial fraction of variation in inflation. Applying a rolling VAR model to examine the relations among stock prices, interest rate, inflation and real activity, Park and Ratti (2000) find that monetary policy affects inflation.

Most empirical studies suggest that current changes in inflation lead to changes in expected inflation, which in turn lead to changes in the central bank's decisions for interest rate, i.e. whether to tighten or loosen monetary policy accordingly. The Fisher hypothesis has given rise to lively debate about whether the real interest rate or expected inflation is the main influence driving the changes in the nominal interest rate. Many studies claim that the real interest rate is more stable. Therefore, changes in the nominal interest rate really reflect the changes in expected inflation (Fama, 1975; Fama and Schwert, 1977; Evans and Lewis, 1995; *etc*). This means that given the real interest rate is stable in a long period, the changes in the nominal interest rate mainly result from changes in expected inflation. Consequently, nominal interest rates will change one-to-one for a given change in expected inflation when there are no taxes. However, some studies (e.g. Pennachi, 1991) hold that the nominal interest rate is more unstable than the inflation rate, hence, the changes in the nominal interest rate are mainly due to the changes in the real interest rate.

Instead of supporting either side of the debate, some studies suggest a more complicated situation in which changes in the nominal interest rate could come from either the real interest rate or expected inflation and that such relations vary across different countries. Gupta and Moazzami (1996) test the relation between short-run before-tax nominal interest rates and expected inflation for eleven developed countries including Australia, Canada, France, Italy, Japan, Netherlands, Sweden, UK and USA. They find that: 1) the Fisher hypothesis of unity coefficient for expected inflation can be rejected for all countries except for the UK, Sweden and Belgium; 2) the values of the real interest rates have significantly increased since 1980 for all countries except for Japan; 3) the short-run effect of changes in inflationary expectations on the nominal interest rates captured is significantly different from zero for all countries. Therefore, Gupta and Moazzami (1996) suggest that despite the significant increases in the real interest rate, expected inflation still moves one-to-one with the nominal interest rate for the UK. This finding is also supported by Granville and Mallick (2004) who suggest that the Fisher hypothesis holds in the UK.

In short, it is debatable whether the one-to-one relationship exists between expected inflation and the nominal interest rate for all countries, but most empirical studies indicate the existence of at least some positive relationship between the two. For the UK market, some studies even suggest a one-to-one relationship. As such, it may be expected that a rise in inflationary expectations will lead to a corresponding increase in the nominal interest rate, and vice versa.

2.3 The Impact of Monetary Policy on Stock Returns

Economists have long been interested in the response of stock returns to operation of monetary policy instruments such as open market operations, changes in the reserve requirements, adjustment of the discount rate or the interest rate of inter-bank overnight lending of reserves. According to Rozeff (1974), in the efficient market, stock prices which full reflect available information including expected monetary policy will respond to unexpected changes in monetary policy since unexpected changes in monetary policy contain unexpected information which has not been reflected in current stock prices. To gauge the magnitude of such impact, various studies have applied the event-study methodology in their investigations, with a focus on the announcement effects on either the level or the volatility of stock returns using intraday, daily or weekly data.

Existing event studies usually examine the announcement effects at short horizons around a monetary event from which one may obtain a measure of the unanticipated impact of the event on the wealth of the asset holders (Kothari and Warner, 2004). Existing evidence demonstrates that share prices react to the announcement pertinent to corporate control, regulatory policy and macroeconomic conditions since these announcements tend to affect fundamentals, e.g. announcements of macroeconomic variable (Culter et al, 1988; Compbell, Lo and MacKinlay, 1997, p.149).

However, empirical findings are not conclusive. Some empirical studies argue that monetary policy has no effect on stock prices, some examples as Black (1987), Goodhart and Smith (1985), MacDonald and Torrance (1987), Tarhan (1995) and Serwa (2006) Goodhart and Smith (1985), Tarhan (1995), Rangel (2006) and Serwa (2006). Black (1987) presents that monetary policy can not affect stock returns. Goodhart and Smith (1985) find no evidence of announcement effect of money supply on the UK stock market. Tarhan (1995) also shows that in the sample period 1979-1984 there is no evidence of the impact of Fed open market operation on US stock prices in spite of the arguments that Fed open market operations might influence the stock market in many channels. Similarly, Rangel (2006) and Serwa (2006) find limited evidence that stock market index reacts to the monetary policy changes on the announcement day.

Other literature, on the contrary, suggests that changes in monetary policy would affect the stock returns since changes in monetary policy leads to changes in interest rates, which in turn affects real activity and inflation, which results in the changes in common stocks (Sellin, 2003) and provides evidence that stock returns significantly respond to the monetary policy announcements, some examples as Waud (1970), Berkman (1978), Lynge (1981), Cornell (1983), Pearce and Roley (1983,1985), Smirlock and Yawitz (1985), Tarhan (1987), Jensen and Johnson (1993,1995,1997) Thorbecke and Alami (1994), Thorbecke (1997), Lobo(2000), Madura (2000), Flannery and Protopapadakis (2002), Bomfim (2003), Guo (2004), Ehrmann and Fratzscher (2004), Bernanke and Kuttner (2005), Gregoriou et al. (2006), Wongswan (2006), Berdin et al. (2007), Chulia-Soler et al. (2007) and Chang (2008).

Different from previous literature which shows either favourable or contradictory results, other studies show mixed results varying in different time periods, for example, Hafer (1986) finds no significant announcement effect of discount rate in pre-1979 and post-1982 periods but significantly negative effect in the 1979-1982 period. Consistent with Hafer (1986), Hardouvelis (1987) examines the announcement effect of discount rate on stock prices in two time periods: pre-1982 and post-1982 from 1979 to 1982 and finds that discount rate only negatively affect stock prices in the pre-1982 period, not in the post-1982 period.

Studies on the effects of monetary policy announcement focus on either the level of stock returns or the volatility of stock returns, and make use of intraday, daily or weekly data of different monetary policy tools.

The response of the level of stock returns to monetary policy announcements is widely investigated by using different proxies as monetary policy, such as money supply, discount rate, Fed funds rate target (interest rate), open market operations or other proxies for non-US countries (Sellin, 2001). A large amount of studies use money supply as a measure for the monetary policy, as in Berkman (1978), Lynge (1981), Cornell (1983), Pearce and Roley (1983), Goodhart and Smith (1985), Tarhan (1987), Jain (1988) and McQueen and Roley (1993). Berkman (1978) uses the M1 as the monetary policy proxy and finds that the surprise increase in weekly money supply leads to a drop of share prices, implying a negative impact of money supply on stock prices. Lynge (1981) also tests the effect of weekly money supply announcements of M1 on the US stock prices and finds a negative relationship between the two, but in this study no distinction is made between expected and unexpected changes in money supply. In Pearce and Roley's (1983) similar examination, they find that stock prices only react to the unexpected changes in money supply which is consistent with Berkman (1978). McQueen and Roley (1993) extend previous studies to examine the response of stock returns to M1 news at different stages of the business cycle. They show that money supply announcements negatively affect the S&P 500 index and the impact appears stronger at the higher stage of the business cycle.

Studies based on intraday data rather than the daily or weekly data find similar evidence. Using the hourly data of stock returns covering a sample period from the start of 1978 to the end of 1984, Jain (1988) investigates the impact of M1 on S&P 500 index and concludes that money supply surprises have negative effect on stock prices and stock prices reflect money supply surprises quickly in an hour period. Differing from previous studies that focus on the announcement effect of money supply on the aggregate market, Tarhan (1987) examines the US bank stocks from 1979 to 1982 which show that bank stock prices of these stocks are negatively related to money supply surprises.

Despite numerous supports for the effect, some studies find no evidence as in Goodhart and Smith (1985) and MacDonald and Torrance (1987). They investigate the impact of money supply in terms of £M3 on the UK stock market and find no evidence of the announcement effect on the UK stock market, which is inconsistent with findings about the US case in Berkman (1978), Lynge (1981) and Pearce and Roley (1983).

Some studies use changes in the discount rate to measure changes in monetary policy. For example, Waud (1970) unearths evidence of the influence of discount rate changes on the stock market demonstrating that the discount rate announcements adversely affect the S&P index form 1952 to 1967. Smirlock and Yawitz (1985) separate the expected and unexpected components from discount rate changes while investigating the announcement effect of monetary policy on the stock returns. Their results confirm the efficient market hypothesis in that the expected components of discount rate changes does not affect the stock market and only the unexpected component has an effect, which is negative. Jensen and Johnson (1993) also measured the response of the US stock prices to discount rate announcements, but in a longer period from 1962 to 1990. Consistent with previous findings, they show that news about changes in the discount rate is adversely correlated with the stock prices. A hike of the discount rate is bad news to the stock market, while rate reduction represents good news. It is interesting that they find evidence of the preannouncement effect but little evidence of the post-announcement effect.

In a further study, Jensen and Johnson (1995) delve into the asymmetric effect of decreases and increases in the discount rate on stock markets. They detect the asymmetric effect since the stock market has greater responses in periods following good news (i.e. the discount rate decreases) than that in periods following bad news (i.e. when the discount rate increases). Jensen and Johnson (1997) additionally examine the heterogeneous reaction of industries to the discount rate news. Analyzing the association of short- and long-term stock returns responses with the discount rate announcements using daily index of 17 US industries from 16th August 1968 to the end of 1991, they find that industries that experienced stronger than average return patterns are sensitive to changes in spending and the availability of money. In contrast, industries below average patterns are less sensitive to changes in spending as they involve items purchased with more regularity.

Some studies deploy the Fed funds rate target (or interest rate of the non-US countries) as a proxy of the monetary policy, e.g. Thorbecke and Alami (1994), Thorbecke (1997), Ehrmann and Fratzscher (2004), Bernanke and Kuttner (2005), Gregoriou et al. (2006), Serwa (2006), Chulia-Soler et al. (2007)and Berdin et al. (2007). Thorbecke and Alami (1994) examine the response of stock prices to the Fed funds rate target announcements from 1974 to 1979 and find a strong negative relationship between them, implying that monetary tightening (loosening) news lower (increase) stock prices. Thorbecke (1997) applies a variety of empirical techniques to investigate how monetary policy shocks affect stock returns. Investigating the responses of Dow Jones Industrial Average and Dow Jones Composite Average to Fed funds rate target from 11th August 1987 to 31st December 1994, his findings show that there is a significantly negative relationship between monetary announcements and stock returns, thus, providing evidence that monetary expansion increases stock returns.

Ehrmann and Fratzscher (2004) also investigate the heterogeneous effect of the surprise component of Fed funds rate target on daily returns of different industries and individual firms in the US market on the days of announcement. Using both S&P 500 index and 500 individual stocks divided in 9 industries sectors and 60 industry groups from 1994 to 2003, they find that returns of cyclical and capital-intensive industries react strongly and negatively to monetary policy. Firms that are financially constrained respond more to monetary policy than less constrained ones. Bernanke and Kuttner (2005) also measure the stock market response to announcements of Fed funds rate target both in the aggregate and at industry portfolios. Employing a vector autoregression (VAR) model to calculate revisions in expectations of Fed funds rate target, they find a significantly negative relationship between stock returns and the Fed funds rate target, but there are variations in the relationships across industry based portfolios. Chulia-Soler et al. (2007) examine the response of S&P 100 return to the Federal funds target rate. Using the intraday data from May 1997 to November 2006, they find that surprises of the Fed funds target rate affect the US market and the response of the stock market is asymmetric. Positive surprise, meaning tightening monetary policy, has a stronger effect than does the negative surprise, meaning loosening monetary policy. Moreover, they show that different industries react differently to the same surprise: Financial and IT industries have the strongest responses.

To examine the non-US cases, Gregoriou et al. (2006) employ the Bank of England official bank rate as a measure for the UK's monetary policy and examine the effect of the Bank of England's rate announcements on the UK stock market. Applying the GMM method to the data from June 1999 to November 2005, they show that both the expected and unexpected rate announcements affect the UK stock returns. In a similar study, Berdin et al. (2007) they use the daily data of FTSE All Share Index and sixteen industries to examine the response of UK stock returns to Bank of England's official rates, with the results showing that the surprise UK monetary policy negatively affects the returns of the aggregate stock market and most industries. But such aggregate market impact in the UK is smaller than that found for the US market. More important, they show that the effect of monetary policy in the UK differs across industries.

Serwa (2006) investigates the announcement effect on the emerging market instead of mature markets. He analyses the impact of changes in the interest rate announced by the National Bank of Poland on the stock market using the identification derived through heteroscedasticity methodology on the base of the daily data of the Polish stock market from 1st January 1999 to 10th July 2005. His findings indicate that monetary policy changes negatively influence stock indices on the announcement day, but the significance of the effect is limited.

Some studies utilise the central bank's open market operations as the proxy. Tarhan (1995) explains that open market operations have the potential to influence asset prices by affecting interest rates. Through examination of the effect of daily open market operation on stock prices, he however concludes that in the sample period 1979-1984 there is no evidence of the impact of open market operation on US stock prices.

There are studies that investigate the joint effects of money supply and discount rate on stock prices. Pearce and Roley (1985) analyze the response of US stock prices to the news of both money supply (M1) and Fed reserve discount rate from 1977 to 1982. Using the survey forecast data to predict the expected changes in money supply and the discount rate, they find that money supply announcements negatively affect stock prices in the full sample period and discount rates also negatively influence stock returns, but only in the post-1979 period. Moreover, they find no evidence of the delay effect of the announcements.

Hafer (1986) analyzes the stock market response to the news of M1 and the discount rate in three time periods, i.e. pre-1979, 1979-1982 and post-1982. Both the aggregate stock market and industry level reactions are considered. Deploying the survey forecast data to predict the expected components of money supply and the discount rate, he finds negative effects of money supply surprise on both aggregate stock prices and industry indices for the full sample period. However, there is no significant announcement effect of the discount rate in the pre-1979 and post-1982 periods. In the period 1979-1982, the effect is significantly negative. In addition, he uncovers the asymmetric influence of money supply on stock prices. While positive unexpected changes in money supply (as bad news) have negligible effect, the negative unexpected changes in money supply (good news) have no significant effect.

Hardouvelis (1987) examines the announcement effect of monetary policy proxied by money supply (M1) and discount rate on stock prices in two time periods: pre-1982 and post-1982. Consistent with Hafer (1986), he shows that unexpected changes in money supply have strong negative influence on stock prices during the whole sample period, while the discount rate negatively affect stock prices only in the pre-1982 period.

Attempts to examine stock price responses to Fed funds rate target and discount rate changes have also been made by researchers such as Madura (2000). Following Tarhan (1987) who examines the response of bank stocks to money supply surprise and Thorbecke (1997) who tests the response of bank stocks to the discount rates announcements, Madura (2000) assesses the response of stock prices of commercial banks to both the Fed funds rate target and discount rate changes from 20th September 1974 to 31st December 1996. He finds a negative relationship between the both rates and bank stock prices and that the loosening of monetary policy (as good news) negatively affects the bank stock prices while the tightening of monetary policy (as bad news) has a weak negative effect. Moreover, he shows that large banks' reactions to the loosening of monetary policy are stronger than small banks'.

The response of the stock market volatility to monetary policy announcements has also been taken on an interest. Flannery and Protopapadakis (2002) use a GARCH model to examine the effect of seventeen macroeconomic factors including money supply (M1, M2) on the US stock volatility and find that money supply (M1) affects the stock returns conditional volatility in the sample period from 1980 to 1996.

Lobo (2000) considers the responses of stock price volatility to announcements of changes in the Feral funds rate target from 1990 to 1998, using the asymmetric autoregressive exponential GARCH models. He finds evidence of asymmetries in the stock prices adjustment process around the policy change, since stock prices incorporate news of overpricing (as bad news) faster than news of under-pricing (as good news). In a similar research, Bomfim (2003) shows that the pre-announcement effects are present after 1994 and monetary decisions tend to boost volatility in the stock market on the day of announcements. He finds the evidence of another form of the asymmetric effect of monetary news. Positive surprises (as bad news) tend to have a larger effect on volatility than negative surprises (as good news). Guo (2004) argues that the asymmetric effect exists because small firms usually have less retained earnings and are more vulnerable to adverse liquidity shocks than big firms. This asymmetric effect is more pronounced during economic recessions than during economic expansion due to changing states of liquidity. Using daily returns on value-weighted and equal-weighted market portfolios in the US market in two periods of 1974-1979 and 1988-2000, he finds that stock prices of small firms react more negatively to unanticipated changes in the monetary surprise in the period 1974-1979 when the US economy was in recession, but this asymmetric size effect is not presented in the period 1988-2000 when there were economic expansions. Estimating the intraday stock return volatility by means of the realized volatility (RV) using the five-minutes frequency for the 60-minutes window, Chulia-Soler et al. (2007) also examine the effect of US Fed funds rate target announcements on S&P 100 return volatility. They claim that the Fed funds rate target would increase volatility of the US stock market and the bad news has a larger effect on the volatility than the good news.

With regard to evidence from the non-US markets, Chang (2008) develops an extended GJR-GARCH (1, 1) model to estimate reaction of the Taiwan stock market volatility to the monetary policy announcements. Using daily stock returns on the market index and 22 industrial indices from January 1995 to October 2007, he shows that the whole market and most of the industries react significantly. Hence, he concludes that the monetary policy announcements in Taiwan asymmetrically affect the volatility of Taiwan stock returns.

Instead of investigating the monetary policy and stock market in the same country, some other studies provide evidence of the effect of developed countries' monetary policy announcement on developing countries' stock market volatility. Bredin et al. (2005) examine the response of Irish stock market volatility to the US Fed funds rate targets. Using daily data from June 1989 to June 2003, they show that Irish stock market volatility is influenced by the US monetary policy and the effect is asymmetric. A negative policy surprise reduces Irish stock market volatility more than a positive surprise does to increase market volatility in Ireland. Wongswan (2006) examines the impact of macroeconomic announcements of US and Japan on volatility of Korean and Thai equity markets. Using high frequency intraday data from January 1995 to December 2000 and comparing results from different GARCH models, he finds no evidence of the impact of the US Fed funds rate target announcements on the volatility of the Korean and Thai stock markets. However, there is evidence that Japanese monetary policy announcements have a large and significant impact on Korean market volatility.

On the other hand, some studies find no evidence of the impact of monetary policy announcements on stock market volatility. Rangel (2006) examines the macroeconomic announcement effect on the US stock market volatility based on a mixture of a GARCH model with a Poisson jump process. Using daily data of S&P 500 from 1992 to 2003, he finds that the US Fed funds rate target announcement has little impact on the conditional volatility of the US stock market and there is no evidence of the asymmetric effect.

Unexpected changes in monetary policy are widely believed and empirically confirmed to have a significant effect on the stock market. On top of these empirical investigations, recently there have emerged theoretical studies that endeavour to provide a theoretical underpinning to the interpretation of the response of stock market to monetary policy announcements. Cornell (1983) suggest four plausible interpretations: 1) *the expected inflation hypothesis* which states that changes in monetary policy affect the expected inflation rate, which in turn affects the after-tax real profits, resulting in changes in stock returns; 2) the *Keynesian hypothesis* which assumes that the interest rate will react immediately to changes in monetary policy since agents anticipate a tightening of monetary policy following a positive money supply shock, and vice versa; 3) the *real activity hypothesis* which suggests that a positive money supply shock informs the future money demand, possibly due to the fact that higher expected future output would give rise to higher expected future cash flows; and 4) the *risk premium hypothesis* which suggests that higher than expected money supply increases risk leading to a higher risk premium for the stock. Hardouvelis (1987) holds that stock markets respond to changes in monetary policy because they might cause the changes in inflation and the interest rate, which is consistent with both *the expected inflation hypothesis* and *the Keynesian hypothesis*.

Consistent with Cornell (1983), Bernanke and Kuttner (2005) explain that there are three ways that the unexpected changes in monetary policy affect the stock market: a positive surprise of monetary policy may 1) decrease expected future dividends; 2) raise the future expected real interest rates; or 3) increase the expected excess returns (equity premium) of stocks. They employ a VAR model to obtain proxies for expected future dividends, expected real interest rates and expected excess returns and find that the effect of monetary policy surprise on stock returns come from expectations of future excess returns and expectations of future dividends, but real interest rates have very small effect. Berdin et al. (2007) also investigate the path of monetary policy effect for the UK market. They find that future excess returns are the main reason for the monetary policy effect on stock returns. It is stronger for sectors of traditional industries, which is partly consistent with Bernanke and Kuttner (2005).

2.4 The Relationship between Inflation and Stock Returns

2.4.1 Theoretical Hypothesis

The proposition of Fisher, summarized in equation (2.1), suggests that the nominal rate ought to change one-to-one with the changes in expected inflation rate. The expected nominal returns therefore contain market assessments of expected inflation rates. This can be applied to all assets under the efficient markets hypothesis, meaning that in an efficient market, an asset will be priced in such a way that its expected nominal return is the sum of the equilibrium expected real return and the correctly assessed expected inflation (Fama and Schwert, 1977). Generalizing to the market of common stocks, Fisher's theory predicts a similar relationship between common stocks and inflation, because common stocks, which represent claims on the real assets, should be independent of the changes in commodity prices, displayed as inflation (Bodie, 1976). Therefore, common stocks should also positively move one-to-one with expected inflation and completely hedge against expected inflation (Bodie, 1976).

Extending the Fisher hypothesis, one may find that actual nominal returns are composed of expected nominal returns and unexpected nominal returns. The unexpected returns can be further decomposed into the unexpected real returns and unexpected inflation. This extended Fisher hypothesis is reflected in many studies, e.g. Nelson (1976), Bodie (1976), Jaffe and Mandelker (1976), Fama and Schwert (1977) and Peel and Pope (1985, 1988). Peel and Pope (1985, 1988) provide a general description of the extended theory, summarized in equation (2.2), According to their theory (Peel and Pope, 1988), the *ex post* nominal returns of common stocks are a function of the real rate of return (expected and unexpected) and inflation (expected and unexpected).

$$S_t = r_t^e + p_t^e + r_t^u + P_t^u \qquad (2.2)$$

where

S_t: ex post nominal return;

r_t^e : expected real rate of return;

r_t^u : unexpected real rate of return;

P_t^e: expected rate of inflation;

P_t^u: unexpected rate of inflation.

Thus, if unexpected inflation is included in the Fisher model, the coefficient on it (P_t^u) should be equal to that on expected inflation (P_t^e), and is assumed to be unity. Hence, common stock should be positively related to inflation and hedge against unanticipated as well as anticipated inflation.

However, such a one-to-one relationship holds only in the long run. In the short run, the relationship could be ambiguous. This theoretical relationship between unexpected inflation and stock returns can also be explained by the discounted cash flow model, shown in equation (2.3). The intrinsic value of the firms should be retained, if the changes in cash flow, as the changes in prices pass through to the consumers due to changes in inflation in the numerator, will be adjusted by changes in the discount rate to compensate stock holders for the changes in purchasing power in the denominator (Jaffe and Mandelker, 1977; Adams et al, 2006; Bodie et al., 2005, p. 453-457).

$$V = C^e / R \qquad (2.3)$$

where

V: the intrinsic value of the firm;

C^e: expected cash flow;

R: discounted rate.

As Campbell and Shiller (1988) explain, while unexpected higher inflation may increase the discount rates which lower returns, and increase future dividends which increase returns, the price elasticity of future cash flows is not necessarily equal to unity. This results in the ambiguous effect of unexpected inflation on the stock prices in the short run. Therefore, the theoretical relationship between stock returns and expected inflation should be equal to one and that between stock returns and unexpected inflation should be equal to one in the long run but ambiguous in the short run.

2.4.2 Empirical Investigation

Although the Fisher hypothesis suggests that common stock should hedge against inflation, some studies find contradict results for this hypothesis, for example, Bodie (1976) finds that the stock returns are negatively related to both expected and unexpected inflation, in contrast to the Fisher hypothesis. Fama and Schwert (1977) also find that common stock returns are negatively related to the expected inflation. Following their work, several empirical studies document mixed results of the inflation-stock returns relationship.

At present, **event studies** which investigate the effect of inflation announcements on stock returns indicate that stock returns are negatively related to inflation associated with the efficient markets hypothesis. This is an anomalous result. A number of studies that examine the effect of inflation on stock prices appear in the United States. Producer Price Index (PPI) announcements and Consumer Price Index (CPI) announcements, as proxy for the inflation surprises, are investigated for the US market and most of these studies report that both PPI and CPI are negatively related to stock returns. After investigating the weekly and daily responses of the US stock returns to the announcements of unexpected inflation, Schwert (1981) finds a weak negative relationship between CPI surprises and stocks and the market reacts slowly to the announcement. Consistent with Schwert, Cutler et al. (1989) also show a significant negative effect of the CPI news on the stock returns after examining individual and general effects of the macroeconomic news on the stock returns using vector auto-regressions method and the US data from 1871 to 1986.[2] Also using the daily data of the US market and the GARCH model to detect variables from conditional variance, Fannery and Protopapadakis (2002) investigate whether macroeconomic factors influence stock returns depending on seventeen macro series' announcements including CPI and PPI and find both CPI and PPI affects the market portfolios returns.

However, some studies show that only one of the two measures (either CPI or PPI news) is significantly related to stock prices. Some studies suggest only PPI impacts stock prices but CPI does not, for instance a study by Pearce and Roley (1985) extends the previous analysis using survey data to measure inflation expectations. Pearce and Roley (1985) find that daily stock prices significantly and negatively respond to PPI before 1979, but do not respond to CPI information on the day of the announcement or on any subsequent days. This conflicts with the results of Schwert (1981). Likewise, McQueen and Roley (1993) investigate the effect of the announcements of macroeconomic factors including inflation on stock prices by allowing business-condition-dependent responses in three states: high, medium and low, using US daily data from September 1977 to May 1988. They find weak evidence of the negative relationship for PPI news but not for CPI new. Consistent with previous studies, Graham et al. (2002) also show that only PPI, not CPI, has significant influence on stock valuation, though the effect of PPI is not as strong as other macroeconomic factors. On the other hand, some studies suggest that only CPI news affects the stock prices. Jain (1988) examines the response of stock prices to announcements about the money supply, CPI, PPI, industrial production and unemployment rate at one-hour horizons, which may be more precise than daily data. Results are found to support the effect of CPI and money supply only. Moreover, a few studies report no significant effects of inflation announcements on stock prices, for example, Hardouvelis (1987) considers a broader set of macroeconomic variables

[2] Cutler et al. (1988) find that as "bad news" for the stock market, one point inflation innovation may lower share values by about 0.13.

and concludes that both measures of inflation: CPI and PPI are insignificant related to stock returns from October 1979 to August 1984.

However, many studies suggest a strong negative relationship between inflation and stock returns in recent years. Adams et al. (2004) find a very strong link between PPI and CPI inflation news and stock returns, and suggest that the stock response to PPI inflation is more significant, whereas the response to CPI inflation is larger. Moreover they pointed out that the inflation-stock returns relation has a directional asymmetric effect. This shows that investors are more sensitive to positive unexpected inflation news (bad news) than negative unexpected inflation news (good news), and that the relationship also depends on the length of the return window after comparing windows of 1, 5, 15 minutes, 1 hours and 1 day, and depends on the size of the stock and the strength of economy as well.

In contrast to previous studies, which mostly concerned the US market, empirical evidence from other countries also suggests the negative relationship between inflation and stock returns. Goodhart and Smith (1985) investigate the UK market and find that inflation announcements, proxy by the retail prices index (RPI), have a significantly negative effect on the stock prices in the UK stock market, and that inflation influences the market slowly which suggest a delay effect of inflation news. However, Joyce and Read (2002) examine the monthly RPI announcements effect on the stock prices of the UK and find no significant evidence of unexpected inflation on the stock prices on the day of RPI announcements during the whole sample period from 1980 to 1997. Moreover, they show that there is no asymmetric effect of inflation news divided into negative unexpected inflation announcement (bad news) and positive unexpected inflation announcement (good news), since both groups of inflation announcement display insignificant negative coefficients. Likewise, the negative relationship is also support by other countries, for example, Israel. Amihud (1996) investigates the Israeli stock market and a selection of different Israeli industries. Examining the stock price reaction of CPI-linked bonds in Israel on the day following the monthly announcement of the official CPI, he finds that unexpected inflation has a very strong significant negative effect on stock prices for the entire period from January 1986 to October 1991 and two sub-periods.

Although most evidence supports the negative (or insignificant) relationship between stock prices and inflation in event studies, there is one exception, Pearce and Roley(1988) provide evidence that either positive or negative relationship between unexpected inflation and stock returns differing across individual firms can be found. Pearce and Roley (1988) examine 84 stocks individually to determine the unanticipated inflation estimated by announcement data. They find that time-varying firm characteristics related to inflation predominately could either positively or negatively affect unanticipated inflation on a stock's rate of returns.

For **short horizon studies,** large numbers of studies document the cross-sectional negative relationship between stock returns and inflation after examining stock returns with aggregate, expected or unexpected inflation rates across different countries or even industries. Bodie (1976) shows that real stock returns are negatively related to both expected and unexpected inflation using the monthly, quarterly and annual data of US market. Using the monthly data of US, Nelson (1976), Jaffe and Mandelker (1976) and Fama and Schwert (1977) likewise report a negative relationship between returns and both anticipated rates of inflation and unanticipated changes in the rate of inflation. Fama (1981) examines the monthly, quarterly and annual data of US market for the post-1953 period, and his results are consistent with Bodie's. Using the quarterly data of US for 1958-78, Summer (1981) also finds that inflation estimated from the rolling ARMA approach shows a strong negative relationship to security returns. Similar evidence of the negative inflation-stock returns relation for the US market is shown in many subsequent studies (See Geske and Roll, 1983; James et al., 1985; Lee, 1992). For the other countries, Cohn and Lessard (1981) test Modiliani-cohn hypothesis for 8 developed countries, and find that for the decade of the 1970's the quarterly stock prices are negatively related to inflation in these countries. For emerging markets, Osamah (2004) investigates nine financial markets in Pacific Basin region, as Australia, Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Taiwan and Thailand covering data sets from 1980 to 1994 but with different estimates across countries. He shows that if use two estimates of expected inflation rate to examine the relationship between nominal stock returns and ex ante inflation, then stock returns are general negatively related to both expected and unexpected inflation and there is a lack of any significant positive relationship between them with either of the two estimates of expected inflation in all nine countries. Hence, their results also reject the Fisher effect, which is consistent with the previous studies for the US.

Contrary to previous studies which find significant relations between stock returns and both expected and unexpected inflation, French et al.(1983) only find the significantly negative relationship between stock returns and expected inflation during all the sub-sample periods, but insignificant for unexpected inflation, after investigating the quarterly rate of returns of the low 328 to a high 1184 firms from the US stock market in four sub-periods during 1946-1979, whereas Bernard (1986) applies the similar models suggested by French et al.(1983) on quarterly and annually data of 136 firms from 27 industries and finds that stock returns are significantly related to unexpected inflation. For the UK market, Peel and Pope (1988) use the actual stock returns data and a new proxy for the market expected inflation based on public forecasts by main macroeconomic modelling agencies. With attempts of correctly forming both expected real rate and expected inflation, they find a strong negative relationship between unexpected inflation and stock returns, but an insignificant positive relationship on expected inflation and report that the coefficients are different from unity. For the emerging market, Samer (2005) uses two suggested GARCH models: EGARCH in mean and Threshold GARCH to examine the relationship between stock returns and unexpected inflation on five emerging MENA countries: Bahrain, Egypt, Jordan, Oman and Saudi Arabia. His results suggest a strong negative relationship between stock returns and unexpected inflation in these countries without any leverage effect (asymmetric news effect).

Although many studies document the negative inflation-stock returns relationship, many other studies also suggest that this relationship could be either negative or positive varying over time and depending on different monetary regimes, different components of inflation or returns, or different inflationary regimes, in contrast to the simple negative one. For example, 1) Kaul (1987, 1990) suggests the inflation-stock returns relationship is time varying and depends on different monetary regimes. Kaul (1987) points out that this relationship varies over time, since either positive or insignificant relations caused by pro-cyclical movements are found during 1930s, while the negative one influenced by money demand and counter-cyclical money supply effects is documented during post-war period, after investigating 4 industrial countries. Kaul (1990) provides further evidence of the negative post-war relationship between inflation and stock returns in these four developed countries. He shows that the relationship is not only time varying but depends on the monetary regime as well since it appears to be significantly stronger negative during interest rates regimes than during money supply regimes. Timan and Warga (1989) find a statistically positive relationship between stock returns and future inflation rate changes and conclude that it might be caused by the shift in federal policy or monetary regime. Graham (1996) also suggests that the relationship is unstable under different monetary policies. Using the Granger causes analysis, he finds that the relationship between inflation and stock returns is unstable, negative before 1976 and after 1982 without showing Granger causes, but positive between these years with Granger causes. He suggests that the evidence resulted in a shift of the monetary policy from a counter-cyclical to a pro-cyclical monetary policy in 1976 and back to a counter-cyclical policy in 1982. Similarly, Hess and Lee's (1999) show that the post-war negative relationship between inflation and stock returns is caused by supply shocks. Park and Ratti (2000) also find that contract monetary policy shocks generate statistically significant movements in inflation and expected real stock returns, and these movements go in opposite directions. So they argue that the countercyclical monetary policy process is important in explaining the negative correlation between inflation and stock returns. Du (2006) provides more general evidence to support Kaul's (1987) finding that the positive relationship during the 1930s is due to the strong pro-cyclical monetary policy. He also provides further evidence to support Hess and Lee's (1999) opinion that the inflation-stock returns relationship is depending on both monetary policy regime and the relative importance of demand and supply shocks. 2) Marshall (1992) suggests that the relationship varies with different components of inflation. Examining the quarterly US data of real equity and bond markets from 1959 to 1990, he finds a negative correlation between aggregate real equity returns and inflation. Moreover, he shows if distinction is made between the sources of inflation into two types of fluctuations: real economic activity and money, a positive relationship between real equity returns and inflation generated by monetary fluctuations and a negative relationship for inflation generated by fluctuations in real economic activities could be found. 3) Recently, Pilotte (2003) suggests that the relationship varies in different components of returns. He uses short horizon data to investigate the different relations between inflation and two components of returns: dividends and capital gains, and finds a negative relationship between capital gains returns and inflation, but a positive relationship between dividend yields and inflation. 4) Some studies even show that the inflation-stock returns relation varies during different inflationary regimes. After investigating 25 countries, Barnes et al. (1999) find that inflation-stock returns relation is related to different types of economies: negative for low-to-moderate inflation economies, but positive for high inflation economies. Choudhry (2001) examine the four high inflation countries in Latin and Central American: Argentina, Chile, Mexico and Venezuela from 1981 to 1998. He provides evidence that a positive relationship between current nominal stock market returns and current inflation during short horizon under conditions of high inflation in all four countries and a direct one-to-one relationship for Argentina and Chile, which means that stocks act as a good hedge against inflation in these high inflation countries. Ahmed and Cardinale (2005) investigate the dynamics of the relationship between inflation and stock returns in six inflation regimes: deflation ($P<0$), very low ($P < 1.5\%$), low ($1.5\% < P < 3\%$), moderate inflation (3% < P < 6%), high (6% < P < 10%) and very high (P > 10%) for the US, the UK, Germany, and Japan. They suggest that both deflation and higher inflation have been bad for equity returns by comparing the mean of nominal equity returns stored in different inflationary regimes.

Moreover, some short-horizon studies show that the negative or positive (or insignificant) relations vary over different time scales, across countries, or even across different industries. 1) Boudouht and Richarson (1993) show there is horizon sensitivity in the inflation-stock returns relationship. They compare the performance of common stocks as a hedge against inflation at a short horizon (1-month) and at a long horizon (5 years) and find entirely different results: a negative correlation for the former and a positive one for the later. Schotman and Schweitzer (2000) also study the horizon sensitivity of the inflation hedge of stocks and show that the short-term negative relationship between inflation and stock returns comes to be positive in the long-run (over 15 years). Wong and Wu (2003) use the similar methodology as Boudoukh and Richardson (1993) to test the Fisher effect both at short and long horizon and find different results at different horizons with a stronger support for the positive relationship at the long horizon. In recent years, more and more studies support the horizon sensitivity hypothesis. Kim and In (2005) investigate the relationship between nominal inflation and stock returns by wavelet analysis over different time scales associated with different horizons. They find that a significant positive relationship can be observed in 1-month period, while a significant negative can be documented in the rest of short horizons (2, 3, 4, 5 and 6-month periods). Their results provide evidence that the relationship between stock returns and inflation varies over different time scales. Similarly, Ryan (2006) also shows comparable results for the relationship between inflation and stock returns at short and long horizons using the data of Ireland. 2) Gultekin (1983) show that the relationship varies across different countries. After investigating this relationship in 26 countries, he finds that the regression coefficients for both expected and unexpected inflation are predominantly negative with an exception in the UK, but insignificant in some cases, and it is time varying and differs among countries. More specific evidence is presented in Hess and Lee's (1999) study which shows that the inflation-stock returns relation varies over time and across countries. The study is based on the quarterly data of US, UK, Japan and Germany. 3) Wei and Wong (1992) find that the coefficients vary greatly across different industries using 19 industries of the US market to test the sensitivity of the relationship between stock returns and inflation between pre- and post-war periods. Boudoukh et al. (1994) also investigate the relationship across different industries, and find that the relationship could be negative or reverse in different industries, at short horizons. Pilotte (2003) also shows that the relationship between inflation and stock returns varies across different industries, but does not support the explanation given by Boudoukh et al. (1994) for the variation being caused by economic fundamentals.

For **long horizon and long-term studies**, Boudoukh and Richardson (1993) argue that the negative relationship between inflation and stock returns reported in existing studies is due to the short-term asset returns with time horizons of less than one year. They show that using the annual instead of monthly or quarterly data, to examine the relationship at long horizon (e.g. 5 years), a positive relationship could be found, and results obtained from the two centuries data of the US and the UK stock and bond markets empirically support their supposition. Boudoukh et al. (1994) extend this study to different industries, and find further evidence of a positive relationship at long horizon. Schotman and Schweitzer (2000) also compare the potential of stocks against inflation for different investment horizons. They show that the negative inflation hedges potential stocks at the short run but can become positive if the investment horizon changes to long run (over 15 years horizon), which relies on inflation persistence: the higher inflation persistence the better performance of stocks as a hedge against inflation. Engsted and Tanggaard (2002) measure inflation and returns at 1, 5 and 10 years horizons using a VAR model approach on the US and Danish stock and bond market. They find a weak positive relationship in the UK stocks market at all three horizons without showing an increase with a longer horizon, but a significant positive relationship which becomes stronger as the horizon increases in Denmark stock market, consistent with Boudoukh and Richardson (1993). In the same spirit, Wong and Wu (2003) use the similar methodology as Boudoukh and Richardson (1993) to test the Fisher effect at both short and long horizon for fifteen countries including G7 and 8 Asian countries. They find stronger support for the positive relationship in using the long horizon data when the model is estimated by an instrumental variable (IV) or generalized method of moments (GMM) than by the ordinary least squares (OLS). In recent years, more and more studies support the finding of Boudoukh et al. (1994). For example, based on a wavelet multi scaling method to decompose the given time series of nominal stock returns and inflation on a scale-by-scale basis, Kim and In (2005) show a positive relationship between nominal stock returns and inflation at a long scale (128-months period), but a negative one at most of the short scales (Lest than 6-months period) in the US market from 1926 to 2000, which also supports Boudoukh and Richardson (1993). Ryan (2006) looks at the relationship between continuously compounded nominal returns and inflation over short and long horizon and finds supporting evidence of a positive relationship at long horizon as well using two centuries of annual data for Ireland.

In addition, after examining the data of 16 industrialized countries during 1957-1992 in the theory of cointegration, Ely and Robinson (1997) show that in a long sample period, stocks maintain their value relative to movements in overall price, which means that stocks are good hedge against inflation, supporting the long-run Fisher effect. In order to find further evidence on the long-run inflation-returns relation, Anari and Kolari (2001) also use cointegration methods and data of six industrial countries during 1953-98 to investigate the relationship of stock prices and goods price. Their study shows that long-run elasticity of stock prices with respect to goods prices exceed unity and the initial response of stock prices is negative and thereafter becomes positive and permanent, consistent with the negative relationship at short-run studies but positive at long-run. Furthermore, Luintel and Paudyal (2006) investigate the long-run relationship between stock prices and goods prices at industry level in a cointegrating framework to see whether the common stocks in various industry groups differently hedge against inflation. After examining the aggregate and 7 industrial sectors of the UK market during 48 years, they find that in most of the cases, goods price elasticity is above unity, consistent with Anari and Kolari. However, Ahmed and Cardinale (2005) investigate the long-run equilibrium relationship between stock market returns and consumer prices in a cointegrating framework for the US, the UK, Germany and Japan and find mixed results which are sensitive to the data horizon in choosing how many years of lag. Also, they find mixed support for the one-to-one equilibrium hypothesis in different inflation regimes. Laopodis (2006) uses the bivariate and multivariate vector autoregressive cointegrating specifications to test the dynamic interactions among the equity market, economic activity, inflation and monetary policy under three monetary regimes and find a weak negative relationship between the US stock returns and inflation during the period 1970s and 1980s, contrary to previous cointegration studies.

The current literature therefore is not yet able to provide a finite conclusion on the inflation-stock returns relation since there is increasing evidence showing that the relationship is mixed; it could be positive, negative or neutral. Given the fact that a large body of evidence shows a negative relationship between inflation and stock returns, which deviates from what the Fisher hypothesis predicts, several interpretations have been made to explain the "anomaly".

2.4.3 Interpretations

According to the efficient market hypothesis, all relevant information including expectations of inflation is to be fully reflected in the stock prices. As a consequence, only the unexpected component of inflation is left to affect the asset prices (Bodie et al., 2005, p.381). While theoretical models such as the discounted cash flow model (equation 2.3) suggest that the relationship between unanticipated inflation and stock returns is ambiguous in the short run, most empirical studies shows that there is a negative (or insignificant) effect of unexpected inflation announcements on stock returns. Two main hypothesises have been put forward to explain the negative relationship: the policy anticipation hypothesis (PAH) and the expected inflation hypothesis (EIH). Both agree that the relationship between unexpected inflation and stock returns is more complicated than what the discounted cash flow model states. This is chiefly because, the holding of this relationship is dependent on the investors' expectations, but there are many different ways to relate them.

Joyce and Read (2002) explain that PAH implies that current higher than expected inflation affects investors' anticipation that authorities will tighten monetary policy or retrench fiscal policy in order to counteract higher inflation. These policies will discourage investment and consumption demand, causing an increase in the short-term real returns of assets. Therefore, on the one hand, higher real rates due to tightening monetary policy under inflationary pressure will directly result in a higher discount rate and increased future cash flow. On the other hand, higher real rates will adversely affect real output causing future cash flows to drop. Thus, due to higher discount rates, stock values will decline without the corresponding increase or even decrease in future cash flows.

Joyce and Read (2002) also explain that EIH suggests that current higher than expected inflation will increase investors expected inflation in the future, since authorities may be not committed to a specific inflation objective thus the inflation news has no implications for the immediate inflationary pressure but only signals higher expected inflation in the future. Therefore, investors' higher expected inflation will increase the discount rate but decrease future cash follows, since the after tax real dividends will decrease, resulting in a drop in stock values. In this framework, Joyce and Read (2002) investigate the same-day response of a variety of UK asset prices to monthly RPI inflation announcements and find the responsiveness of implied medium and long-term forward inflation rates, suggesting the UK monetary policy is not fully credible.

To explain the anomaly of a negative relationship between inflation and stock returns, eight main hypothesises have been put forward in the short-horizon, long-horizon and long-term studies: (1) the proxy hypothesis (Fama, 1981) which follow the Fisher hypothesis (1930) that real and monetary sectors are causally independent; (2) general equilibrium models in which money is treated as an asset in examining the inflation-stock returns relation; (3) the tax-effects hypothesis which assumes that interactions between the tax system and inflation affect the stock prices (Feldstein, 1980); (4) the money illusion hypothesis suggested by Modigliani and Cohn (1979) who posit irrational investors and market inefficiency for the explanation; (5) the nominal contracting hypothesis, which shows inflation surprise transfers wealth from nominal contract holders to real contract holders (Kessel, 1956); (6) the capital management hypothesis, introduced by Lintner (1975); (7) the tax-augmented hypothesis, suggesting that nominal stock returns must exceed inflation to compensate tax-paying investors (Anari and Kolari, 2001; Luintel and Paudyal, 2006), and (8) the agency problem hypothesis, developed by Jovanovic and Ueda (1998) .

The proxy hypothesis introduced by Fama (1981) is one of the main explanations for the inflation-stock returns relation. It suggests that the negative relationship between inflation and real output fundamentally determining the stock price, as a proxy effect, leads to the negative relationship between inflation and stock returns under the assumption that real activities are independent of the monetary sector (Fisher theory, 1930). Fama (1981) shows that the negative inflation-stock returns relation is the result of two underlying relations: the relation between stock returns and real activity and the relation between real activity and inflation, which is explained by a combination of money demand theory. To support his theory, he shows that if adding both real activity and inflation as explanatory variables for the real stock returns, inflation would lose the explanatory power. Hence, he argues that the negative inflation-stock returns relation is a proxy for the positive relation between stock returns and real activity.

A large number of subsequent studies conduct empirical tests for the proxy hypothesis, or suggest that additional variables, for example monetary policy or the interest rate, may also provide the role of proxy effect in explaining the negative inflation-stock returns relation. These studies extend the Fama's hypothesis which assumes that the only link between inflation and stock returns is real activity. Geske and Roll (1983) provide an explanation for this negative relationship in terms of the money demand theory. They argue that investors adjust stock prices when they realize exogenous shocks in real output, signalled by the stock market, induce changes in tax revenue, in the deficit and a chain of events which results in a higher rate of monetary expansion. Hence, stock returns are negatively related to contemporaneous changes in expected inflation. But their argument that stock returns signal expected inflation is contrary to Fama's explanation for the causality direction of the inflation-returns relation. Applying the ARIMA model to test each of the supposed relationships individually, they explain that their results are consistent with Fama (1981)'s suggestion that stock returns anticipate changes in real activity, but the relationship between inflation and real activity is due to changes in the government deficit and central bank's debt monetization, since change in government revenue are assumed to vary adversely with changes in real activity and inflation is induced by the money base growth rate. Hence, when investors anticipate a change in the real activity and adjust stock prices, the stock returns signal the change in expected inflation. Consistent with Geske and Roll, Solnik (1983) shows that movement of stock prices negatively signals revisions in inflationary expectations and finds a weak real interest rate effect for some of the nine countries. This explanation is also supported by James et al. (1985), who use the VAR model to analyze the causal relations among stock returns, real output and nominal interest rates with the finding that stock returns signal changes in expected inflation, also find a strong link between stock returns, real activity and the growth rate of the monetary base, since changes in real activity and money supply growth are important to predict the changes in inflation.

However, Lee (1992) argues the validity of the model presented by James et al. (1985) because of lack of a separate role of interest rates, which could be a very important variable. He investigates the causal relation and the dynamic interaction between asset returns, real activity and inflation, applying a multivariate VAR model to the post-war US data. Finally, he shows that if interest rates are included in the model, stock returns explain little changes in inflation, which is in contrast to Gesk and Roll (1983) and James et al. (1985). In his study, interest rates explain changes in inflation which translates to too little change in real activity, which is in contrast to Fama (1981) who identifies a relationship between real activity and inflation. Domian et al. (1996) find that the negative relationship between interest rates/inflation and stock returns is almost entirely due to a statistically and economically significant relationship between declines in interest rates and increases in stock returns, against Gesk and Roll (1983). Applying the new method of symmetric and asymmetric Granger-causality to the German data from 1970 to 1999, Kim (2003) considers the causal relations between stock returns and inflation as well as between stock returns and the growth rate of gross domestic production. The empirical evidence in his study confirms the proxy hypothesis and further suggests that, the indicative role of stock returns may be asymmetrically Granger-causal to the growth rates of gross domestic production. The absolute magnitude of changes in inflation plays the key role in the inflation-stock returns relation while the sign, rather than the magnitude, of changes in GDP plays the key role in the stock returns-GDP regression. Adragi et al. (1999) and Adrangi and Chatrath (2000) investigate this relation on emerging markets including Korea, Mexico or Brazil using the Johansen and Juselius cointegration tests verifying a long-run equilibrium between stock prices, general price levels and real economic activity. They find that for Korea and Brazil, but not for Mexico, the negative relationship between real stock returns and unexpected inflation persists after purging inflation of the effects of the real economic activity. Stock prices and general price levels have a strong long-run equilibrium with the real economic activity and each other, supporting Fama's proxy hypothesis.

Moreover, Kaul (1987, 1990) based on Fama and Gesk and Roll, argues that negative relationship between inflation and stock returns depends on the equilibrium process in the monetary sector. He claims that the negative inflation-returns relation is due to deficit-induced, counter-cyclical monetary policy, interacting with money demand. Kaul (1987) suggests that the inflation-stock returns relation can be either positive or negative depending on the counter or pro-cyclical monetary policy. He shows the evidence of a positive relationship during Great depression and a negative one during post World War II. By providing more evidence during the period of post World War II, Kaul (1990) shows that the negative stock inflation-returns relation varies across monetary regimes with stronger negative relationship during interest rate regimes as compared to money supply regimes. Park and Ratti (2000) provide a strong support to Kaul (1987) and confirm a critical role of the countercyclical monetary policy in explaining the negative relationship between inflation and stock returns. Graham (1996) finds that the relationship between inflation and stock returns is unstable with a shift of the monetary policy from a counter-cyclical to a pro-cyclical monetary policy and back to a counter-cyclical policy. He also points out that Granger-cause inflation does not arise during the negative relationship in the counter-cyclical monetary policy when variability in the inflation rate is associated with variability in the growth rate of real output, but arises during the negative relationship in pro-cyclical monetary policy, which suggests that negative real inflation-stock returns relation observed is spurious, supporting the proxy hypothesis. Gallagher and Taylor (2002) develop a theoretical model to derive testable implications of proxy hypothesis based on the theory that inflation due to supply shocks has an impact on stock returns since part of inflation due to supply shocks should act as a proxy for expected future movements in real activity while demand shocks have little or no effect. Using multivariate innovation decomposition, they show that a strongly negative correlation between real stock returns and inflation due to supply shocks but no significant correlation between real stock returns and inflation due to demand shocks, which provides a strong confirmation of the proxy hypothesis.

Boudoukh et al. (1994) point out that Fama's proxy hypothesis and the subsequent studies that simply test the causal relations suggested by the proxy hypothesis, only provide a qualitative description of the inflation-stock returns relation. In order to provide a specific model to explain the inflation-stock returns relation upon Fisher's money-neutral hypothesis, Boudoukh et al. (1994) provide both the theoretical underpinning of the cross-sectional relationship between stock returns and inflation and empirical evidence across different industries. Their models do not rely on dropping the assumption that real and monetary sectors are causally independent but allow expected inflation to be a partial proxy for expectation of future real rates. Their findings show that relationship between stock returns and expected inflation differs from unity depending on the correlation between the stocks expected dividend growth rate and the overall expected inflation rate in the economy. They explain that the coefficient describing the relationship between stock returns and expected inflation shown in equation (2.4) can be different from unity, and could possibly even be negative, because it depends on the correlation between the expected dividend growth rate and the overall expected inflation rate in the economy. 1) $\lambda < 1$ can happen, if $\rho_{g\pi}$ <0 (expected real dividend growth and expected inflation are negatively correlated); 2) λ <0 also can happen, if $\rho_{g\pi} < - \delta_\pi / \delta_g$ occurs.

$$\lambda = 1 + \frac{\rho_{g\pi}\delta_g}{\delta_\pi} \tag{2.4}$$

where

λ : the coefficient of expected inflation and stock returns;

$\rho_{g\pi}$: the unconditional correlation between conditional expectations of dividend growth and expected inflation;

δ_g : the standard deviation of expected output growth;

δ_π : the standard deviation of expected inflation.

Using the model that predicts cross-sectional variation in the coefficients of expected inflation across stock returns of various industries with different expected growth rates of future cash flows due to different industries being affected differently by economy-wide changes that take place during business cycles, they empirically examine the US stock market and find a positive relationship between stock returns of non-cyclical industries but a negative relationship for cyclical industries at short horizons, and a positive relationship at long horizons.

Further to Boudoukh et al. (1994)'s finding, that inflation-output relation cannot explain all the cross-sectional differences of inflation-stock returns relation and that the time-varying real price/dividend ratios affect the relation, Pilotte (2003) argues that inflation also proxies for variation in real/dividend ratios and focusing on differences in the inflation-stock returns relation for the two components of stock returns: dividend yields and capital gain returns. By mainly examining US market and foreign markets, he shows that dividends and capital gains relate differently to inflation: There is a negative relationship between capital gains returns and inflation, and a positive relationship between dividend yields and inflation. Moreover, he explains that the generally negative relationship between total returns and inflation is induced by a negative relationship between real price/dividend ratios and expected inflation. Another support for the proxy hypothesis is from emerging markets. Osamah (2004) investigates the Fisher effect for nine Pacific-based Asian countries, and finds the negative relations without significantly positive coefficients between inflation and stock returns in two estimates of expected inflation for all nine countries. After testing the causal relations among them by the VAR method, he claims no unidirectional causality between stock returns and inflation due to lack of either consistent negative response of stock returns to inflation or consistent negative response of inflation to stock returns. Hence this view is more likely to support Fama's (1981) proxy hypothesis that the proxy effect reflects the positive relationship between inflation and excess returns.

Some recent empirical studies argue that even expected income growth (real activities) is accommodated in estimating the inflation-stock returns relation, the Fisher hypothesis does not hold. Wei and Wong (1992) show that inclusion of future real activity eliminates the spurious negative relationship between stock returns and expected inflation. However, it does not remove the relationship between stock returns and unexpected inflation. Liu et al. (1993) provide a more comprehensive test for three propositions of the proxy hypothesis using specified models and data from four industrialized nations. Their results do not support the proxy hypothesis since they only find a negative relationship between expected inflation and anticipated real activity but an insignificant relationship between real stock returns and anticipated real activity.

Cocharan and Defina (1993) show that inflation does not merely proxy for future changes in real output and stock prices uncertainty has no significant impact on expected future output, after investigating whether the observed negative relationship arises because inflation proxies for more fundamental relations between stock prices and real variables. They further suggest that inflation has significant transitory negative impacts on real stock prices and reject the proxy hypothesis in its various forms. Likewise, Balduzzi (1995) shows that innovations in inflation account for most of the negative covariance between the inflation and stock returns in a VAMs model with a covariance analysis to test the proxy hypothesis. He further points out that inflation and stock returns show strongly negative correlation in response to the interest rate shocks. Caporale and Jung (1997) also provide evidence against Fama's proxy hypothesis. Using a long sample period and allowing both actual and surprise movements in inflation and output growth to influence stock prices, they show that even after controlling for the effect of expected and unexpected real output growth, the impact of anticipated inflation remains negative and significant implying the negative relationship between inflation and stock returns is an important empirical phenomenon. However, against previous studies, Madsen (2005) argues that supply shock variables need to be included in the test of the Fisher hypothesis, or else the coefficient of expected inflation might be biased downwards because they simultaneously affect inflation and real profits. He provides evidence to support the proxy hypothesis and shows that the Fisher hypothesis cannot be rejected at conventional significant levels and the results are robust to different measures of supply factors.

The models testing the proxy hypothesis mostly follow Fama's work in which money demand, real activity and the interest rate are exogenous with respect to the price level. The estimated coefficients suggest the relationship between them. For example, Geske and Roll (1983), James et al. (1985) and Kaul (1987) suggest the influence of monetary policy and estimate regressions among stock returns, inflation, GNP and money growth. Lee (1992) uses VAR to find the causal relationship among asset returns, real activity, inflation and the interest rate. Bodudoukh et al (1994) provide a general regression for expected stock returns in terms of expected inflation and real variables reflecting the underlying stock.

On the other hand, other researchers set up their models to directly estimate the relationship between stock returns and inflation. Kaul (1990) allow dummy variables of monetary policy regimes in the regression. Plotte (2003) distinguishes stock returns in two parts, dividend yields and capital gains and directly estimates the coefficient between these components and expected inflation. The proxy hypothesis and the models testing it as used by the main stream in explaining the inflation-stock returns relationship are still a very popular tool for conducting empirical research.

General equilibrium models with money being treated as an asset are suggested to interpret the inflation-stock returns relation. Unlike the proxy hypothesis that assumes no relationship between real activity and monetary sectors, theoretical analyses based on equilibrium models treat money as an asset, suggesting that the value of money is determined simultaneously with other assets including stocks (Ely and Robinson, 1997). In this approach, money assumes a role in general equilibrium models, thus endogenizing the price level and inflation together with stock prices. At present, there are four ways for money as an asset to enter the general equilibrium models: 1) by providing the role of transaction services in the equilibrium models, 2) by providing real money balances as an argument of agents' utility functions, 3) by imposing money demand through cash-in-advance constraints, and 4) by presenting money as an object of portfolio choice for risk averse agents (Danthine and Donaldson, 1986).

Danthine and Donaldson (1986) consider the relations between inflation, monetary growth and stock prices in a general equilibrium setting with real money balances being introduced as an argument of the agent's utility function, with a view to explain why real rates of return appear negatively correlated with the rate of inflation. In their model, expectations of higher inflation reduce wealth by reducing the purchasing power of money balances carried forward through time and in turn reduces the expected real returns on stocks. So rates of returns and inflation are not independent of one another and common stocks are not a good hedge against non-monetary inflation, but offer perfect protection over the long run against purely monetary inflation. Many other theoretical analyses are consistent with Danthine and Donaldson. Stulz (1986) suggests that expected real stock returns are negatively related to money growth. By presenting money as an object of portfolio choice for risk averse agents, he provides an equilibrium model which shows that if expected inflation increases because of a worsening of the investment opportunity set, the expected real rate of return on the market portfolio of risky assets may fall by more than the real rate of interest, whereas it may fall less if inflation increases because of money growth. Hence, the stock returns may be negatively related to inflation when the source of inflation is more related to the non-monetary sector. However, his study only provides the theoretical explanation, but lacks any empirical evidence that matches the theory.

Many studies provide further explanations by stressing the importance of demand and supply shocks in determining the inflation-stock returns relation. They suggest that supply shocks result in a negative relationship while demand shocks generate a positive relationship. Hence, the actual relationship depends on the relative importance of demand and supply shocks. Marshall (1992) extends Stulz's studies of examining the co-movements of real asset returns, inflation and money growth and introduces money in her model through the cash-in-advance constraints. In order to find out whether the predicted negative correlation between inflation and asset returns accompanying the relationship between money demand and asset returns is large enough in magnitude to match the data, Marshall (1992) suggests to distinguishing resources of inflation and investigates the negative correlation between expected returns and expected inflation in a monetary economy in which inflation fluctuation is a combined outcome of two resources i.e. fluctuations in real economic activity and by monetary conditions. He formulates and a monetary inter-temporal asset pricing model and applies the model to test whether the magnitudes of the correlations are large enough to match the data. The findings are that the aggregated real asset returns are negatively related to inflation but positively related to money growth, which is contrary to Stulz's expectation of a negative relationship between real return and money growth. He concludes that the apparent negative relationship between inflation and asset returns is due to the main source of fluctuations in inflation, the fluctuations in real economic activity, because their relationship is strongly negative when the inflation is caused by fluctuations in real economic activity although a positive relationship is observed when the inflation is caused by monetary fluctuations. However, Marshall's models only focus on the determination of stock market prices, not on economic explanations of changes in the variables. Bakshi and Chen (1996) offer an economic theory for explaining why inflation can be partially non-monetary and monetary as well to support Marshall's view. They assign money a role of consumption transaction in an asset pricing model to investigate the endogenous and simultaneous determination of the price level, inflation, asset prices and the term structure of interest rates, both real and nominal. The modelling provides a way to know how changes in the real and monetary variable affect inflation and stock prices.

Further to Marshall's (1992) study in which the source of inflation is related to non-monetary factors (real economic activity). Hess and Lee (1999) suggest that both monetary and non-monetary shocks affect the relationship. Consistent with Marshall's view of inflation, Hess and Lee (1999) demonstrate structural macroeconomic models to distinguish inflation in two combinations of shocks: supply shocks due to real output shocks that cause a negative relationship between stock returns and inflation and demand shocks due to monetary shocks that cause a positive relationship. Applying the VAR model to the stock market data of four countries, they show that the relationship between stock returns and unexpected inflation is either positive or negative and varies across countries that have different monetary regimes, depending on the source of inflation, and the relative importance of supply shocks versus demand shocks.

However, Ely and Robinson (1997) argue that stocks maintain their values relative to goods prices following both real and monetary shocks in the long run, in contrast to Marshall's and Hess and Lee's finding that real and monetary shocks adversely affect the inflation-stock returns relation, although consistent with their view that the source of inflation should be considered when estimating whether stock prices maintain their values relative to goods prices. They conclude that stocks are a hedge against inflation, consistent with Fisher hypothesis, after examining the long-run relationship between stock prices and goods prices for the international markets by employing the vector error-correction (VEC) models to capture the long-run relations.

By imposing money demand through cash-in-advance constraints, Marshall (1922) suggests money reduces the costs of consumption transactions assuming that money transfer is made at the beginning of the period and that agents can use the this money immediately for transactions. Hence his model has both a pecuniary component (inflation) and a non-pecuniary component (marginal transaction cost saving, measured by agent's consumption and money). After estimating the ratio and direction of two coefficients of returns and money, he explains the relationship between stock returns and inflation in two components affected by output growth or money growth. Consistent with Marshell, Hess and Lee (1999) directly estimate the supply shock and demand shock and their influence on the growth of output and inflation, based on several macroeconomic models in which money is assumed to affect the price together with productivity. They then investigate the relation between prices changes and the two shocks and the relationship between changes in inflation and the two shocks. By linking the two shocks, they interpret the relationship between stock price and inflation.

Comparing the testable models for proxy hypothesis in the previous section with the general equilibrium models in this section, the difference between them seems to be: testable models based on proxy hypothesis assume exogenous influences among factors, while the models based on general equilibrium models assume the endogenous role of money in determining the stock prices.

However, since the general equilibrium hypothesis suggests that monetary and real sectors interact with each other, which contradicts the Fisher hypothesis of monetary and real sectors being independent, it is always criticised by other studies, e.g. Boudoukh et al. (1994).

The tax-effects hypothesis introduced by Feldstein (1980) is one of the important explanations of the negative inflation-stock returns relation. Feldstein (1980) shows that the negative inflation-stock returns relation is not due to the other related economic events, but results from the basic features of the tax system, particularly historic cost depreciation and the taxation of nominal capital gains. This is because the effective tax rate on real profits rises when the taxes rise with increased reported profits since corporations are taxed on reported profits. Therefore, when prices rise, the historic-cost method of depreciation causes the real value of depreciation to fall and real taxable profits to increase and as a result, real net profits of corporate income tax vary adversely with inflation. The Tax system interacts with inflation effectively, depressing the stockholders' returns. He uses a general stock valuation model, as shown in equation (2.5), (2.6) and (2.7), to derive the assets demanded by investors in different tax situations, and shows that inflation can substantially depress the equilibrium share values because of current tax rules which cause taxable income to be predicted to increase faster than the actual rate of inflation.

The real net earnings per share = $(1-\theta)[(1-\tau)\rho-\lambda\pi]-c\pi q$ (2.5)

$$q=\frac{(1-\theta)[(1-\tau)\rho-\lambda\pi]}{(1-\theta)r-(1-c)\pi+\delta} \quad (2.6)$$

$$\frac{dq}{d\pi}=\frac{-(1-\theta)\lambda+q(\theta-c)}{(1-\theta)r-(1-c)\pi+\delta} \quad (2.7)$$

$dq/d\pi$ is negative, if $q(\theta-c)<(1-\theta)\lambda$

where

q: per share, π denotes inflation rate;
r: government bond rate, ρ denotes marginal product of capital;
τ: corporate income tax rate;
θ: personal income tax rate;
σ: risk premium asked by the investor;
c: equivalent tax rate on accrued capital gains.

He concludes that tax treatment of depreciation leads to a substantial reduction in the ratio of share prices to pre-tax earnings with the increasing inflation, hence a negative relationship between inflation stock returns occurs. Consistent with Felstein (1980), Summers (1981) also shows that taxes will be a positive function of inflation and therefore reduce the real economic earnings of the firm in the time of inflation, since depreciations for tax purposes are at historical cost and historical cost accounting implies that accounting earnings of the firm with large depreciation expenses will overstate the firm's dividend paying ability in inflationary periods. Bradford (1974) examines the effect of different returns on monetary items and finds that the firm can attain its desired balance sheet position during inflation by appropriate adjustment in any combination of income and cost of monetary assets and liabilities held. Hong (1977) examines the relation between inflation and the market value of firms and finds that inflation affects vary widely across firms due to different degrees of depreciation and the cost of inventory withdrawals. Hence, his results support the nominal capital gains tax effect.

However, in contrast to Felstein's idea, Modigliani and Cohn (1979) point out that this explanation fails to recognize that stockholders are not taxed on that part of their returns that consists of depreciation of debt. In other words, the portion of pre-tax operating income paid in taxes declines with the rate of inflation, rather than increase with the rate of inflation as Felstein suggests. This is because shareholders are allowed to deduct their entire interest expense even though the portion of it corresponding to the inflation premium is really a return of capital. They also provide evidence of the US market that by and large, the tax results tend to cancel out for the corporate sector as a whole. Similarly, Fama (1981) argues that although the change in tax rates and regulations allow the liberalized depreciation methods among other methods and lower the average tax rates during the period of high inflation, the marginal tax rates to aggregate firms are not adjusted to offset inflation since there are still possible distributive effects of unexpected inflation. This idea is supported by Gonesdes (1981) who identifies inflation influences on corporations' profitability, effective real tax rates and investment incentives and provides opposite evidence of the nominal capital gains tax effect. In using a variety of macroeconomic data as capital expenditures, profits tax liability, independent interest, GDP and so on, Gonesdes' empirical results show that tax issues are inconsistent with the view that accounting methods affect the profitability, whereas they are consistent with the hypothesis that changes in real tax burdens can be reduced by favourable and available devices, such as the debt-induced tax shields, which are the alternative options to firms that are allowed by the government. Therefore, the tax-effects of inflation as an explanation for the negative relationship between changes in stock prices and inflation are rejected. Pindyck (1984) also agues that increases in expected inflation together with concurrent increases in the variance of inflation should have had a possible but small effect on share values. Based on the simple model of asset returns, asset demands and share price determination, he finds that the tax deductions of higher interest payments on debt cancel out the tax penalty, which leads him to conclude that the tax-effects are empirically unimportant. The opponent idea to the nominal capital gains tax effect comes from Madsen (2002) who suggests that share markets fail to incorporate into share prices the tax penalties that are associated with inflation due to depreciation at historical costs.

Hasbrouck (1983) argues that the linear time-series model applied by Goneseds (1981) has many limitations in evaluating the tax-effects such as the slow reaction of some variables in the model to changes in inflation, introduction of non-neutral inflation data into the model and possible noise in the series and the confounding of transitional effects in the estimation. Given these problems, Hasbrouck suggests using the simulation techniques to model a representative firm characterized by a number of realistic assumptions, such as first in first out (FIFO), last in first out (LIFO) and average cost for the inventory valuation adjustment (IVA) method for income adjustment to study the corporate tax burden at various rates of inflation. He finds that the net corporate tax burden is a nonlinear function of inflation, and it not only reflects penalties resulting from historical cost accounting for depreciation and cost-of-goods sold, but also offsets benefits from deduction of nominal interest payments since his empirical results show that the tax burden increases with positive inflation at first and upon peaking, declines thereafter and dips lower than the rate at no inflation level. His findings don't support all the previous studies and are more likely to suggest a mixed situation.

The money illusion hypothesis is introduced by Modigliani and Cohn (1979) who posit irrational investors and market inefficiency as an explanation. They point out that price equities fail to reflect their true economic value because investors have two main forms of "money illusion" for corporate assets in the inflationary period. First, investors fail to correct reported accounting profits for the gain of stockholders from the real depreciation in nominal corporate liabilities since the inflation-caused increase in nominal interest rates paid to debtors of the company can be deducted before tax and tends to reduce taxable accounting profits. Second, investors tend to capitalize equity earnings at the nominal interest rate rather than the economically correct real rate. Therefore, after finding consistent evidence of the U.S. market, he concludes that investors incorrectly under evaluate stock prices during the inflationary period because they use the higher rates to discount future earnings, ignoring the positive effect of inflation on reducing the real value of debt for corporations, especially for levered firms. This explanation is supported by French et al. (1983) who initially test the nominal contracting effects but find little supporting evidence. They therefore attribute their results to money illusion as an explanation. Cohn and Lessard (1981) examine seven developed countries compared with results of the US to find whether the evidence provided by Modiliani and Cohan are robust in other countries. Focusing on the valuation of share prices in relation to a measure of noise-free earnings by controlling for the effects of real economic factors, their results for the seven countries mostly support the money illusion hypothesis.

The money illusion hypothesis is also supported by Ritter and Warr (2002) who focus on the misevaluation as the explanation for the relationship between expected inflation and valuation measures, and develop a measure of intrinsic value. Results from the estimation of the residual income model with monthly panel data for firms that are in the Dow Jones Industrial Index show that the bull market is due in part to equities being undervalued and the amount of undervaluation is positively correlated with leverage and expected inflation, consistent with Modigliani and Cohn who point out that levered firms are undervalued most in the time of inflation. They, furthermore, show that the misevaluation error, in conjunction with expected inflation, can significantly help predict real share returns in the subsequent year.

Consistent with previous studies, Madsen (2002) also finds similar results. He uses pooled cross-section and time series data for OECD countries for the post-war and the Great Depression period and compares the empirical results of three models based on the tax-effects, inflation-illusion and the risk-aversion hypotheses. Results show that stock markets fail to distinguish between nominal and real magnitudes and investors erroneously use the nominal interest rate to discount real cash flow and fail to acknowledge that inflation lowers the real value of debt, the same as Modigliani and

Cohn (1979) suggest.

However, Gesket and Roll (1983) argue that the money illusion hypothesis directly conflicts with the rational expectation and efficient market hypothesis and it is more likely to build the theory on irrationality.

The capital management hypothesis put forward by Lintner (1975) who suggests that both anticipated and unanticipated inflation increase the external financing requirements of the corporation and dilute the returns to old equity shares. Hence, firms with fixed gross profit margins and fixed dividend payout ratios require a higher fraction of non-internally-generated funds during periods of inflation in order to sustain working capital in a fixed proportion to sales. He assumes that the augmented working capital resources do not earn the cost of capital, as a result, cash balances for instance receive zero interest and accounts receivable apparently do not influence sales revenues.

However, Geske and Roll (1983) argue that this hypothesis contradicts managers behaviour since corporate mangers will respond to increased inflation by cutting cash balances and tightening the terms of trade credit, delaying payments and numerous other devices rather than Lintner's assumption that they will obtain external funds to invest in sub-assets.

The tax-augmented hypothesis is put forward by Anari and Kolar (2001) and Luintel and Paudyal (2006). Under the Fisher hypothesis, the nominal interest rate should change one-to-one with changes in expected inflation. However, Dardy (1975) points out that when nominal interest income is taxed, the Fisher relationship implies a response from nominal interest rates that is greater than the change in expected inflation. Therefore, a higher tax on nominal interest income will raise the change in nominal interest rate required to compensate a given change in expected inflation. His point of view is supported by Summers (1983) who suggests that the value of the

Fisher effect is 1.3 to 1.5 given average marginal tax rates in US, and Crowder and Wohar (1999) who suggest that taxes have a substantial influence on the size of the estimated Fisher effect which was the consensus reached by many subsequent researchers.

Anari and Kolar (2001) and Luintel and Paudyal (2006) suggest the tax-version of Fisher hypothesis that claims nominal stock returns must exceed inflation to compensate tax-paying investors, hence, the long-run relations between stock returns and inflation are positive. Studies in the area suggest straightforward tests for whether returns on stocks exceed the rate of inflation using the cointegration technique, since the tax-paying investors may be compensated for the loss in the real wealth due to changes in inflation.

This hypothesis comes forth in recent years. Ely and Robinson (1997) firstly investigate the relation between stock price and goods prices in the time of inflation in a cointegration framework. They show that in a long sample period stocks maintain their values relative to movements in overall price, which means that stocks are a good hedge against inflation. But they fail to give an explanation for their findings. Anari and Kolari (2001) investigate the long-run fisher hypothesis by also analysing the cointegrating relationship between stock price and the Consumer Price Index (CPI) which proxy for inflation, as shown in equation (2.8).

$$S_t = c + d\,P_t \tag{2.8}$$

where

S_t: stock price (expected stock price pluses unexpected movement in stock price) in period t;
P_t: goods price (expected goods price pluses unexpected movement in goods price) in period t;
c,d: coefficients (d coefficient is the elasticity of stock prices with respect to goods prices).

Most important, they attribute the results that the coefficient estimates are significantly greater than one to the tax version of the Fisher effect. However, they fail to provide further explanation for this tax-version hypothesis which is later approached by Luinter and Paudyal (2006). Luinter and Paudyal summarize these long-run studies on the tax version of the Fisher effect to interpret the relationship between inflation and stock returns as the tax-augmented hypothesis in which the return on stocks must exceed the inflation rate to compensate for the loss in the real wealth of tax-paying investors. Building on previous studies, they apply the cointegration method to investigate the long-run relations between stock prices and goods prices across industries, therewith, they identify and control the structure breaks in order to improve the precision of the investigation. Their results which indicate that six out of eight investigations of retail price elasticity of stock returns are above unity support a positive long-run relationship between stock prices and inflation, consistent with the tax-augmented version of the Fisher effects. Also their results reveal that long-run real returns vary across industries.

However, Ahmed and Cardinale (2005) find mixed evidence of the long-run equilibrium between stock market returns and consumer prices in a cointegrating framework for the US, the UK, Germany and Japan since the estimated equilibrium relationships appear to be an outcome of on-off events rather than sustained or more frequent corrections, and these relationship are sensitive to lag length chosen. Laopodis (2006) examines the dynamic interactions among the equity market, economic activity, inflation and monetary policy under three monetary policy regimes in three sub-periods from 1970 to 2002. He applies bivariate and multivariate VAR and VEC models to exploit the presence of cointegrating relationship, but finds that the bivariate results for the real stock returns-inflation pair provide only weak support for a negative correlation in the 1970s and 1980s for the US market, which is in contrast to previous research which also applies the cointegration analysis.

The agency problem hypothesis suggested by Jovanovic and Ueda (1998) assumes that there is an agency problem between firms and their workers. In a monetary system in which final goods sell on spot markets, while labour and dividends sell through contracts, firms and workers confuse absolute and relative price changes, so that a positive price-level shock makes sellers think they are producing better goods than they really are. They split this apparent windfall with workers who get a higher real wages so workers are more rewarded than their efforts warrant under the assumption that wage contract are renegotiation-proof. As a result, money affects real activity by altering the distribution of income from shareholders to workers. They suggest a signal-confusion model in which when many goods markets clear through impersonal spot trading, the market for labour services is an overwhelming one. Therefore their assumption is proved since the contracts naturally drive out spot market trades in the labour market. Extending the principal-agent model with moral hazard, renegotiation, and the nominal value of the sales of the agents developed by Jovanovic and Ueda (1998), Martin and Monnet (2000) show that their explanation for the occurrence of nominal contract is robust even relaxing an assumption that agents choose pure strategies. However, there is still a lack of empirical evidence in support of this hypothesis.

2.5 Nominal Contracting Hypothesis, Corporate Financing Mix and Inflation Exposure

2.5.1 Corporate Financing Mix and Inflation Exposure

The expectation that the equilibrium money rates of interest observed in the capital market are unaffected by unexpected inflation cannot be held in reality, since the nominal rate of interest fails to reflect changes in unexpected inflation because estimates of the course of future prices are biased. As a result, there are transfers of wealth between nominal contract holders: from the creditor to debtor. This kind of transfer will happen in any kinds of nominal contracts which carry interest rates including depreciation tax shields, notes receivable, account payable, bonds, labour contracts and so on. Thus, once interest rates are set on outstanding nominal contracts, no such inflation adjustment is feasible until the contract is due or is sold to a new holder. Therefore, business firms that hold a lot of nominal contracts will face the inflation exposure. The wealth transfers formed by unanticipated inflation would be positive for net debtors, negative for net creditors.

As discussed in the previous sections, there is an interaction between inflation and monetary policy. The interest rate that monetary policy mainly works through is affected by expected inflation in the Fisher framework. Although arguments arise against the one-to-one relationship between expected inflation and the nominal interest rate, most of empirical studies at least support the positive relationship between expected inflation and the nominal interest rate. Some studies even support the one-to-one relationship, completely consistent with the Fisher's hypothesis. Therefore, the interest rate will rise due to the increase in expected inflation, and vice versa.

If extending Fisher theory to both expected and unexpected inflation, in the long run, nominal interest rates will change one-to-one with both expected and unexpected inflation, since current higher than expected inflation will increase investors expected inflation in the future. The inflation news carrying positive unexpected inflation has no implications for the immediate inflationary pressure and only signals higher expected inflation in the future. Therefore, the investors' higher expected inflation will finally increase the nominal interest rate.

Changes in nominal interest rate affect bond prices. Bonds, as the basic fixed-income securities, can promise a stream of future payments of some forms. For example, discount bonds make a single payment on maturity date, and coupon bonds make payments of a given fraction of face value at equally spaced dates up to and including the maturity date and pay the face value on maturity date as well (Campbell et al. 1997, p. 396). As long as the bonds are sold, the issuer will get the amount of cash and have the obligation to make fixed payments to bondholder on specified dates, while the bondholder will get the fixed income in the future only faced with the credit risk of the issuer. However, since the payment formulas are specified in advance for bonds, there is still one risk, i.e. interest rate risk, needs to be considered by both the issuer and the bondholder.

For the bondholder, interest rate risk affects the bond prices. The bond prices are determined by the bond face value, the coupon rate, and the interest rate. Since face value and the coupon rate are fixed, the bond prices are determined by the interest rate. If interest rate movements are known with certainty and all bonds are properly priced, all bonds will provide equal one year rates of return. However, in the real word, future interest rates are uncertain and can turn out higher or lower than expected. There is a negative relationship between current bonds prices and interest rates. If the interest rate increases, bond prices drop and vice versa. This interest rate risk differently affects short-term bonds and long-term bonds. Prices of longer-term bonds are more sensitive to changes in interest rates. Changes in interest rate can put the long-term bond investors in a very risky situation.

For the issuer, changes in interest rate affect the cost of financing. The issuer borrows money from the bondholder by issuing bonds. As long as the bonds are sold at a specific price with the discount rate or the coupon rate depending on expected interest rate, costs of the debt have been set for the issuer. If interest rate moves over or under expectation, issuer will gain or lose from these changes. If the interest rate turns out to be over expectation during the holding period of bonds, it means that the issuer pays a lower than current market cost for using this debt. Thus, the issuer gains from unexpected increase in interest rate and vice versa. During a longer period, the uncertainty of interest rate increases. Thus, these unexpected changes in interest rate affect the long-term debt more than the short-term debt. Although the long-term bonds always offer higher yields to maturity than short-term bonds because higher yields are risk premiums for the interest rate risk, according to the liquidity preference theory, the inflation risk cannot be eliminated by this risk premium since the inflation exposure is large.

From previous patterns of inflation, the interest rate and bond prices, the unexpected changes in inflation cause the same unexpected changes in the nominal interest rate as given by the Fisher theory, and unexpected changes in interest rate affect the bondholder and the issuer. Therefore, unexpected changes in inflation affect the bondholder and the issuer adversely and affect the long-term bond holder or the long-term bond issuer more than the short-term one.

Since the bondholder or issuer will gain or lose from unexpected changes in interest rate due to unexpected inflation, their stock prices may correspondingly change with these gains or losses. Thus, the stock prices of the bond holder or issuer may change due to changes in unexpected inflation. If future unexpected inflation turns out to be over expectation, the bondholder losses while the issuer gains, and the long-term bondholder loses more than the short-term bond holder while the long-term bond issuer gains more than the short-term bond issuer, and vice versa.

Firms hold many nominal assets or nominal liabilities such as cash, accounts receivable, depreciation tax shields, contracts to sell products at fixed prices, accounts payable, labour contracts, raw materials contracts and pension commitments. They have similar characteristics as bonds, and so are sensitive to changes in the nominal interest rate due to changes in inflation as well. If extending the theory about the relationship between inflation and bonds to other nominal assets or liabilities held by firms, they are affected by the uncertainties of future interest rates caused by unexpected inflation. In turn, the firm's stock prices might capture these effects. Therefore, the stock price of a market, an industry or a firm might negatively reflect unexpected inflation if they are holding a positive net nominal position. Thus, the nominal contracting hypothesis might provide a further explanation for the relationship between unexpected inflation and firm prices.

2.5.2 Nominal Contracting Hypothesis

The nominal contracting hypothesis is first proposed by Kessel (1956) suggests that nominal contracts due to unexpected inflation transfer wealth from nominal contract holders to real contract holders. This particular explanation of wealth redistribution rests on the assumption that interest rates fail to completely reflect price level changes during inflation, based on the postulation that interest rates are an implicitly biased estimator of the future course of prices (Kessel, 1956). Hence, the parties involved in the nominal contract estimate the present value of the future payments with considerations of inflation over the contract periods and the deviations between actual and expected inflation cause the value of nominal contracts to change which transfers the wealth between two parties in the contract: the holder of nominal assets such as cash, accounts receivable, depreciation tax shields and so on, and the creditor of liabilities such as debt, accounts payable, labour contracts and so on (French et al, 1983). Since most firms that have many nominal contracts on both the asset side and the liability side are debtors and creditors at the same time, net debtor firms or markets will gain and the gains are positively related to inflation, but net creditor firms or markets lose and the losses are negatively related to inflation.

Therefore, related to nominal contracts, this hypothesis has two further assumptions. One is the debtor-creditor hypothesis which says 1) the debtors will gain and creditors will lose when positive unexpected inflation occurs, and vice verse; 2) inflation may be more profitable for large debtors than smaller debtors. An aggregate market, an industry or a firm will therefore gain from inflationary periods if they are on the nominal position of net debtors, and vice versa. The larger the debt ratios, the larger the profits gained by the debtors. Another hypothesis is the labourer-capitalists hypothesis which suggests that inflation causes wages to lag behind prices that redistributes income from labourers to capitalists since business firms gain extra profits during inflation.

Over the last fifty years, although only a few studies have investigated the nominal contracting hypothesis, debates on the wealth transfers due to nominal contracting effect are intense. One of the arguments is whether the nominal contracting hypothesis is meaningless for the aggregate market or industries. De Alessi (1964) and Geske and Roll (1983) argue that the nominal contracting hypothesis has no meaning for the aggregate market or different industries, since aggregate markets or most industries are net debtors which should positively relate to unexpected inflation according to the nominal contracting hypothesis, and this is inconsistent with the negative relationship between unexpected inflation and stock returns in most previous studies.

De Alessi (1964) distinguishes net debtor firms, net creditor firms or neutral firms according to the net monetary position of a firm. The monetary position is defined as the difference between its monetary assets (e.g. cash on hand, bonds held, and accounts receivable) and its monetary liabilities (e.g. bonds outstanding, accounts payable). He finds that over 80% of UK business firms are net debtors and in the aggregate the UK market from 1948 to 1956 holds a net-debtor position, thus the aggregate UK market should gain from inflation. He also finds that the frequency of net-debtor firms in the US market from 1934 to 1956 varies from 40% to 60% and the aggregate US market holds a net-debtor position most of the time but a net-creditor position some time. Therefore, he generally rejects the hypothesis that business firms are net debtors and gain from inflation. De Alessi (1975) also points out that common stocks provide a hedge against changes in the general level of prices only to the extent that the firms in a portfolio have a zero net monetary position either individually or in the aggregate. Thus, there is no a priori reason to expect that common stocks would provide a hedge against changes in the general level of prices. He shows that the US non-financial firms held a moderate net debtor position in 1939 and 1949 and a somewhat larger net debtor position in 1960 and 1970. Accordingly, the US firms as a whole should gain slightly at least for part of these periods. However, the negative relationship between inflation and stock returns suggested in previous studies is inconsistent with what the nominal contracting hypothesis suggests. Geske and Roll

(1983) also argue that most non-financial corporations are net debtors since they appear to have more fixed nominal liability commitments than fixed nominal assets. Kessel's hypothesis is therefore not empirically compelling.

However, nominal contracting hypothesis cannot be rejected by previous studies which observe only some nominal contracts instead of all nominal contracts. It is almost impossible to identify whether the aggregate market, an industry or a firm is a net debtor or creditor, since firms hold many nominal contracts, such as labour contracts, supply contracts, debt contracts, pension commitments and so on, and calculating the real net nominal position needs to identify all these contracts for different firms, which is hard to conduct in reality (French et al. 1983). Thus, previous research which claims to have observed "the net nominal position" of the aggregate market or industries cannot be accurate. Previous studies whose intent was to observe the "net nominal position" of a market or an industry to see whether the nominal contracting hypothesis is consistent with the empirical relationship between inflation and stock returns are on the wrong footing right from the start.

Indeed, the nominal contracting hypothesis is empirically hard to test fully because it is almost impossible to observe all the nominal contracts and test both assumptions, i.e. debtor-creditor assumption and the labourer-capitalise assumption. However, the nominal contracting hypothesis is still testable or at least partly testable by focusing on as many nominal contracts as possible. It may also be tested by focusing on debtor-creditor assumption at the firm level, since most nominal contracts related to debts or other relative monetary claims are observable.

Kessel and Archian (1962) extensively discuss the demand for money, wealth transfers, the transitional stage between expected and unexpected inflation. They stress the need of investigating the monetary position because positive unexpected inflation increases the wealth of the net monetary debtor and decreases the wealth of the net monetary creditor, while negative unexpected inflation has an opposite effect regardless of whether the creditors and debtors are corporations, governments or other individual or groups. French et al. (1983) suggest investigating the depreciation tax shield along with the net monetary position and provide a testable model for the nominal contracting hypothesis. Pearce and Roley (1988) extend their study to inventories and pension expense. Other studies also provide testable nominal contracts and models for the nominal contracting hypothesis, for example Hong (1977), Bernard (1986), Chang et al. (1992) and Wei and Wong (1992).

Another argument in the debate on wealth transfers concerns the substitution of systematic risk. Some argue that debtor and creditor firms differ in the systematic risk they are exposed to, thus, the effect of wealth-transfer effect due to unanticipated inflation on stock returns is undetectable or not able to be isolated given many other sources of variation in stock returns. Some studies support the substitution of the systematic risk. For example, Bach and Stephenson (1974) test the nominal contracting effect adjusting for the systematic risk. They show that the effect of inflation associated with different net monetary positions is completely picked up by the systematic risk. Rozeff (1977) theoretically discuss the relationship between net monetary position and systematic risk. He explains that debtor and creditor firms have different financial leverage which is the determinant of systematic risk. Net debtor firms are considered to be riskier by the market than net creditor firms because the former has higher leverage than creditor firms. Since the systematic risk has impounded the firm's net monetary position, it is hard to isolate the effect of monetary position from the systematic risk. He also argues that the financial leverage associated with debtor or creditor firms can be found if inflation is correctly anticipated, but the effect of a net monetary position suggested by the nominal contracting hypothesis can be predicted by the systematic risk. This suggestion that wealth-transfer effect can be captured by the systematic risk since debtor or creditor firms have different leverage which is the determinant of systematic risk, is supported by Hong (1977), Chang et al. (1985) and Chang et al. (1992) as well. They show that, if the effect of systematic risk in the testing models is controlled, the effect of net monetary position can be made to vanish. Chang et al. (1992) even suggest that inflation-induced wealth transfer effect may be spurious if systematic risk is not controlled in the model since the net debtor firms are deemed riskier by the market than are creditor firms.

However, other studies show that even considering or including the systematic risk in the models, the wealth-transfer effect due to unanticipated inflation on stock returns still work. Bernard (1986) find that half of the cross-sectional variance in stock returns associated with unexpected inflation can be explained by cross-sectional differences in systematic risk. However, the rest can be partly explained by nominal contracting hypothesis. Pearce and Roley (1988) and Dokko (1989) also provide similar evidence of nominal contracting hypothesis even taking systematic risk into consideration.

Empirical findings of the nominal contracting hypothesis are conflicting. Some studies show very weak support or even no evidence of the nominal contracting hypothesis, contrary to Kessel's theory, as in Bradford (1974), Bach and Stephenson (1974), Hong (1977), French et al. (1983), Chang et al. (1985), Wei and Wong (1992) and Chang et al. (1992). However, there are studies that support or at least partly support the nominal contracting hypothesis, such as Bernard (1986), Pearce and Roley (1988) and Dokko (1989).

At the early stage of the research, most of the studies applied the general investigation on the net debtor or net creditor position of the market and tried comparing the effects of net debtor firms from net creditor firms, for example, Bradford (1974) and Bach and Stephenson (1974). Bradford (1974) examines the general net monetary position for aggregate market by considering the effect that different returns on monetary items have on the informational content of price-level accounting and using price-level restated financial reporting and a methodology of specifying gains and losses from holding monetary items during inflation. He suggests that the effect of inflation on the value of the firm in the case of monetary items can be analyzed at three levels: 1) general price-level changes measure the changes to income and principal; 2) the net holding gain or loss measures the net effect of holding monetary items; 3) the expected price-level changes which will affect the previous two analysis need to be estimated. He finds that the holding positive (negative) net monetary assets may not mean losses (gains) for the firm on a net basis during inflation and the effect on the firm depends upon the rates of income and costs of monetary items, against the nominal contracting hypothesis.

Bach and Stephenson (1974) examine the redistribution effects caused by the nominal contracts due to inflation for aggregate groups such as business and wages, households and the government, older and young people, as well as individual companies as net creditors or debtors. Without a clear conclusion in their study, they show that redistribution effects caused by nominal contracts due to inflation are complex and only very weak support exists in a few sample periods, hence, they doubt the conclusions reached by the hypothesis.

The later studies on the other hand use the specific accounting variables as the factors to test the different wealth transfer effects caused by nominal contracts due to unexpected inflation on a firm, for example, Hong (1977), French et al. (1983) and Wei and Wong (1992). In contrast to previous research that examines the relationship between inflation and stock returns on the aggregate level, Hong (1977) firstly suggests using companies' accounting variables as explanatory factors to examine the changes in stock prices during inflation by distinguishing net debtor firms from net creditor firms. He investigates the inflation effect on individual firms, but finds no support for the debtor-creditor hypothesis. In order to find out what the different wealth transfer effects due to inflation are, he distinguishes the monetary assets and the real assets of a firm and tests the impact of net monetary positions, plant and equipment and inventories on stock prices in three inflation periods. He finds no evidence of transfers from creditors to debtors, but finds instead, a transfer through the taxation system from business to the government. But he also explains that a firm would issue debts at different times, and a different expected inflation rate would impound the yield at each time of issue. He concludes that it is difficult to make any general statements about gains or losses from net monetary position, until a more accurate modelling of debt of varying maturities has been found, since a mixture of short-term and long-term bonds carries different implicit expected inflation rates which could be above or lower than real inflation rate.

Extending Hong's (1977) idea, French et al. (1983) firstly distinguish net monetary position into short- and long-term monetary position and test whether the sensitivity of stock returns to unexpected inflation (coefficient) is related to the nominal contracting variables (the short- and long-term monetary position and the depreciation tax shield). Since the nominal contracts (such as labour contracts, supply contracts, debt contracts and pension commitments) for each firm are not easy to observe, they only obtain the data of debt contacts and depreciation tax shields. They form 27 different portfolios of stocks from 1946 to 1979 with similar sets of nominal contracts depending on the three variables sorted into three equal-size groups. In order to find out whether the nominal contracting hypothesis holds, they test whether the returns of different firms in nominal contract are affected differently by unexpected inflation as suggested by Kessel and Archian (1962) and model the impact of unexpected inflation upon stock prices with net monetary position divided into short- and long-term components and the tax basis of firms' depreciable assets, although Dokko (1989) later argues that their models suffer from colinearity among explanatory variables. Since they find little evidence that stock holders of net debtors firms with relatively large net monetary liabilities benefit from unexpected inflation relative to the stock holders of net creditor firms with net monetary assets, they conclude that wealth effects caused by nominal contracts due to unexpected inflation are not an important factor in explaining the behaviour of stock prices.

Chang et al. (1985) examine this wealth transfer theory on one of the financial service sectors—insurance industry. They firstly point out that previous studies fail to distinguish unexpected inflation from realized inflation and use real inflation as if it were entirely unexpected when testing the nominal contracting hypothesis. They also include systematic risk in their testing model and test the reaction of different portfolios depending on net monetary positions during positive or negative unexpected inflation. They find that net creditors gain during positive unexpected inflation while net debtors have no significant effects on unexpected inflation, which is contrary to the nominal contracting hypothesis.

Following Bernard (1986) and Pearce and Roley (1988), Wei and Wong (1992) also empirically test the nominal contracting hypothesis for firms in NYSE in 19 industries from 1961 to 1985.[3] They employ four variables: debt ratios, inventory values, the depreciation tax shield and the pension expense of firms as nominal contract variables. They find that all these four nominal contract variables are insignificant at conventional level from 1961 to 1985, inconsistent with Pearce and Roley (1988), but consistent with French et al. (1983). Therefore, their results of the general market and different industries do not support the nominal contracting hypothesis during the post war period.

As opposed to previous studies which all compared price responses of claims to real assets across firms, Chang et al. (1992) focus on a specific nominal contract: long-term bonds and directly examine the nominal contracting hypothesis by examining the price responses of stocks and long-term bonds issued by the same firms to unexpected inflation, since in a specific nominal contract the involved debtors gain the wealth while the involved creditors lose from unexpected inflation. Long-term debt is chosen by Chang et al. (1992) who explain the reasons for choosing long-term debt contract: Firstly, the market values of depreciation of long-term bonds are directly observable, while other nominal contracts are not available. Secondly, prices of long-term bonds are more likely to respond to unexpected inflation than prices of shorter-term instruments. Thirdly, according to previous studies, long-term bonds are

[3] Wei and Wong apply the model of Bernard (1986) but to test the different firm characteristics: inventories, long-term debt ratio, depreciation tax and pension, as Pearce and Roley (1988) do.

most significant when compared with other nominal contracts. They test whether the market value of equity will rise because the market value of debt declines by comparing the time series coefficient on unexpected inflation of bond returns (nominal contract holder) and stock returns (real contract holder) for the same firm using daily nominal returns from November 1977 to December 1982 and monthly real returns from 1963 to 1982. If their coefficients are in opposite directions and not equal, the nominal contracting hypothesis is supported. However, they fail to reject the hypothesis that unexpected inflation causes stock returns and bonds issued by the same firms to move in the same direction and by similar magnitudes. Since they only focus on one specific nominal contract of a firm and do not control for other nominal contracts which might also affect the intra-firm wealth redistribution, they cannot general reject the nominal contracting hypothesis. They also suggest that previous studies which investigate cross-firm cases could be an alternative explanation for the nominal contract hypothesis, which means there is no final result for their studies.

However, empirical findings of other studies support or at least partly support the nominal contracting hypothesis, such as Bernard (1986), Pearce and Roley (1988) and Dokko (1989).

In order to respond to the argument that the wealth transfer effect caused by the nominal contracts due to inflation may be spurious if systematic risk is not controlled for in the model since the net debtor firms are deemed riskier by the market than creditor firms (see Bach and Stephenson, 1974; Rozeff, 1977; Hong, 1977 and Chang et al. 1985), Bernard (1986) extends the model of French et al. (1983) by including systematic risk and cash flows from operation and test 136 firms and 27 industries of the US market from 1961 to 1980. Different from French et al. (1983) model, Bernard (1986) does not include expected inflation in his model, but includes systematic risk and the cash flow response parameters as additional explanatory factors. Bernard (1986) reports that the relationship between unexpected inflation and stock returns differs systematically across firms in a manner that is consistent with the cross-sectional variation in firms' nominal contracts, although the relations cannot be described as a direct product of wealth transfers due to the nominal contracting effect, since other factors, besides direct monetary claims and tax shields, explain more than two-thirds of the variance in returns associated with inflation. Moreover, Dokko (1989) suggests that the sum of the two of Bernard's estimates can provide better evidence of the nominal contracting and tax effects.

Extending the idea of French et al. (1983) and Bernard (1986), Pearce and Roley (1988) form their own model and testing the nominal contracting hypothesis using the US data from November 1977 to December 1982 and CPI as proxy for the unanticipated inflation. In order to avoid directly using systematic risk as an explanatory factor and to avoid the omitted variable problems, they use market index as proxy for systematic risk and include expected inflation as one of the explanatory factors. After examining the individual responses of 84 stocks to unanticipated inflation, he finds that time-varying firm characteristics related to inflation predominately partly determine the effect of unanticipated inflation on a stock's rate of return and a firm's debt-equity ratio appears to be particularly important in determining the response which is in agreement with this hypothesis.

A strong support for this hypothesis comes from Dokko (1989). He suggests jointly testing the nominal contracting hypothesis, the nominal capital gains tax effect hypothesis and the inflation risk hypothesis in the same firm to avoid model misspecification. He suggests that inflation affects stock prices through various channels. Firstly, unexpected inflation causes the wealth redistribution through nominal contracts. Secondly, unexpected inflation negatively affects real economic activity, therefore affects the required risk premium for common stocks. Thirdly, unexpected inflation affects the anticipated future inflation which will affect the anticipated corporate profitability through nominal capital gains taxation (Feldstein 1980). Thus he suggests a testable model to capture these multiple channel inflation effects jointly. Depending on the recognition that asset and capital structure variables are balance sheet constrained, Dokko (1989) examines the different responses of assets and nominal liabilities to unexpected inflation. Dokko creates 50 semi-annual cross-sectional samples of non-financial and non-utility corporations from 1961 I to 1985 II including four features about a firm's asset and capital structure: inventories, plant and equipment on the asset aside and short-term debt net of monetary assets and long-term debt on the claims side and extends previous studies that examine the wealth redistribution effect and the nominal capital gains tax effect of inflation jointly, avoiding the collinearity effect of these variables. From the joint test, he provides support for all of these three hypothesises: the nominal contracting, the tax effect and the inflation risk hypothesis. Thus he suggests that the wealth redistribution effect caused by nominal contracts due to inflation between bondholders and shareholders does exist.

Despite the mixed empirical findings, the nominal contracting hypothesis links the corporate financing mix, the inflation risk and the wealth redistribution effect together to form a micro-firm level explanation for the relationship between inflation and stock returns.

2.6 Summary

The literature on the interaction between monetary policy, inflation and stock returns has been reviewed in this chapter. The current literature informs that monetary policy affects inflation and contemporary changes in inflation lead to changes in expected inflation leading to changes in the central bank's future decisions on the interest rate. The Fisher hypothesis provides the theoretical underpinning of this process and a rich body of empirical literature has uncovered supporting evidence of this proposition.

Monetary policy furthermore affects stock returns. Studies using the event-study method to investigate the impact of monetary policy announcements on stock returns focus on the effects of monetary announcements on either the level of stock returns or the volatility of stock returns based on intraday, daily or weekly data. A variety of proxies have been used in an attempt to capture the working of monetary policy such as broad money supply, the discount rate, Fed funds rate target (the interest rate), open market operations for the US, some other proxies are used for non-US countries. Efforts have also been found in the literature that try to provide interpretations of the particular form of responses of stock returns to monetary policy, backed by empirical evidence for the explanations. So far, however, empirical findings are conflicting. While some empirical studies argue that monetary policy has no effect on stock prices, much of existing literature shows evidence that stock returns significantly respond to monetary policy announcements and some other studies show that the results are mixed, varying in time periods and across policy environments.

According to the Fisher's hypothesis, common stocks should be a good hedge against inflation. Empirical evidence, however, shows that the relationship is complex and more complicated than what the standard theories have indicated. Empirical investigation into the relationship has produced results that are puzzling. It is found that the relationship between inflation and stock returns can have various signs, may be positive, negative or neutral. A large body of literature generates evidence of a negative relationship between inflation and stock returns, contrary to the Fisher hypothesis. To explain such an anomaly, the studies on announcement effects of unexpected inflation suggest the policy anticipation hypothesis (PAH) and the expected inflation hypothesis (EIH) to explain the negative relationship found in the event studies. For the short-horizon, long horizon or long-term studies, there are eight main perspectives interpreting the empirical inflation-stock returns relation. They are the proxy hypothesis (Fama, 1981), general equilibrium models, the tax-effects hypothesis (Feldstein, 1980), the money illusion hypothesis (Modigliani and Cohn, 1979), the nominal contracting hypothesis (Kessel, 1956), the capital management hypothesis (Lintner, 1975), the tax-augmented hypothesis (Anari and Kolari, 2001; Luintel and Paudyal, 2006) and the agency problem hypothesis (Jovanovic and Ueda, 1998).

The extant models hypothesising possible reasons of the inflation-stock returns puzzle were reviewed in this chapter. Among these hypothesises, the nominal contracting hypothesis links together the corporate financing mix, the inflation risk that firms are faced with and the wealth redistribution caused by nominal contracts due to unexpected inflation. It uniquely provides an explanation of the puzzle with a micro-firm level exposition. Debates on the theoretical underpinning and empirical rigour of the nominal contracting hypothesis have been lively. Amid conflicting evidence afforded in the literature, some studies show very weak supporting evidence or even no evidence of the hypothesis while others unearth evidence that confirms or at least partly supports the nominal contracting hypothesis.

Therefore, although there is a growing number of studies investigating the interaction between monetary policy, inflation and stock returns, empirical work shows no conclusive evidence of the nature, extent and driving forces of the interactions. This prompts the current study to extend the scope of investigation in the existing literature by examining the UK case, where the financial market is mature and evolution of the monetary policy makes available a wealthy body of experience the richness of which is instrumental to many other countries. In this light, the UK represents a weighty case for reaching a better understanding of the research questions indentified and to be solved by this study.

Chapter 3 Monetary Policy and Stock Returns

3.1 Introduction

In the past few decades, there have been steadily increasing studies investigating whether monetary policy affects stock markets. Central banks use many monetary policy instruments including open market operations, changes in reserve requirements, discount rate, the interest rate of inter-bank overnight lending of reserves and so on to manipulate the money supply and interest rates, which in turn affect the overall economy. Rozeff (1974) explains that as claims on real assets, common stocks are affected by unexpected changes in monetary policy since unexpected changes in monetary policy contain unexpected information which has not been reflected in current stock prices. Mishkin (2007, p.155-156) furthermore suggests that monetary policy might negatively affect stock prices because monetary policies can alter the path of expected dividends, the discount rate or the equity premium.

However, despite the accumulation of papers, whether monetary policy affects stock market is still a critical issue in modern finance. Different monetary instruments, such as money supply, discount rate, Fed funds rate target (interest rate), open market operations or others for non-US countries, are chosen as proxies to measure the monetary policy. Using these proxies, studies which either focus on the effect of monetary policy announcement on the *level* of stock returns or on the *volatility* of stock returns report mixed evidence. Black (1987) unearths that monetary policy can not affect stock returns and Goodhart and Smith (1985) find no empirical evidence of the impact of monetary policy on stock returns. However, many studies provide evidence of significantly negative responses of stock returns to monetary policy announcements, as in Waud (1970) and Berdin et al. (2007). However, some even show that the responses vary, could be either significantly negative or insignificant, depending on sample periods, as in Hafer (1986).

Although monetary economists have investigated the responses of stock returns to monetary policy announcements, the present controversies reflect that this issue is inclusive. Investigating the effect of monetary policy announcements on stock returns is especially important for policy makers who are concerned with the effect of the policy decision, for investors who watch carefully the central banks' monetary policy announcements and interest in the stock prices and effective investment and for company managers considering the risk management decisions. Therefore, further empirical analysis with wider coverage of countries and new techniques could possibly shed light on this critical issue.

Despite the fact that many studies have investigated the impact of monetary announcements on stock returns, the void exists in the field. Firstly, there is a few studies that have investigated the effect of monetary policy announcements and heterogeneous industry effect on the UK market in recent years. Most studies analyze the announcement effect of money policy on the US market.[4] A limited number of studies have examined the UK market, and these include Goodhart and Smith (1985), MacDonald and Torrance (1987), Gregoriou et al. (2006) and Berdin et al. (2007). The UK monetary policymaking process and inflation target is different from those in the US. The Bank of England and its Monetary Policy Committee (MPC) made its monetary policy decisions independently after May 1997 to meet the inflation target set by the Chancellor of the Exchequer. Compared with the US Federal Reserve System and its monetary policy making committee-the Federal Open Market Committee (FOMC) which can independently make monetary policy without democratic control from the government setting the target inflation rate, the Bank of England is less goal-independent and has more obligations for the inflation stability (Buckle and Thompson, 2004, p.352-357; Mishkin, 2007, p.326). Due to these differences between the UK and the US, the US evidence might be inapplicable for the UK market. Thus further investigation for the UK market seems necessary.

[4] Some example as Thorbecke and Alami (1994), Lobo (2000), Ehrmann and Fratzscher (2004), Bernanke and Kuttner (2005)

Secondly, until now, there is lack of study that has examined the response of stock market volatility to monetary policy announcement on the UK market. Since volatility interpreted as time-varying risk associated with the asset enable investors to value the maximum to lose over a given time period and is important for risk managements (Harris and Sollis, 2003, p.214), investigations for the response of the stock market volatility to monetary policy are as important as those for stock returns. At present, most studies have investigated the effect on stock market volatility on the US market or some emerging markets, but little has been done on the UK market.

Thirdly, although some studies that examine the US market use both money supply and discount rate as a proxy for the monetary policy, literature investigating the UK market uses either the Bank of England official bank rate or money supply as a proxy for the monetary policy, instead of both. Although monetary policy may influence the economy largely through its effect on interest rate, money supply and interest rate are both important indicators of monetary policy and changes in money supply affect the short-term interest rates (Bodie, 2005). Goodhart and Smith (1985) and MacDonald and Torrance (1987) use the money supply (£M3) as the proxy for the monetary policy while Gregoriou et al. (2006) and Berdin et al. (2007) both use the Bank of England official bank rate as proxy for the monetary policy for the UK market. Both broad money supply and the Bank of England official bank rate are important indicators of the UK monetary policy. However, none of them use both the broad money supply and the Bank of England official bank rate to provide much general evidence of the UK market.

Fourthly, there are a few studies that have examined the preannouncement effect and the delay effect on the UK market in the existing literature. Studies focusing on the US market suggest that there may be a preannouncement effect and a delayed effect on the response of stock returns to monetary policy news. Goodhart and Smith (1985) and MacDonald and Torrance (1987) also examine the delay effect as well as the on the date of announcement effect on the UK market, while Gregoriou et al. (2006) and

Berdin et al. (2007) only focus on this effect on the announcement date. Whether the preannouncement effect or delay effect exists on the UK market needs to be considered.

Fifthly, as far as the author knows, there is lack of study that has analyzed the asymmetric effect of bad news and good news for the UK stock market. Asymmetric effect is worth considering because it suggests that investors might have preference for good news or bad news. Some studies that investigate the US market provide evidence of the asymmetric effect of bad news and good news, for example, Hefer (1986) finds evidence that bad news has a significant effect on the stock prices, while good news has no significant effect while Jensen and Johnson (1995) find evidence that US stock market has greater response to good news than bad news. However, for the UK market, no study analyzes this asymmetric effect.

Sixthly, the difference of announcement effect on the UK stock returns between before and after 1997 has not been considered in the existing literature. The Bank of England became independent in 1997. Before the Bank of England become independent , the UK monetary policy was decided by the chancellor of exchequer following a monthly consultation with the Governor of the Bank of England and the Bank of England only generally indicated the decision of monetary policy of the government to the markets by changing the rate at which it conducted its daily money market operations, but in the case of no change decisions, the decision not to change rates did not became clear at any discrete point in time (Burrows and Wetherilt, 2004). Therefore, the market participants found it hard to anticipate the monetary policy, which might led to a lower efficiency response of stock returns to the changes in monetary policy before May 1997. However, since independence was conferred upon the Bank of England, the Bank of England Monetary Policy Committee (MPC) has regular meetings to independently decide the monetary policy to meet the inflation target set for the monetary policy. The regular meeting date is set in advance and published on the website of the Bank and the official bank rates are set by the MPC on very regular basis. Market participants therefore find it easier to anticipate the changes in monetary policy, and as a result, the stock prices may respond to the changes in monetary policy in advance or more efficiently than would otherwise have been possible. Thus, the independence of the Bank of England directly affects not only the decision of monetary policy, but also the way that monetary policy is announced, even the meaning of the monetary policy within the stock market. Therefore, comparing the announcement effect of monetary policy on the stock returns before and after the independence of Bank of England in 1997 is important. However, lack of previous studies realize this.

To contribute to the literature, this chapter empirically examines the response of the daily UK stock returns and volatility to the Bank of England's official bank rate and the effect of broad money supply (M4) on stock returns. The aggregate market, ten industries and the sub-sample of before and after the independence of the Bank of England in May1997 are investigated. This analysis will provide insights into the stock market efficiency around the monetary policy announcement days and the asymmetric response of the stock market to good news and bad news.

The remainder of this chapter is organized as follows: Section 2 briefly reviews the relative literature. Section 3 describes the data. Section 4 explains the methodologies and the testable models. Section 5 shows the empirical results and conclusion is presented in Section 6.

3.2 Brief Review of Literature

Many studies investigate the announcement impact of monetary policy and these studies may be divided into two groups: one is focused on the effect of monetary policy announcements on the *level* of stock returns and the other concerns the impact on the stock market *volatility* (Bomfim, 2003). Some studies argue that monetary policy has no effect on the level of stock returns, e.g. Goodhart and Smith (1985), MacDonald and Torrance (1987), Black (1987), Tarhan (1995) and Serwa (2006). However, a great number of studies have shown that the level of stock returns significantly respond to the monetary policy announcements, such as Waud (1970), Pearce and Roley (1983, 1985), Jensen and Johnson (1993, 1995, 1997), Wongswan (2006) and Berdin et al. (2007). In between, there are studies that report mixed results depending on time periods, e.g. Hafer (1986) and Hardouvelis (1987). Similarly, while some studies show that monetary policy announcements has no effect on the stock market volatility, e.g. Rangel (2006), many studies suggest that there is evidence of the effect, e.g. Lobo(2000), Bomfim (2003) and Chang (2008).

Associated with the announcement effect, some studies also investigate whether there is a preannouncement effect and the delay effect on the response of stock returns to monetary policy news. For example, Jensen and Johson (1993) find the preannouncement effect of discount rate change on the US stock prices. However, other analyses show no preannouncement effect on the stock market volatility, e.g. Bredin et al. (2005). Most studies show no delay effect on the response, for example, Pearce and Roley (1985) analyze the response of US stock prices on the news of both money supply (M1) and Fed reserve discount rate and find no evidence of delay effect of the announcements. Jensen and Johson (1993) also find little evidence of delay effect. Consistent with the US evidence, Goodhart and Smith (1985) and MacDonald and Torrance (1987) find no evidence of delay effect on the response of the stock prices to the money supply news on the UK market.

Some studies, moreover, examine the asymmetric effect of different news, since stock market may react more to a tightening monetary policy (bad news) than a loosening one (good news). Some show evidence of the asymmetric effect of bad news and good news, but the evidence differs in supporting either good news or bad news. On one side, evidence supports the bad news effect. For example, Hefer (1986) presents the asymmetric influence of monetary policy on US stock prices, only positive unexpected changes in money supply (bad news) have a significant effect on the stock prices, while the negative unexpected changes in money supply (good news) seems have no significant effect. Bomfim (2003) also presents the asymmetric effect of monetary news: positive surprise (bad news) tends to have a larger effect on US stock market volatility than negative surprises (good news). Consistent with Bomfim, Bredin et al. (2005) also show that bad news (tightening of the US monetary policy) affects the Irish stock market volatility more than the good news (loosening of the US monetary policy). Similarly, Chulia-Soler et al. (2007) present that bad news of Fed funds rate target affects the US stock market to a greater extent than the good news does. Lobo (2000) investigates the asymmetries in the US stock prices adjustment process around the monetary policy change event and finds that stock prices incorporate news suggesting overpricing (bad news) faster than news suggesting under-pricing (good news).

On the other side, evidence supports good news. For example, Jensen and Johnson (1995) find evidence of asymmetric effect: US stock market has greater response in periods following good news (discount rate decreases) than in periods following bad news (increases). Madura (2000) assesses the response of stock prices of commercial banks to both Fed funds rate target and discount rate changes and finds that good news negatively affects the bank stock prices while bad news has a weak negative effect.

In conclusion, the response of stock returns to monetary policy announcements has been well documented in previous empirical studies. Although some empirical studies show that monetary policy has no effect on stock returns, most studies provide evidence that stock returns respond negatively to the monetary policy announcements. The preannouncement effect or the delay effect on the response of stock returns to monetary policy news is also shown in some studies, suggesting a leakage of information before the news is officially announced and the stock market might respond more slowly to the monetary policy news. Moreover, some studies further examine the asymmetric effect of different news and provide evidence of the asymmetric effect of bad news and good news, but the evidence differs in supporting either good news or bad news, thus, suggesting that investors might have preference for good news or bad news.

3.3 Data and Descriptive Statistics

3.3.1 Data

This study is composed of FTSE All Share Index (FTA), ten industry indices named Oil and gases (OI), Basic materials (BM), Industrials (ID), Consumer goods (CG), Healthcare (HL), Consumer services (CS), Telecoms (TM), Financials (FN), Information technologies (IT) and Utilities (UT). Performance for the indices was measured by their log returns. The daily data are obtained from Datastream. The sample period for the investigation of interest rate, determined by the availability of announcement data of interest rate and indices, individually are from 3rd January 1978 to 31st December 2007 for the aggregate market (FTA), from 1st January 1986 to 31st December 2007 for nine industry indices (OI, BM, ID, CG, HL, CS, TM, FN, IT) and from 9th December 1986 to 31st December 2007 for the industry index of Utilities (UT). Due to the independent of the Bank of England in 1997, two sub-samples, before and after May 1997 are set. Sample period for the investigation of the money supply, determined by the availability of the survey data of forecast money supply, FTA and ten industry indices are all from 1st January 2000 to 31st December 2007. The detail on the sample and the description of the data is shown on Table 3.1 and 3.2.

Investigating the impact of monetary policy on stock returns needs to identify the policy changes. Although there are many proxies suggested by previous studies examining the US market, such as discount rate, money supply, Fed funds rate target and open market operations, for the UK market, only Both the Bank of England (BoE) official bank rate and the broad money supply (£M3 or M4) have been used.[5] Since the Bank of England's official bank rate is a very important indicator for the UK monetary policy and suggested to be the best proxy for the policy change by Berdin et al. (2007), it is adopted in this chapter. On the other hand, since broad money supply which will affect the interest rate is another important indicator for monetary policy, Goodhart and Smith (1985) and MacDonald and Torrance (1987), Clare and Courtenay (2001) and Burrows and Wetherilt, (2004) suggest the broad money supply (£M3 or M4) as the proxy for the policy changes. The Bank of England modified its measures of money several times. M0, M2, £M3, M3, M4 and so on all have been provided as the measures of monetary aggregate since 1970 when the Bank of England started to publish a range of monetary aggregate. Sterling (£)M3, renamed M3 in 1987, was used to be the widely accepted measure of broad money supply, however, it was no longer published and M3 was redefined as the estimate of the European Central Bank's broad money aggregate for the UK. Therefore, the broad monetary aggregate M4 introduced in 1987 becomes the widely accepted proxy for the UK money supply and it is also selected in this chapter. Both the Bank of England (BoE) official bank rate and broad money supply (M4), thus, are investigated in this chapter.

Official bank rates are set by the Bank's Monetary Policy Committee (MPC) which sets an interest rate to meet the inflation target after the Bank of England became independent in May 1997. The regular meeting date is set in advance and published on the website of the Bank of England. The MPC decisions on interest rates are announced at 12 noon immediately following the Thursday meeting on a monthly base. Thus, after May 1997, the announcement of interest rate is a monthly base. 129

[5] The Bank of England official bank rates from January 1978 to December 2007 are mixed with the discount rate and interest rate. The BoE uses the following bank rates as the official bank rate: Minimum Lending rate from January 1978 to March 1981, Minimum Band 1 dealing rate from August 1981 to October 1996, Repo Rate from May 1997 to August 2005 and the Official Bank rate from August 2006 to December 2007. The Minimum Lending Rate, Repo Rate and Official Bank Rate are interest rates but the Minimum Bank 1 Dealing Rate are discount rates (see Official Bank Rate History——Changes in the Rate from 1970, the Bank of England web page) Discount rates are transformed into interest rate. Thus, all the BoE official bank rates used in this chapter are interest rates.

announcements with 39 official rate changes are recorded over the period from 1st May 1997 to 31st December 2007.[6] Before May 1997 the UK monetary policy was decided by the Chancellor of Exchequer following a monthly consultation with the Governor of the Bank of England. Thus, before independence, the Bank of England generally indicated the decision to the markets by changing the rate at which it conducted its daily money market operations, but in the case of no change decisions, the decision not to change rates did not became clear at any discrete point in time (Burrows and Wetherilt, 2004). Therefore, before May 1997, the announcement of the BoE official bank rate was not a monthly base, it was an event base. 141 announcements of changing bank rate are recorded over the period from 3rd January 1978 to 30th April 1997.

The unexpected changes in the Bank of England official bank rate are proxied by the daily changes in the three months Sterling LIBOR futures contracts offered by the Bank of England. This rate is widely used as a good proxy for the market expectation for the Bank of England official bank rate (See Brook et al., 2000 and Berdin et al., 2007). Thus the difference in the price changes in the three months Sterling LIBOR between t and t-1 are used as the unexpected changes in the BoE official bank rate. The expected change in the interest rate is defined as the difference between the actual change and the unexpected change in interest rate.

The Bank of England regularly releases the provisional broad money supply, M4, on the 14th working day of the month or 21st working day of the month for the final data. The seasonal adjusted monthly changes in broad money supply are used in this chapter. The expected changes in money supply come from the survey data on financial market. The analysts' forecast M4 for the UK is provided by Informa Global Markets (IGM) (former Money Market Services International (MMS)).[7] IGM forecast announced a

[6] Only one exception of the announcement that is not declared on a monthly base after May 1997 is recorded on 11 September 2001, on which Bank of England announced to cut interest rate from 5% to 4.75%.
[7] Informa Global Markets (IGM) was formed by the merger of McCarthy, Crisanti & Maffei (MCM) and Money Market Services International (MMS) in September 2003.

week before the official figure announced by the BoE. Since the IGM monthly forecast enable go back to Jan 2000, the sample period is from Jan 2000 to December 2007.

According to Joyce and Read (2002), the survey data of analysts' forecast needs to be tested whether it is actually represent the consensus opinion of the whole market assumed to be rational. Until the data can pass through the tests of unbiasedness and (weak) efficiency, which are both the requirements for the assumption of rationality, this survey data cannot be used as the forecast of M4. Thus, we follow Joyce and Read (2002) to examine whether the underlying IGM data satisfy rationality and do the unbiasedness and (weak) efficiency tests as follows.

An unbiasedness test is conducted as shown equation (3.1). If α=0, β=1 and ε_t is serially uncorrelated, then the IGM data is the unbiased forecast.

$$P_t = a + \beta P_t^e + \varepsilon_t \tag{3.1}$$

The weak-form test of efficiency shown in equation (3.2) examines whether the forecast error could be explained by past values of inflation. If the null hypothesis, H_0: $\beta_1=\beta_2=\ldots=\beta_{12}=0$ can be accepted, then the IGM data satisfies the weak form efficiency.

$$P_t - P_t^e = a + \beta_1 P_{t-1} + \ldots + \beta_{12} P_{t-12} + e_t \tag{3.2}$$

Table 3.1 shows that the null hypothesis that α is equal to zero cannot be rejected whereas β has a significant value, 0.9166, thus, it rejects the null hypothesis that β is equal to zero. It also reveals no evidence of serial correlation, and the joint hypothesis (α, β) = (0, 1) cannot be rejected. Thus, the IGM data are unbiased forecasts of broad money supply M4.

Table 3.2 shows that on the basis of the F-statistic, the null hypothesis H_0: $\beta_1=\beta_2=...=\beta_{12}=0$ cannot be rejected, therefore, the IGM data meets the weak efficiency. Results of previous tests reveal that the survey data of IGM expected broad money supply M4 satisfy the rationality and can represent the consensus opinion of the whole market.

3.3.2 Descriptive Statistics

Panel A of Table 3.3 presents the summary statistics for the Bank of England official bank rate from 3rd January 1978 to 31st December 2007. The sample mean of actual changes in interest rate is -0.01% (S.E.= 0.0067), the mean of expected changes in interest rate is -0.02% (S.E.=0.0054) and the mean of unexpected changes in interest rate is 0.01% (S.E.= 0.0027). Panel B of Table 3.3 reports the summary statistics for the Bank of England broad monetary supply (M4) from 1st January 2000 to 31st December 2007. The sample mean of actual changes in monetary supply is 0.74% (S.E.= 0.0045), the mean of expected changes in money supply is 0.73% (S.E.= 0.0036) and the mean of unexpected changes in money supply is 0.01% (S.E.= 0.0030). Panel C and D of Table 3.3 also presents the summary statistics for the stock returns on and around the announcement date of the interest rate and money supply.

3.4 Methodology and Hypothesis Development

In order to examine the response of the daily UK sectors stock returns and volatility to the Bank of England's official bank rate and broad money supply M4 and the possible pre-announcement effect, delay effect or asymmetric response of stock market to good news and bad news, we impose the event study methodology to test whether the monetary policy announcements influence the stock returns and the extended GARCH models to test whether the announcements of the Bank of England's' official bank rate affect the stock market volatility.

3.4.1 Tests for the Effect of Changes in Interest Rate on Stock Returns and Stock Market Volatility

Many previous studies suggests that changes in interest rate would affect the stock returns and provide evidence that stock returns significantly respond to the interest rate announcements. In this chapter, the impact of interest rate announcements on stock returns is investigated in an event study framework. Two subsamples before or after May 1997 are also examined.

According to Mishkin (2007, p.155-156), when the central bank use monetary policy tools to lower interest rate which will encourage the investment and consumption in turn expand the economy and increase the future dividend of stocks or the growth rate in dividends, at the same time the investors accept a lower returns from the investment in equity, meaning stock prices will move up. Therefore, interest rate announcement will be expected to adversely affect stock prices. Thus, the effect of interest rate announcements on stock returns following the baseline equations (3.3) and (3.4) is examined in a three day event window. For each regression, we test for the response of stock returns to the news of changes in interest rate against the null hypothesis H_1: $\beta = 0$, interest rate news affect the stock returns and negative estimates of β are associated with announcements of increase interest rate being the bad news for stock returns. In accord with the efficient market hypothesis, no leakage of information occurs before the news released by the Bank of England on the official announcement date, then the stock returns fully reflect the inflation news on the announcement date but no longer change after the announcement date. Thus, significant estimates of β on the date before or after the announcement imply that the preannouncement effect or the delay effect occurs.

$$R_{t+B} = \alpha + \beta \Delta i_t + \varepsilon_t \tag{3.3}$$

$$R_{\Delta 3t} = \alpha + \beta \Delta i_i + \varepsilon_t \tag{3.4}$$

where

Δi_t : actual changes in the interest rate;

R_{t+B} for B (-1, 0, 1): the stock returns on the day $t+B$, hence, R_{t-1}, the stock returns on $t-1$ (one day before the announcement date), R_t, the stock returns on t (the announcement date) and R_{t+1}, the stock returns on $t+1$ (one day after the announcement date);

$R_{\Delta 3t}$: three days stock returns (the stock returns of the announcement date t, the day before and the day after).

Following Berdin et al. (2007), the response of stock returns to the expected and unexpected changes in interest rate is examined using equations (3.5) and (3.6). According to the efficient market hypothesis, stock prices reflect all available public information, therefore, only unpredictable information will affect the stock prices. Thus, only unexpected changes in interest rate which contain new information will affect the stock returns at the time when the announcement is released while expected changes in interest rate will not (Joyce and Read, 2002). Therefore, for each regression, we test for the response of stock returns to announcements of changing interest rate being consistent with the null hypothesis H_1: $\gamma = 0$, expected news have no effect on the stocks, and against the null hypothesis H_2: $\beta = 0$, negative estimates of β are associated with the announcement of unexpected change in interest rate being the bad news for stocks. Significant estimates of γ or β on the date before or after the announcement means the preannouncement effect or the delay effect occurs.

$$R_{t+B} = a + \gamma \Delta i_t^e + \beta \Delta i_t^u + \varepsilon_t \tag{3.5}$$

$$R_{\Delta 3t} = \alpha + \gamma \Delta i_t^e + \beta \Delta i_t^u + \varepsilon_t \tag{3.6}$$

where

Δi_t^e : expected change in interest rate;

Δi_t^u : unexpected change in interest rate.

Since previous studies, e.g. Hefer (1986), present the evidence of the asymmetric effect of monetary policy on US stock prices, we test whether the response of the UK stock returns to the interest rate announcements is different from positive unexpected change in interest rate (tightening monetary policy) than negative unexpected change in interest rate (loosening monetary policy) following Adams et al. (2004). To test this directional asymmetric effects from good news to bad news we use equation (3.7) to test whether the response to positive unexpected change in interest rate (bad news) is of the same absolute magnitude as the response to negative unexpected change in interest rate (good news) against the null hypothesis: $\beta_+ = \beta_-$, which states that the coefficients for good news are equal to the ones for bad news. D_+ are dummy variables for bad news (positive unexpected change in interest rate) while D_- are dummy variables for good news (negative unexpected change in interest rate).

$$R_t = \alpha_+ D_+ + \alpha_- D_- + \beta_+ D_+ \Delta i_t^u + \beta_- D_- \Delta i_t^u + \varepsilon_t \tag{3.7}$$

where

D_+=1 if unexpected change in interest rate is larger than zero, Δi_t^u>0 and 0 otherwise;

D_- =1 if unexpected change in interest rate is less than zero, Δi_t^u<=0 and 0 otherwise.

Previous findings show that announcements of monetary policy influence not only the level of stock returns but also the stock market volatility, therefore, following Jones et al. (1998) and Bomfim (2003), we also investigate the effect of interest rate announcements on stock market volatility in the extended GRACH (1, 1) model by following equations.

$$R_t = b_0 + b_1 \Delta i_t^u + b_2 R_{t-1} + \mu_t \tag{3.8}$$

$$\mu_t = \sqrt{s_t} e_t \tag{3.9}$$

$$E(e_t | \Omega_{t-1}) = 0 \tag{3.10}$$

$$E(e_t^2 | \Omega_{t-1}) = h_t \tag{3.11}$$

$$h_t = \alpha_0 + \alpha_1 h_{t-1} + \alpha_2 e_{t-1}^2 \tag{3.12}$$

$$E(\mu_t^2|\Omega_{t-1}) = s_t h_t \quad (3.13)$$

$$s_t = 1 + \delta_1 I_t^{BoE} \quad (3.14)$$

where

I_t^{BoE} : dummy variable set to one on the days of announcements.

The conditional mean of daily stock returns are valued by the unexpected change in interest rate and the lag 1 stock returns in equation (3.8). μ_t captures the unexpected movements in daily stock returns with two components, s_t and e_t, as shown in equation (3.9). e_t is a random variable with time varying conditional mean 0 and conditional variance h_t, shown in equation (3.10) and (3.11). h_t follows a GARCH (1,1) process, shown in equation (3.12). s_t is a deterministic scale factor which provides the main channel for days of interest rate announcements to have a separate effect on volatility. The conditional variance of μ_t is shown in equation (3.13). Moreover h_t is independent of s_t. Jones et al. (1998) explains that the dummy variables can measure the impact of news on the announcement date on the conditional volatility. Thus equation (3.14) is used to test whether days on announcements affect the stock market volatility. The equations (3.8) to (3.14) allow the conditional variance on none-announcement days is h_t while on the announcement day is given by $h_t(1+\delta_1)$.

Therefore, we will estimate a multiplicative dummies for volatility on the announcement date by the set equation from (3.8) to (3.14) to test the impact of unexpected changes in interest rate on stock market volatility against the null hypothesis: $\delta_1 = 0$, significant estimate of δ_1 means interest rate surprise influence stock market volatility.

Moreover, in order to see whether preannouncement effect or delay effect occurs, we also estimate a multiplicative dummies for volatility on the day, before and after the announcement by the set equation from (3.8) to (3.13) and (3.15) to test the impact of unexpected interest rate announcements on stock market volatility against the null hypothesis H_1: $\delta_2 = 0$, interest rate surprise influence stock market volatility, and against the null hypothesis H_2: $\delta_1 = 0$, and H_3: $\delta_3 = 0$ significant estimates of δ_1 or δ_3 means the preannouncement effect or the delay effect occurs.

$$s_t = 1 + \delta_1 I_{t-1}^{BoE} + \delta_2 I_t^{BoE} + \delta_3 I_{t+1}^{BoE} \quad (3.15)$$

where

I_{t-1}^{BoE}: dummy variable set to one on the days immediately before the announcement dates;

I_{t+1}^{BoE}: dummy variable set to one on the days immediately after the announcement dates.

As discussed in previous sections, the official bank rate of the Bank of England's' decision changes dramatically after the Bank of England was granted independence in May 1997. The independence of the Bank of England directly affects not only the decision of monetary policy, but also the way that monetary policy is announced, even the meaning of the monetary policy to the stock market. Thus we expected stock prices to respond to the interest rate announcements differently before and after the independence of the Bank of England and test the hypothesis by replacing equation (3.14) with equation (3.16). Therefore, we will estimate the impact of unexpected interest rate announcements on stock market volatility before and after May 1997 against the null hypothesis H_1: $\delta_2 = 0$, interest rate surprises affect the volatility before 1997, and against the null hypothesis H_2: $\delta_1 = 0$, and H_3: $\delta_3 = 0$ significant estimates of δ_1 or δ_3 imply that the preannouncement effect or the delay effect occurs before 1997, also against the null hypothesis H_4: $\delta_5 = 0$, interest rate surprise influences the stock market volatility after 1997, and against the null hypothesis H_5: $\delta_4 = 0$, and H_6: $\delta_6 = 0$ significant estimates of δ_4 or δ_6 imply that the preannouncement effect or the delay effect occurs after 1997.

$$s_t = 1 + I_t^{pre97}(\delta_1 I_{t-1}^{BoE} + \delta_2 I_t^{BoE} + \delta_3 I_{t+1}^{BoE}) + I_t^{aft97}(\delta_4 I_{t-1}^{BoE} + \delta_5 I_t^{BoE} + \delta_6 I_{t+1}^{BoE}) \quad (3.16)$$

where

I_t^{pre97}: dummy variable set to one on the days before May 1997;

I_t^{aft97} : dummy variable set to one on the days after May 1997.

Many studies suggest that the macroeconomic news has an asymmetric effect on the volatility (see Nelson, 1991; Bomfim, 2003). In order to see whether the response to positive unexpected change in interest rate (bad news) is of the same absolute magnitude as the response to negative unexpected change in interest rate (good news), we replace the equation (3.8) and (3.14) with equation (3.17) and (3.18) to test the asymmetric effect against the hypothesis H_1: $\beta_+ = \beta_-$, which states that the coefficients for good and bad news are equal, and H_2: $\delta_1 = \delta_2$, which states that the response of stock market volatility to bad news is of the same absolute magnitude as the response to good news.

$$R_t = b_0 + b_1 \Delta i_t^{u-Pos} + b_2 \Delta i_t^{u-Neg} + b_3 R_{t-1} + \mu_t \tag{3.17}$$

$$s_t = 1 + \delta_1 I_t^{BoE} I_t^{Pos} + \delta_2 I_t^{BoE} I_t^{Neg} \tag{3.18}$$

where

I_t^{Pos}: dummy variable set to one if unexpected changes in interest rate are positive;

I_t^{Neg}: dummy variable set to one if unexpected changes in interest rate are negative.

3.4.2 Tests for the Effect of Changes in Money Supply on Stock Returns

Along with the Bank of England official bank rate, money supply is another important indicator for monetary policy, therefore, we also examine the effect of money supply announcements on stock returns in an event study framework following baseline equations (3.19) and (3.20) in a three-day event window. According to Pearce and Roley (1983), there might be two channels through which money supply affects the stock prices. One of them is inflation channel: changes in money supply will positively influence the agents' expectation of inflation, due to the negative relationship between inflation and stock returns in reality, so changes in money supply negatively affect stock prices. Another is interest rate channel: increased money supply will raise the investors' expectation of the reaction of the central bank which will accordingly increase the interest rate. Due to the negative impact of the interest rate on stock prices, money supply will adversely affect the stock prices. A negative effect of money supply on stock price is thus expected. We test for the response of stock returns to the money supply news against the null hypothesis: $\beta = 0$, money supply news affects the stock returns and negative estimates of β are associated with announcement of increase money supply being the bad news for stock returns. Significant estimates of β on the date before the announcement imply that leakage of information occurs before the news are officially released by the Bank of England and the significant estimate of β on the date after the announcement imply that the delay effect occurs.

$$R_{t+B} = \alpha + \beta \Delta M_t + \varepsilon_t \tag{3.19}$$

$$R_{\Delta 3t} = \alpha + \beta \Delta M_i + \varepsilon_t \tag{3.20}$$

where

ΔM_t: actual changes in the money supply;

R_{t+B} for B (-1, 0, 1): the stock returns on the day $t+B$, hence, R_{t-1}, the stock returns on $t-1$ (one day before the announcement date), R_t, the stock returns on t (the announcement date) and R_{t+1}, the stock returns on $t+1$ (one day after the announcement date);

$R_{\Delta 3t}$: three days stock returns (the stock returns of the announcement date t, the day before and the day after).

We also examine the response of stock returns to the expected and unexpected changes in money supply with equation (3.21) and (3.22). According to the efficient market hypothesis, only the unanticipated changes in money supply affect the stock returns while anticipated money supply has no discernible effect. Therefore, we test for a stock returns response to money supply news being consistent with the null hypothesis H_1: $\gamma = 0$, expected news have no effect on the stocks, and against the null hypothesis H_2: $\beta = 0$, negative estimates of β are associated with unexpected changes in money supply being the bad news for stocks. Significant estimates of γ or β on the date before or after the announcement imply that the preannouncement effect or the delay effect occurs.

$$R_t = a + \gamma \Delta M_t^e + \beta \Delta M_t^u + \varepsilon_t \tag{3.21}$$

$$R_{\Delta 3t} = \alpha + \gamma \Delta M_t^e + \beta \Delta M_t^u + \varepsilon_t \tag{3.22}$$

where

ΔM_t^e : expected change in money supply;

ΔM_t^u : unexpected change in money supply.

Similar to the previous section, whether the response is different from positive unexpected change in money supply than negative unexpected change in money supply is also investigated, following Adams et al. (2004). To test this directional asymmetric effects from good news to bad news we use equation (3.23) to test whether the response to positive unexpected change in money supply (bad news) is of the same absolute magnitude as the response to negative unexpected change in money supply (good news) against the null hypothesis: $\beta_+ = \beta_-$, which states that the coefficients for good news are equal to the ones for bad news. D_+ are dummy variables for bad news (positive unexpected change in money supply) while D_- are dummy variables for good news (negative unexpected change in money supply).

$$R_t = \alpha_+ D_+ + \alpha_- D_- + \beta_+ D_+ \Delta M_t^u + \beta_- D_- \Delta M_t^u + \varepsilon_t \tag{3.23}$$

where

$D_+=1$ if unexpected change in money supply (M4) is larger than zero, $\Delta i_t^u > 0$ and 0 otherwise;

D_{-} =1 if unexpected change in money supply (M4) is less than zero, Δi_t^u<=0 and 0 otherwise.

3.5 Empirical Results

This section empirically examines the response of the daily UK aggregate and ten industry sectors stock returns to the Bank of England's official bank rate and broad money supply M4 in the following order. First, the impact of interest rate announcements on the level of stock returns is investigated using the event study methodology. The pre-announcement effect, delay effect, asymmetric effect and the subsamples of before and after the independence of the Bank of England in May 1997 are also examined. Second, the impact of interest rate announcements on stock market volatility is estimated using the extended GRACH (1, 1) model. Both asymmetric effect and the effect of the independence of Bank of England are investigated. Finally, the response of stock returns to M4 announcements are estimated by the event study methodology associated with the efficient market hypothesis. The pre-announcement effect, delay effect and asymmetric effect are also examined.

3.5.1 The Effect of Changes in Interest Rate on Stock Returns

This section tests the hypothesis to find out whether the announcements of the Bank of England official bank rate affect the UK stock returns. Table 3.4 reports the results of estimating equations (3.3) and (3.4) testing the impact of the general change in the Bank of England official bank rate on FTSE All Share Index (FTA) and ten industry sectors. For the full sample period, the estimates of the coefficients β for the changes in interest rates for the aggregate market shows a significantly negative figure, -0.45, which means on the announcement days, the FTA falls by 0.45% in response to an increase in interest rate of 1%. Other coefficients for the day before, after and the three-days accumulated around the announcement day are all significantly negative, respectively, -0.17, -0.18 and -0.80. This indicates that interest rate announcements negatively affect the aggregate market before, on and after the announcement day.

Table 3.4 also shows that for the full sample period, seven out of 10 industries show that coefficients on the announcement day are significantly lower than zero and vary from a low of -0.91 for Utilities to a high of -0.37 for Industrials, while the coefficients for the rest three are insignificant. However, only one industry, Oil and gases, exhibits statistically significant response to the general change in interest rate before the announcement day. Moreover, no industry presents significant response after the announcement day. The results for industries also suggest that announcements of changes in interest rate negatively affect the stock returns, which is consistent with the aggregate market.

The efficient market hypothesis predicts that only the unexpected component of the news will affect the stock price while the expected component will not affect it since the expected component of the news has been captured by the stock prices. Thus, in our case, only unexpected changes in interest rate which contain new information will be associated with the changes in the stock returns when the announcement is released while expected changes in interest rate will not. Table 3.5 reports the estimation results of equation (3.5) and (3.6) which test the impact of expected and unexpected changes in interest rate on stock returns. For the full sample period, Table 3.5 Panel A shows that the unexpected changes in interest rate significantly and negatively affect the FTA the announcement day at -1.27 and before the announcement day at -0.58, while the expected changes in interest rate have no effect prior to and on the announcement day but show significant effect after the announcement day. It also shows that for the full sample period, four out of ten industries named Basic materials, Consumer goods, Telecoms and Utilities respond significantly and negatively to the unexpected change in interest rate on the announcement day while only one response is significantly lower than zero before or after the day of the announcement.

Results reported in Table 3.4 and Table 3.5 Panel A suggest that the Bank of England interest rate announcements negatively affect the UK stock returns and the unexpected changes in interest rate contribute to this negative effect while the expected changes in interest rate have little effect, once again in keeping with efficient market hypothesis. The significantly negative effect found for the UK interest rate announcements is consistent with that expected. We expect to see increasing interest rates as a result of tightening monetary policy which ultimately leads to a reduction in stock prices and conversely, reducing interest rates would be expected as a consequence of loosening monetary policy leading to an increase in stock prices. This finding is also consistent with a number of previous studies that present evidence of the negative effect of interest rate announcements on stock returns, for example, Thorbecke and Alami (1994), Thorbecke (1997), Ehrmann and Fratzscher (2004), Bernanke and Kuttner (2005) Chulia-Soler et al. (2007) for the US market and Serwa (2006) for the Polish market. Compared with the studies for the UK market, our finding is also consistent with Berdin et al. (2007) which suggest that the Bank of England official bank rate negatively affects the returns of the UK aggregate stock market and most industries, but partly consistent with Gregoriou et al. (2006) which provides evidence of both the expected and unexpected Bank of England official bank rate announcements.

Moreover, results reported in Table 3.4 and 3.5 show that pre-announcement effect occurs while delay effect does not. Our finding for the pre-announcement effect is consistent with some studies which report the preannouncement effect, for example, Jensen and Johson (1993) in which the preannouncement effect of discount rate change on the US stock prices is found to occur, but inconsistent with Bredin et al (2005) find no evidence of the preannouncement effect. Our finding is also consistent with most studies that show no delay effect on the response of stock returns to monetary policy, for example, Jensen and Johson (1993) and Pearce and Roley (1985) report no delay effect of the M1 and Fed reserve discount rate announcements on the US stock market and Goodhart and Smith (1985) and MacDonald and Torrance (1987) find no evidence of delay effect on the response of the stock prices to the money supply news on the UK market.

Since the Bank of England became independent in May 1997, we estimate the impact of interest rates over two different sub-samples: pre-May 1997 and after-May 1997. Table 3.4 reports that general changes in interest rates significantly and negatively affect the FTA on the day of announcement and after the day of the announcement for the sample period of pre-May 1997 while this news effect only occurs before the day of the announcement for the sample period of after-May 1997. Table 3.5 Panel B and Panel C also show that the response of FTA to the unexpected change in interest rate is significantly negative prior to and on the day of the announcement for the pre-May 1997 sample period while it is only significantly negative before the day of the announcement for the after-May 1997 sample period. Stock returns decline by 1.27% for 1% unexpected increase in interest rate on the announcement days before May 1997, but decrease by 7.26% before the day of announcements after May 1997. Consistent with the aggregate market, five industries significantly respond to the unexpected change in interest rate on the day of the announcement for the pre-1997 sample period while little evidence of the response of industries before or after the day of the announcement is found. However, six out of ten industries show significant response before the announcement day while no industry show significant response on the day or after the day of the announcement for the after-May1997 sample period.

As discussed in previous sections, before May 1997, the chancellor of exchequer and the governor of the Bank of England jointly decided the UK monetary policy and only generally indicated the decision of monetary policy to the markets by changing the rate at which it conducted its daily money market operations. After May 1997 when the Bank of England became independent, the Bank of England Monetary Policy Committee (MPC) has had regular meetings to independently decide the monetary policy needed to meet the inflation target. The regular meeting date is set in advance and published on the website of the Bank of England and the official bank rates are set by the MPC and regularly announced to the public in a timely manner according to a set schedule. Therefore, we expected before May 1997, the market participants might have found it hard to anticipate the monetary policy, which would have led to a lower efficiency in the response of stock returns to the changes in monetary policy before May 1997 while after May 1997 the market participants found it easier to anticipate the changes in monetary policy, as a result, the stock prices could respond to the changes in monetary policy in advance or more efficiently. Results in Table 3.4 and 3.5 suggest that the responses of stock returns to unexpected changes in interest rate are different before or after the Bank got independent, therefore, consistent with that expected. Before May 1997, the unexpected change in interest rate affects the stock returns prior to and on the announcement day, however, after May 1997 it only affects the stock returns before the announcement day. Our finding suggests that before May 1997, a lower efficiency of the response of stock returns to the changes in monetary policy occurred since monetary policy was unpredictable before May 1997 while after May 1997 the market participants could capture the decision of an MPC meeting one day before the news release and fully respond to the information, which is consistent with the efficient market hypothesis.

The idea that the response of the UK stock returns to the interest rate announcements differs for positive unexpected change in interest rate (tightening monetary policy) from what it is for negative unexpected change in interest rate (loosening monetary policy) is tested in this section. Table 3.6 reports the results of the asymmetric impact of unexpected increase or decrease in interest rate on stock returns on the announcement day for the full sample period as given by equation (3.7). In the last row of the table, the aggregate market and four out of ten industries (basic industries, Consumer goods, Telecoms and Financials) can reject the null hypothesis: $\beta_+ = \beta_-$, therefore, the coefficients for good and bad news are equal could be rejected. The response coefficients for aggregate market to bad news (unexpected positive change in interest rate) and to good news (unexpected negative change in interest rate) are all significantly lower than zero. And the magnitudes of response are slightly different: aggregate stock returns decline by 1.29% for 1% unexpected increase in interest rate but increase by 2.16% for 1% unexpected decrease in interest rate. Similarly, the responses coefficients of ten industries to the bad news with seven out of ten significant responses varying from -3.86 to -2.00 are different from the responses to the good news with only one significant response.

Our finding suggests that there is a weak asymmetric effect of stock return responses to unexpected change in interest rate. Stock returns response to the unexpected decrease of interest rate (loosening monetary policy) are slightly more than the response to the unexpected increase in interest rate (tightening monetary policy). Our findings are consistent with the studies report loosening monetary policy affects the stock market more. For example, Jensen and Johnson (1995) which shows that the US stock market has greater response in periods following good news than in periods following bad news and Madura (2000) who shows that good news negatively affects the bank stock prices while bad news has a weak negative effect, but inconsistent with studies that show the evidence of bad news, for example, Hefer (1986) who presents that only positive unexpected changes in money supply (bad news) have a significant effect on the stock prices while the negative unexpected changes in money supply (good news) have no significant effect.

3.5.2 The Effect of Changes in Interest Rate on Stock Market Volatility

The effect of unexpected changes in monetary policy on stock market volatility is as important as the impact of unexpected changes in monetary policy on the level of stock returns, since the monetary announcements might also affect the stock returns level and volatility. Therefore the announcement effect of unexpected changes in interest rate on stock market volatility is examined in the extended GRACH (1, 1) model.

The effect of unexpected changes in interest rate on stock market volatility on the announcement day is tested by equations from (3.8) to (3.14). Table 3.7 reports that in the mean equation the estimate of the coefficients β_I for the aggregate market is significantly negative. The FTA falls by 1.38% in response to the unexpected increase in interest rate of 1%. In the variance equation, we use the dummy variable I_t^{BoE} to test whether days on announcements affect the stock market volatility. Coefficients δ_I for the aggregate market is significant, thus, it suggests that unexpected changes in interest rate announcements affect the aggregate stock market volatility. Table 3.7 also reports that response coefficients of the ten industries to the unexpected changes in interest rate in the mean equation are all significantly negative, varying from -1.35 for Telecoms to -0.61 for Oil and gases. Moreover, five out of the ten industries: Basic materials, Industrials, Consumer goods, Financials and Utilities exhibit statistically significant coefficients δ_I, suggesting that unexpected changes in interest rate announcements affect the stock market volatility of industry sectors on the day of the announcement, which is once again consistent with the aggregate market.

Thus results in Table 3.7 show that the Bank of England interest rate announcements negatively affect the UK stock market volatility, consistent with what's expected. We expected to see that increasing interest rates would be bad news for the stock market while reducing interest rate would be good news for it. Our finding is also consistent with large number of previous studies that provide evidence of the response of stock market volatility to monetary policy, for example, Lobo (2000), Flannery and Protopapadakis (2002), Bomfim (2003), Guo (2004) and Chulia-Soler et al. (2007) for the US market, Chang (2008) for the Taiwan market, Bredin et al. (2005) for Irish market and Wongswan (2006) for the Korean market, but inconsistent with Rangel (2006) who finds no evidence of the impact of the US Fed funds rate target announcement impact on the conditional volatility of the US stock market.

The preannouncement effect or delay effect of the impact of unexpected changes in interest rate on stock market volatility are also examined by multiplicative dummies for volatility on the day, before and after the announcement using equations (3.8) to (3.13) and equation (3.15). Table 3.8, in the last row of the table, reports that, the aggregate market and eight out of 10 industries can reject the null hypothesis: $\delta_1=\delta_2=\delta_3=0$. In the mean equation The FTA falls by 1.24% in response to the unexpected increase in interest rate of 1%. In the variance equation, two coefficients δ_2 and δ_3 for the aggregate market are significant, which suggest that unexpected changes in interest rate announcements affect the aggregate stock market volatility on and after the day of announcement. Similarly, response coefficients of all ten industries to the unexpected changes in interest rate in the mean equation are all significantly negative, varying from a low of -1.32 for Basic materials to a high of -0.65 for Oil and gases. In the variance equation, three out of ten industries: Basic materials, Industrials, Consumer goods, exhibit statistically significant coefficients δ_2. Also with three exceptions: Healthcare, Telecoms and Financials, the ten industries exhibit statistically significant coefficients δ_3. This suggests that unexpected changes in interest rate announcements affect the stock market volatility of the industry sector on and after the day of announcement, which is consistent with the aggregate market.

Therefore, results in Table 3.8 provide evidence of the delay effect, but no evidence of the pre-announcement effect. Our finding for the pre-announcement effect is consistent with studies which report no pre-announcement effect, for example, Bredin et al. (2005) show no preannouncement effect on stock market volatility, but inconsistent with Bomfim (2003) who shows that a pre-announcement effect is presents for the sample period after-1994. Moreover, our finding is inconsistent with most studies that show no delay effect on the response of stock market volatility to monetary policy, for example, Bomfim (2003) and Bredin et al (2005).

As discussed in previous sections, the granting of independence to the Bank of England in May 1997 has important meaning for the decision of monetary policy and the stock market. We therefore test the impact of unexpected change in interest rate announcement on stock market volatility before and after the independence of the

Bank of England. We assume that the market participants might find it hard to anticipate the monetary policy, which might lead to a lower efficiency of response of stock market volatility before May 1997 while after May 1997 market participants may find it easier to anticipate the changes in monetary policy, as a result, the stock prices may respond to the changes in monetary policy in advance or more efficiently. Table 3.9 reports the results of estimating equations (3.8) to (3.13) and equation (3.17). It shows that the aggregate market and the ten industries can reject the null hypothesis H_7: $\delta_1=\delta_2=\delta_3=0$ and eight industries can reject the null hypothesis H_8: $\delta_4=\delta_5=\delta_6=0$. In the mean equation, the coefficient for the aggregate market is significantly negative. In the variance equation, before May 1997 the unexpected changes in interest rate significantly affect the aggregate stock market volatility on the announcement day, while after May 1997 the expected changes in interest rate have no effect on the days prior to, on the day and after the announcement day. Similarly, in the variance equation, before May 1997 the unexpected changes in interest rate significantly affect the stock market volatility of four industries: Basic materials, Consumer goods, technologies and Utilities, on the announcement day. Although all industries with two exceptions: Consumer goods and Healthcare, show significant coefficients on the day after the announcement day, the aggregate market does not reflect the effect. After May 1997, four industries show significant coefficients on the day of announcement on the opposite directions and five industries show significant coefficients on the day after the announcement day. However, after 1997 these effects do not show up in the aggregate market.

Therefore, we find that unexpected changes in interest rate announcement differ in their effect on the stock market volatility before and after the Bank of England became independent: before the Bank of England became independent, the stock market volatility could not fully anticipate the changes in interest rate and reflected the unexpected changes in interest rate on the day of the announcement while after the Bank was made independent the market participants could fully anticipate the changes in interest rate and stock prices could reflect this information in advance. Our findings are consistent with what was expected and with evidence from US, e.g. Bomfim (2003) who shows that the US Fed monetary decisions change in 1994 affected the impact of monetary policy on the US stock market volatility.

The asymmetric impact of unexpected increase or decrease interest rate on stock market volatility on the announcement day is examined in this section. Table 3.10 reports the results of estimating equations (3.9) to (3.13), and equations (3.17) and (3.18). The aggregate market and 10 industries can all reject the null hypothesis H_1: $\beta_+ = \beta_-$ and H_2: $\delta_1 = \delta_2$, which means that the response to positive unexpected changes in interest rate (bad news) is different from the response to negative unexpected changes in interest rate (good news) in the mean and variance equations. In the mean equation, the FTA falls by 1.41% in response to the unexpected increase in interest rate of 1% but increase by 1.36% to the unexpected decrease in interest rate of 1%. In the variance equation, coefficient δ_1 for the aggregate market is significant but coefficient δ_2 is insignificant, which suggests that only unexpected increase in interest rate announcements affect the aggregate stock market volatility. Similar to the aggregate market, in the mean equations, seven industries have larger coefficients for the unexpected increase in interest rate than the unexpected decrease in interest rate. In the variance equation, the unexpected increase in interest rate significantly affects the stock market volatility of seven industries: Oil and gases, Basic materials, Industrials, Consumer goods, Financials, Information technologies and Utilities, while the unexpected decrease in interest rate significantly affects the stock market volatility of four industries.

Therefore, results in Table 3.10 suggest that an asymmetric stock market volatility responses to unexpected interest rate occurs and stock market volatility respond to the unexpected increase in interest rate (tightening monetary policy) more than the unexpected decrease in interest rate (loosening monetary policy) on the announcement day. Our findings are consistent with studies that report that bad news affects the stock market volatility more than good news, for example, Bomfim (2003), Bredin et al.

(2005), Rangel (2006) and Chulia-Soler et al. (2007).

3.5.3 The Effect of Changes in Money Supply on Stock Returns

In this section, the impact of money supply on stock returns is investigated to determine whether or not the announcements of the Bank of England's' broad money supply (M4) affects the UK stock returns. Table 3.11 reports the results of estimating equations (3.19) and (3.20) for the impact of general changes in money supply on stock returns. The estimates of the coefficients β for the changes in money supply for the aggregate market shows that on the announcement days, the FTA falls by 0.47% in response to an increase in money supply of 1%. Other coefficients before the announcement day are significantly positive, and coefficients after and within three-days after the announcement day are insignificant. The results suggest that money supply announcements adversely affect the aggregate stock market on the announcement day. And changes in money supply positively affect the aggregate stock market before the announcement day. Five out of ten industries (Industrials, Consumer goods, Consumer services, Telecoms and Financials) show that response coefficients for money supply on the announcement day varying from a low of -0.75 for Telecoms to a high of -0.38 for Consumer services are significantly while the coefficients for the rest of the five companies are insignificant. Four industries: Basic materials, consumer service, Telecoms and Information technologies, present significantly positive response to the money supply before the announcement day. Four industries: Oil and gases, Basic materials, Industrials and Utilities, show significantly negative response after the announcement day. The results for industries also suggest that money supply announcements negatively affect the stock returns of industry sectors on the day of announcement, which is consistent with the aggregate market. Also, changes in money supply positively affect the stock returns before the day of the announcement but negatively affect it after the day of the announcement.

According to the efficient market hypothesis, only unexpected changes in money supply which contain new information will be associated with changes in the stock returns when the announcement is released while expected change in money supply will not, thus, we also test the impact of expected and unexpected changes in money supply on stock returns by equations (21) and (22). Table 3.12 shows that stock returns of FTA decline by 0.86% for 1% unexpected increase in money supply on the announcement days while response coefficients of aggregate stock returns to unexpected changes in money supply before or after the day of announcement are insignificant, which means that the unexpected changes in money supply only significantly and negatively affect the FTA on the announcement day. Moreover, if the changes in money supply are divided into expected and unexpected component, the expected changes in money supply have no impact on the aggregate stock returns. Similarly, six out of ten industries, Oil and gases, Industrials, Consumer goods, Consumer services, Telecoms and Financials, respond significantly and negatively to the unexpected changes in money supply on the announcement day. Only two industries have significantly positive coefficients before the day of the announcement and only one has significantly negative coefficient after the day of the announcement, while the rest of the coefficients are insignificant. No industry has a significant coefficient for the expected change in money supply on the day of announcement and only a few industries have significant coefficients before or after the day of the announcement. Consistent with the aggregate market, unexpected changes in money supply negatively affect the stock returns of industry sectors while expected changes in money supply have little effect on the stock returns.

Results in Table 3.11 and 3.12 suggest that the money supply announcements negatively affect the UK stock returns and the unexpected changes in money supply have significant effect while the expected changes in money have very little effect, consistent with efficient market hypothesis. The negative impact found for monetary supply announcement is consistent with what is expected. Our findings are consistent with most literature which presents evidence of the impact of money supply announcements on stock returns, for example, Berkman (1978), Lynge (1981), Cornell (1983), Pearce and Roley (1983), Tarhan (1987), Jain (1988) and McQueen and Roley (1993) for the US market, but are inconsistent with Goodhart and Smith (1985) and MacDonald and Torrance (1987) who investigate the impact of money supply (£M3) on the UK stock market and find no conclusive evidence of announcement effect of money supply on the UK stock market.

Moreover, although evidence of pre-announcement effect or delay effect has been confirmed in some studies, we find that neither pre-announcement effect nor delay effect occurs. Our finding for the pre-announcement effect of the money supply on the stock returns is consistent with Bredin et al (2005) which show no pre-announcement effect, but inconsistent with Jensen and Johson (1993) which find the pre-announcement effect. Moreover, our finding is consistent with Jensen and Johson (1993) and Pearce Roley (1985) who show no delay effect on the response of stock returns to monetary policy in the US market, also consistent with Goodhart and Smith (1985) and MacDonald and Torrance (1987) who find no evidence of delay effect on the response of the stock prices to the money supply news (£M3) on the UK market.

The asymmetric impact of unexpected increase or decrease in money supply on stock returns on the announcement day is also examined in this section. Table 3.13 report the results of estimating equation (23). Although neither the aggregate market nor the ten industries can reject the null hypothesis H_1: $\beta_+ = \beta_-$ at lower than 10% significant level, the response coefficients for the aggregate market and three industries (Oil and gases, Consumer goods and Telecoms) to unexpected increase in money supply are significantly negative, for example, stock returns of FTA decline by 1.31% for 1% unexpected increase in money supply on the announcement days, while none of them respond significantly to the unexpected reduction of money supply.. Therefore, we find that there is little evidence of asymmetric stock returns responses to unexpected money supply and stock returns response to the unexpected increase in money supply are equal to the response to the unexpected reduction of money supply. Our finding is inconsistent with Hefer (1986) Jensen and Johnson (1995) and Madura (2000) who report the asymmetric effect.

In conclusion, the results of event studies suggest that stock returns significantly and negatively respond to announcements of both changes in interest rate and changes in money supply around the announcement day. The unexpected changes in monetary policy contribute to this negative effect while the expected change in the policy has little impact. The responses of stock returns to unexpected changes in interest rate are different for the periods before and after the independence of the Bank of England. Furthermore, the results of the event studies show mixed findings for the pre-announcement effect, the delay effect and asymmetric effect.

In addition, the results of GARCH models suggest that unexpected changes in interest rate also affect the stock market volatility. The responses of stock market volatility to unexpected changes in interest rate are different before or after the independence of the Bank of England. A delay effect exists in the response of stock market volatility to unexpected changes in interest rate. Evidence of asymmetric effect is found: the unexpected increase in interest rate (tightening monetary policy) affects the stock market volatility more than the unexpected decrease of interest rate (loosening monetary policy).

3.6 Summary

Financial markets have long considered whether the central banks' monetary policies affect stock returns. Many studies in the area using the event-study methods investigate the announcement impact of monetary policy and focus on the effects of monetary policy announcement on either the level of stock returns or the volatility of stock returns. This chapter aims to find out whether the monetary policy affects the stock returns and stock market volatility. Since interest rate and money supply are both important indicators for monetary policy, this chapter investigates the impact of announcements of both interest rate and broad money supply on the UK stock returns and the impact of announcement of interest rate on the stock market volatility. Moreover, because the dependence of the Bank of England affects not only the decision of monetary policy, but also the way that monetary policy is announced, and even the meaning of the monetary policy to the stock market. This chapter also compares the announcement effect of monetary policy on the stock returns before and after the independence of Bank of England in May 1997.

The results presented in this chapter are consistent with most former studies and confirm that the monetary policy announcements negatively affect the UK stock returns and stock market volatility. Stock returns significantly and negatively respond to announcements of both changes in interest rate and changes in money supply. The unexpected changes in monetary policy contribute to this negative effect while the expected change in the policy has little impact. Unexpected changes in interest rate also affect the stock market volatility, consistent with most of the literature which presents evidence of the effect of monetary policy announcements. Our findings imply that the announcements of tightening monetary policy will be the bad news for the stock, but the announcements of loosening monetary policy will on the contrary be the good news.

Furthermore, the responses of stock returns or stock market volatility to unexpected changes in interest rate are different before or after the independence of the Bank of England. Pre-May 1997, the unexpected changes in interest rate affect the stock returns on the announcement day and before the announcement day, however, after-May 1997, stock returns are mainly affected before the announcement day. Similarly, pre-May 1997, the unexpected changes in interest rate affect the stock market volatility on the day of the announcement, however, after-May 1997, it has little impact on the stock market volatility. It suggests that before the Bank of England became independent, the stock market participants could not fully anticipate the changes in interest rate thus the stock prices reflected the unexpected changes in interest rate around the days of the announcement while after the Bank became independent the market participants could fully anticipate the changes in interest rate thus stock prices reflected this information in advance. Our findings are consistent with the efficient market hypothesis.

The results in this chapter show mixed findings for the pre-announcement effect and the delay effect. We find that a pre-announcement effect occurs in the response of stock returns to unexpected changes in interest rate and a delay effect exists in the response of stock market volatility to unexpected changes in interest rate, however, no pre-announcement effect or delay effect occurs in the response of stock returns to unexpected changes in money supply. It suggests that a leakage of information occurs before the interest rate released by the Bank of England on the official announcement date and stock market volatility response to interest rate announcements is slow.

Mixed empirical results are found for the asymmetric effect in this chapter. A weak asymmetric effect of stock return responses to unexpected changes in interest rate were found suggesting that the response to the unexpected decrease of interest rate (loosening monetary policy) are slightly more significant than the response to the unexpected increase in interest rate (tightening monetary policy). However, we also find that the unexpected increase in interest rate (tightening monetary policy) affects the stock market volatility more than the unexpected decrease of interest rate (loosening monetary policy). Moreover, we find no symmetric effect occurs in the response of stock returns to money supply announcements. Therefore, our findings suggest that the asymmetric effect could be either nonexistent or pointing to different directions.

In conclusion, the implications in this chapter confirm the hypothesis that monetary policy is an important determinant of stock prices. We have found that monetary policy negatively affects stock returns and stock market volatility and changes in the decision makers (e.g. the dependence of the Bank of England and introduced Monetary Policy Committee (MPC)) influence the response of stock market to the monetary policy. We have also found that the unexpected changes in monetary policy affect the stock returns, while the expected changes have little effect, which is consistent with the efficient market hypothesis.

Table 3. 1 Unbiasedness Test

$P_t = a + \beta P_t^e + \varepsilon_t$

α	0.00074 (0.000699)[0.2922]
β	0.9166*** (0.086272)[0.000]
R^2	0.5456
Durbin-Watson Test	2.41
F-test: (α, β)=(0,1)	0.5618 [0.5720]
Breusch-Godfrey LM(12)	1.34[0.2091]

Notes: Standard-errors are shown in parentheses and p-values are shown in square brackets.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 2 Test of the Weak Form Efficiency

$P_t - P_t^e = a + \beta_1 P_{t-1} + \ldots + \beta_{12} P_{t-12} + e_t$

α	0.00153 (0.00140)[0.2778]
β_1	-0.13190 (0.08968)[0.1458]
β_2	0.04378 (0.09181)[0.6349]
β_3	-0.05296 (0.09407)[0.5752]
β_4	-0.02695 (0.09165)[0.7696]
β_5	0.05265 (0.09075)[0.5636]
β_6	-0.10189 (0.09083)[0.2657]
β_7	0.00270 (0.09170)[0.9766]
β_8	0.09555 (0.09860)[0.3358]
β_9	-0.05403 (0.0983)[0.5844]
β_{10}	0.05936 (0.09711)[0.5429]
β_{11}	-0.10904 (0.09513)[0.2555]
β_{12}	0.03867 (0.0932)[0.6797]
R^2	0.1346
Durbin-Watson Test	2.12
Breusch-Godfrey LM(12)	0.2108[0.9973]
F-test:(β_i)=(0)	0.9209 [0.5311]

Notes: Standard-errors are shown in parentheses and p-values are shown in square brackets.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 3: Summary Statistics for the Announcement of Monetary Policy

Panel A: Bank of England Official Bank Rate

	Actual changes in interest rate	Expected changes in interest rate	Unexpected changes in interest rate
mean	-0.0001	-0.0002	0.0001
median	0.0000	0.0000	0.0000
Max	0.0300	0.0266	0.0191
Min	-0.0200	-0.0244	-0.0125
S-d	0.0067	0.0054	0.0027
Skew	1.6316	0.9633	2.4049
J-B	468.1877	407.4098	3622.2720
obs	270	270	270

Note: Max, Min, S-d, Skew, J-B and obs refer to Maximum, Minimum, Standard Deviation, Skewness, Jarque-Bera test and observations, respectively.
Test The sample period of the Bank of England official bank rate is from 3rd Jan. 1978 to 31st Dec. 2007.

Panel B: Broad Money Supply (M4)

	Actual changes in money supply	Expected changes in money supply	Unexpected changes in money supply
mean	0.0074	0.0073	0.0001
median	0.0070	0.0060	0.0000
Max	0.0220	0.0180	0.0160
Min	-0.0040	-0.0040	-0.0080
S-d	0.0045	0.0036	0.0030
Skew	0.2362	0.6378	1.0690
J-B	2.2346	13.8933	232.1707
obs	96	96	96

Note: Max, Min, S-d, Skew, J-B and obs refer to Maximum, Minimum, Standard Deviation, Skewness, Jarque-Bera test and observations, respectively.
The sample period of the Bank of England broad money supply is from 1st Jan. 2000 to 31st Dec. 2007.

Panel C: Stock Indices on and around the Announcement Date of the Bank of England Official Bank Rate

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}											
mean	-0.0002	-0.0013	-0.0006	-0.0011	-0.0009	-0.0002	-0.0011	-0.0016	-0.0006	-0.0010	-0.0013
median	0.0000	-0.0012	-0.0003	0.0004	-0.0002	0.0000	-0.0007	-0.0007	-0.0005	0.0000	-0.0013
Max	0.0298	0.0632	0.0507	0.0298	0.0504	0.0310	0.0389	0.0569	0.0490	0.0699	0.0311
Min	-0.0551	-0.0515	-0.0656	-0.0704	-0.0837	-0.0570	-0.0506	-0.0647	-0.0423	-0.0648	-0.0475
S-d	0.0098	0.0149	0.0130	0.0125	0.0146	0.0116	0.0108	0.0170	0.0123	0.0189	0.0106
Skew	-0.6599	0.0570	-0.4481	-1.7769	-1.3382	-0.9135	-0.5975	-0.1525	0.2709	0.1916	-0.4317
J-B	226.00	57.17	178.52	665.85	486.29	129.65	139.63	21.45	96.67	40.10	53.92
R_t											
mean	-0.0006	0.0007	0.0001	-0.0012	-0.0009	-0.0014	-0.0005	0.0004	-0.0010	-0.0019	0.0000
median	-0.0004	0.0010	0.0012	0.0001	0.0009	-0.0006	-0.0003	-0.0011	0.0001	-0.0001	-0.0004
Max	0.0312	0.0382	0.0854	0.0353	0.0375	0.0288	0.0486	0.0488	0.0476	0.0918	0.0460
Min	-0.0430	-0.0539	-0.0616	-0.0903	-0.0741	-0.0442	-0.0396	-0.0562	-0.0511	-0.1758	-0.0415
S-d	0.0104	0.0142	0.0153	0.0137	0.0146	0.0115	0.0116	0.0168	0.0132	0.0260	0.0115
Skew	-0.4727	-0.3268	0.6172	-1.6736	-1.0107	-0.5177	0.2900	0.2767	-0.2236	-1.4583	0.1394
J-B	32.48	8.911	348.53	750.14	142.46	16.72	65.27	7.686	45.597	1230.93	71.92
R_{t+1}											
mean	0.0008	0.0018	0.0001	-0.0004	-0.0007	0.0007	0.0006	0.0014	0.0002	0.0006	0.0008
median	0.0011	0.0014	0.0003	0.0003	0.0000	0.0002	0.0008	0.0003	0.0014	0.0008	0.0004
Max	0.0421	0.0481	0.0395	0.0475	0.0536	0.0360	0.0401	0.0576	0.0566	0.0689	0.0335
Min	-0.0743	-0.0762	-0.0944	-0.0847	-0.1117	-0.0701	-0.0742	-0.0370	-0.0768	-0.0824	-0.0374
S-d	0.0108	0.0148	0.0135	0.0135	0.0151	0.0115	0.0114	0.0147	0.0139	0.0190	0.0096
Skew	-1.1130	-0.5043	-1.7388	-1.9812	-1.9209	-1.0859	-1.2098	0.4581	-0.9144	-0.1845	-0.2136
J-B	903.74	143.58	1273.61	1142.94	1985.36	425.10	778.54	31.35	326.04	93.61	26.73
$R_{\Delta 3t}$											
mean	0.0000	0.0012	-0.0004	-0.0027	-0.0025	-0.0009	-0.0010	0.0002	-0.0014	-0.0023	-0.0004
median	0.0015	0.0028	0.0006	-0.0014	-0.0011	0.0012	0.0004	-0.0025	0.0021	0.0011	0.0000
Max	0.0500	0.0602	0.0763	0.0653	0.0759	0.0532	0.0632	0.0947	0.0804	0.1754	0.0849
Min	-0.1539	-0.1271	-0.2093	-0.1802	-0.2315	-0.1550	-0.1519	-0.0956	-0.1539	-0.2802	-0.0573
S-d	0.0198	0.0248	0.0272	0.0265	0.0290	0.0219	0.0229	0.0307	0.0256	0.0436	0.0189
Skew	-1.8425	-0.7822	-2.4009	-2.3709	-2.8117	-2.0466	-1.5410	0.1366	-1.2240	-1.1378	0.2941
J-B	2041.55	103.73	2685.33	1469.13	3616.38	1296.05	861.93	12.10	414.44	795.44	78.77
Obs	270	183	183	183	183	183	183	183	183	183	177

Notes: FTA is the first difference of logs of FTSE All Share Index, OI is the first difference of logs of Oil and gases index, BM is the first difference of logs of Basic materials index, ID is the first difference of logs of Industrials index, CG is the first difference of logs of Consumer goods index, HI is the first difference of logs of Healthcare index, CS is the first difference of logs of Consumer services index, TM is the first difference of logs of Telecoms index, FN is the first difference of logs of Financials index, IT is the first difference of logs of Information technologies index and UT is the first difference of logs of Utilities index. The sample period of FTA is from 3rd Jan. 1978 to 31st Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from 1st Jan. 1986 to 31st Dec. 2007, UT is from 9th Dec. 1986 to 31st Dec. 2007.

Max, Min, S-d, Skew, J-B and obs refer to Maximum, Minimum, Standard Deviation, Skewness, Jarque-Bera test and observations, respectively.

Panel D: Stock Indices on and around the Announcement Date of M4

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}											
Mean	0.0007	0.0010	0.0026	-0.0007	0.0016	0.0007	0.0004	-0.0004	0.0006	-0.0001	0.0017
median	0.0012	-0.0002	0.0013	0.0008	0.0002	0.0008	0.0006	-0.0026	0.0000	0.0001	0.0012
Max	0.0361	0.0384	0.0605	0.0266	0.0517	0.0282	0.0267	0.0530	0.0526	0.0687	0.0380
Min	-0.0378	-0.0432	-0.0621	-0.0700	-0.0377	-0.0264	-0.0309	-0.0326	-0.0502	-0.0541	-0.0271
S-d	0.0110	0.0146	0.0156	0.0138	0.0141	0.0104	0.0096	0.0157	0.0146	0.0207	0.0099
Skew	0.0743	-0.2534	-0.1856	-1.7400	0.6636	-0.1385	-0.3033	0.6972	0.3303	0.5100	0.4151
J-B	27.39	4.5065	75.24	215.59	20.68	1.1957	14.74	12.02	47.41	18.38	20.95
R_t											
Mean	-0.0016	-0.0014	0.0001	-0.0022	-0.0015	-0.0014	-0.0011	-0.0026	-0.0020	-0.0056	-0.0014
median	0.0006	0.0007	0.0004	-0.0007	-0.0012	-0.0011	-0.0002	-0.0018	-0.0005	-0.0015	-0.0010
Max	0.0236	0.0273	0.0316	0.0158	0.0271	0.0200	0.0255	0.0360	0.0269	0.0508	0.0156
Min	-0.0542	-0.0608	-0.0891	-0.0563	-0.0511	-0.0481	-0.0395	-0.0726	-0.0600	-0.1212	-0.0465
S-d	0.0104	0.0142	0.0139	0.0117	0.0128	0.0107	0.0101	0.0164	0.0125	0.0257	0.0091
Skew	-1.7787	-1.3952	-2.7342	-2.1704	-1.3443	-1.2517	-0.6777	-1.1111	-1.5782	-1.3019	-1.5436
J-B	236.37	74.50	1309.26	287.82	92.58	72.42	35.13	73.60	196.47	91.61	160.01
R_{t+1}											
Mean	-0.0008	-0.0003	-0.0006	0.0000	-0.0020	-0.0008	-0.0004	-0.0022	-0.0007	-0.0035	0.0012
median	0.0002	0.0009	0.0000	-0.0004	-0.0014	-0.0005	-0.0004	-0.0011	0.0001	-0.0020	0.0008
Max	0.0289	0.0331	0.0326	0.0383	0.0220	0.0355	0.0459	0.0363	0.0535	0.0575	0.0331
Min	-0.0425	-0.0536	-0.0536	-0.0385	-0.0881	-0.0614	-0.0312	-0.0492	-0.0376	-0.0617	-0.0344
S-d	0.0105	0.0136	0.0137	0.0120	0.0146	0.0128	0.0109	0.0160	0.0129	0.0201	0.0101
Skew	-0.6614	-0.9304	-1.0175	-0.4171	-2.5294	-1.0980	0.5226	-0.2561	0.1979	0.0302	-0.2844
J-B	37.37	36.78	61.82	22.42	661.09	116.02	42.209	2.2288	53.15	6.7563	35.290
$R_{\Delta 3t}$											
Mean	-0.0017	-0.0008	0.0021	-0.0029	-0.0020	-0.0014	-0.0010	-0.0051	-0.0021	-0.0092	0.0015
median	-0.0002	0.0013	0.0023	0.0013	-0.0011	0.0000	0.0007	-0.0035	-0.0009	-0.0027	0.0032
Max	0.0339	0.0418	0.0773	0.0410	0.0469	0.0411	0.0307	0.0681	0.0419	0.1575	0.0714
Min	-0.0905	-0.1228	-0.0997	-0.1612	-0.1665	-0.0645	-0.0634	-0.0945	-0.1331	-0.1735	-0.0541
S-d	0.0167	0.0254	0.0250	0.0252	0.0268	0.0184	0.0177	0.0261	0.0219	0.0419	0.0168
Skew	-1.6924	-1.4347	-0.9588	-3.1523	-2.5251	-0.4477	-0.8822	-0.5494	-2.2990	-0.1725	-0.2685
J-B	256.81	119.89	89.10	1157.30	835.46	5.8968	22.09	13.49	684.85	57.61	68.54
Obs	96	96	96	96	96	96	96	96	96	96	96

Notes: FTA is the first difference of logs of FTSE All Share Index, OI is the first difference of logs of Oil and gases index, BM is the first difference of logs of Basic materials index, ID is the first difference of logs of Industrials index, CG is the first difference of logs of Consumer goods index, HI is the first difference of logs of Healthcare index, CS is the first difference of logs of Consumer services index, TM is the first difference of logs of Telecoms index, FN is the first difference of logs of Financials index, IT is the first difference of logs of Information technologies index and UT is the first difference of logs of Utilities index. The sample periods of all variables are from 1st January 2000 to 31st December 2007.

Max, Min, S-d, Skew, J-B and obs refer to Maximum, Minimum, Standard Deviation, Skewness, Jarque-Bera test and observations, respectively

Table 3. 4: Effects of Changes in Interest Rate on Stock Returns

$R_{t+B} = \alpha + \beta\Delta i_t + \varepsilon_t$ (B=-1, 0, 1) $R_{\Delta 3t} = \alpha + \beta\Delta i + \varepsilon_t$ (R_{3t} three days accumulate returns)

		FTA			OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
		1/1962 -12/2007	1/1962 -04/1997	5/1997 -12/2007										
R_{t-1}	β	-0.1675*	-0.1430	-1.1085**	-0.4144*	-0.2336	-0.0444	-0.1366	-0.0942	-0.2586	-0.2866	-0.132438	-0.36441	-0.05952
		(0.0891)	(0.0951)	(0.5159)	(0.2434)	(0.2141)	(0.2057)	(0.2402)	(0.1918)	(0.1773)	(0.2795)	(0.2024)	(0.311)	(0.1923)
		[0.0611]	[0.1352]	[0.0336]	[0.0903]	[0.2766]	[0.8293]	[0.5704]	[0.6238]	[0.1464]	[0.3066]	[0.5136]	[0.2428]	[0.7573]
R_t	β	-0.4540***	-0.4706***	0.1785	-0.3998*	-0.5994**	-0.3715*	-0.3109	-0.1789	-0.5850***	-0.4998*	-0.5300**	-0.52337	-0.9195***
		(0.091)	(0.0897)	(0.5865)	(0.2325)	(0.2485)	(0.2151)	(0.2396)	(0.189)	(0.1867)	(0.2752)	(0.2141)	(0.4276)	(0.1978)
		[0.0000]	[0.0000]	[0.7614]	[0.0872]	[0.0169]	[0.0996]	[0.1961]	[0.3451]	[0.0020]	[0.0710]	[0.0143]	[0.2225]	[0.0000]
R_{t+1}	β	-0.1824*	-0.2046*	0.6682	-0.2987	-0.1614	0.0485	-0.1344	0.0564	-0.0152	-0.0410	-0.031986	-0.1125	0.0245
		(0.0979)	(0.1066)	(0.5549)	(0.243)	(0.223)	(0.222)	(0.2498)	(0.1904)	(0.1886)	(0.243)	(0.2298)	(0.313)	(0.1736)
		[0.0636]	[0.0570]	[0.2307]	[0.2207]	[0.4700]	[0.8274]	[0.5910]	[0.7674]	[0.9359]	[0.8660]	[0.8895]	[0.7198]	[0.8879]
$R_{\Delta 3t}$	β	-0.8039***	-0.8182***	-0.26182	-1.1130***	-0.9944**	-0.3674	-0.5819	-0.2167	-0.8595**	-0.8275	-0.6943*	-1.0002	-0.9546***
		(0.1744)	(0.1977)	(0.9373)	(0.4006)	(0.4432)	(0.437)	(0.476)	(0.3615)	(0.3719)	(0.5022)	(0.4197)	(0.7153)	(0.3362)
		[0.0000]	[0.0001]	[0.7804]	[0.0060]	[0.0261]	[0.4016]	[0.223]	[0.5496]	[0.0219]	[0.1012]	[0.0998]	[0.1637]	[0.0051]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. The sample period of FTA is from 3rd Jan. 1978 to 31st Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from 1st Jan. 1986 to 31st Dec. 2007, UT is from 9th Dec. 1986 to 31st Dec. 2007.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 5: Effects of Expected and Unexpected Changes in Interest Rate on Stock Returns

$R_{t+B} = \alpha + \gamma\Delta i_t^e + \beta\Delta i_t^u + \varepsilon_t$ $(B = -1, 0, 1)$ $R_{\Delta 3t} = \alpha + \gamma\Delta i_t^e + \beta\Delta i_t^u + \varepsilon_t$

Panel A: Full Sample Period

		FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}	γ	-0.0189	-0.3158	-0.12303	0.0607	-0.0579	0.11035	-0.1377	-0.1392	0.2104	-0.2959	0.15682
		(0.1149) [0.869]	(0.2807) [0.2621]	(0.2467) [0.6186]	(0.2371) [0.7982]	(0.2771) [0.8346]	(0.2194) [0.6155]	(0.2039) [0.5005]	(0.322) [0.6662]	(0.228) [0.3573]	(0.359) [0.4108]	(0.2171) [0.4711]
	β	**-0.5848*****	-0.9160	-0.7963	-0.5793	-0.5364	**-1.1349***	-0.8737	-1.0365	**-1.8765*****	-0.7127	**-1.1361****
		(0.2238) [0.0095]	(0.7493) [0.2231]	(0.6585) [0.2282]	(0.6329) [0.3612]	(0.7399) [0.4694]	(0.5856) [0.0542]	(0.5444) [0.1103]	(0.8598) [0.2296]	(0.6086) [0.0024]	(0.9584) [0.458]	(0.5523) [0.0412]
R_t	γ	-0.1745	**-0.6637****	-0.4379	-0.3399	-0.4336	-0.10491	**-0.4354****	-0.3085	-0.4269*	-0.6979	**-0.8403*****
		(0.1152) [0.1311]	(0.2656) [0.0134]	(0.286) [0.1276]	(0.2599) [0.1925]	(0.2761) [0.1181]	(0.218) [0.6309]	(0.2144) [0.0438]	(0.3166) [0.3311]	(0.2468) [0.0854]	(0.4932) [0.1587]	(0.2258) [0.0003]
	β	**-1.2392*****	0.9427	**-1.4210***	-0.5317	0.3133	-0.5551	**-1.3505****	**-1.4732***	-1.053700	0.364910	**-1.3137****
		(0.2244) [0.0000]	(0.7091) [0.1854]	(0.7636) [0.0644]	(0.6939) [0.4445]	(0.7371) [0.6713]	(0.5819) [0.3414]	(0.5724) [0.0194]	(0.8451) [0.0830]	(0.6589) [0.1115]	(1.3165) [0.782]	(0.5742) [0.0234]
R_{t+1}	γ	**-0.2141***	-0.4136	-0.3696	-0.18695	-0.33011	-0.0571	-0.1449	-0.1053	-0.2430	-0.3675	-0.0239
		(0.1272) [0.0936]	(0.2802) [0.1417]	(0.2557) [0.1500]	(0.254) [0.4627]	(0.2869) [0.2515]	(0.2192) [0.7948]	(0.2169) [0.5051]	(0.2805) [0.7078]	(0.2636) [0.3577]	(0.3595) [0.308]	(0.1983) [0.9043]
	β	-0.0933	0.2859	0.8974	**1.2463***	0.8610	0.6336	0.6446	0.2857	1.0415	1.1849	0.2652
		(0.2479) [0.7068]	(0.748) [0.7027]	(0.6825) [0.1902]	(0.678) [0.0677]	(0.7661) [0.2625]	(0.5852) [0.2803]	(0.5793) [0.2673]	(0.7488) [0.7032]	(0.7036) [0.1405]	(0.9597) [0.2185]	(0.5044) [0.5996]
$R_{\Delta 3t}$	γ	**-0.4075***	**-1.3931*****	**-0.9305***	-0.4662	-0.8217	-0.0516	**-0.7179***	-0.5530	-0.4595	-1.3614	**-0.7074***
		(0.2235) [0.0694]	(0.4608) [0.0029]	(0.5118) [0.0707]	(0.5045) [0.3567]	(0.5485) [0.1359]	(0.4167) [0.9015]	(0.429) [0.0959]	(0.5785) [0.3405]	(0.4834) [0.3431]	(0.8244) [0.1004]	(0.3823) [0.0660]
	β	**-1.9173*****	0.3126	-1.3199	0.135321	0.637877	-1.0565	-1.5795	-2.2241	-1.8887	0.8371	**-2.1845****
		(0.4355) [0.0000]	(1.2300) [0.7996]	(1.3664) [0.3353]	(1.347) [0.9201]	(1.4644) [0.6637]	(1.1126) [0.3436]	(1.1452) [0.1695]	(1.5445) [0.1516]	(1.2905) [0.1451]	(2.2009) [0.7041]	(0.9726) [0.0260]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. The sample period of FTA is from 3rd Jan. 1978 to 31st Dec. 2007. OI, BM, ID, CG, HL, CS, TM, FN and IT is from 1st Jan. 1986 to 31st Dec. 2007. UT is from 9th Dec. 1986 to 31st Dec. 2007.

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Panel B: Sub-Sample Period 1

		FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}	γ	0.0191	-0.1286	-0.0082	0.1578	0.0447	0.1318	-0.0586	-0.0516	0.4164	-0.2013	0.1956
		(0.1231)	(0.271)	(0.2945)	(0.2784)	(0.3747)	(0.2706)	(0.2389)	(0.2963)	(0.2571)	(0.2428)	(0.2848)
		[0.8771]	[0.6371]	[0.9779]	[0.5732]	[0.9053]	[0.6284]	[0.8072]	[0.8623]	[0.1115]	[0.4110]	[0.4957]
	β	-0.5847**	-0.6259	-0.8895	-0.7117	-0.3086	-1.0307	-1.0608*	-0.8518	-1.7607***	-0.8403	-1.0240
		(0.236)	(0.6868)	(0.7465)	(0.7056)	(0.9495)	(0.6859)	(0.6055)	(0.7509)	(0.6517)	(0.6153)	(0.6795)
		[0.0144]	[0.3664]	[0.2390]	[0.3179]	[0.7465]	[0.1391]	[0.0858]	[0.262]	[0.0093]	[0.1780]	[0.1388]
R_t	γ	-0.1759	-0.6699**	-0.4797	-0.3598	-0.4151*	-0.1374	-0.4022	-0.4188	-0.3977	-0.6296*	-1.0215***
		(0.1112)	(0.2512)	(0.2981)	(0.2236)	(0.2422)	(0.2197)	(0.2525)	(0.2551)	(0.275)	(0.3254)	(0.3254)
		[0.1161]	[0.0103]	[0.1138]	[0.1138]	[0.0926]	[0.5344]	[0.1173]	[0.1068]	[0.1543]	[0.0586]	[0.0030]
	β	-1.2744***	0.7372	-1.5080*	-0.7455	0.1348	-0.7083	-1.5553**	-1.3476**	-1.3821*	0.1774	-1.3995*
		(0.2133)	(0.6368)	(0.7555)	(0.5667)	(0.6138)	(0.5567)	(0.6399)	(0.6464)	(0.6971)	(0.8247)	(0.7762)
		[0.000]	[0.2523]	[0.0513]	[0.1942]	[0.8270]	[0.2090]	[0.0186]	[0.0421]	[0.0528]	[0.8305]	[0.0781]
R_{t+1}	γ	-0.2540*	-0.4853	-0.4831	-0.3369	-0.4113	-0.2326	-0.3009	-0.3373	-0.3918	-0.6312*	-0.1433
		(0.1399)	(0.3195)	(0.3382)	(0.3259)	(0.4209)	(0.2839)	(0.2859)	(0.2448)	(0.3014)	(0.3464)	(0.2586)
		[0.0715]	[0.1351]	[0.1593]	[0.3061]	[0.3331]	[0.4163]	[0.2975]	[0.1742]	[0.1995]	[0.0743]	[0.5822]
	β	-0.0700	0.3155	0.9859	1.0860	0.7865	0.9192	0.7773	0.3251	1.1395	1.2323	0.4285
		(0.2682)	(0.8098)	(0.8571)	(0.826)	(1.0667)	(0.7194)	(0.7245)	(0.6204)	(0.7639)	(0.8778)	(0.617)
		[0.7944]	[0.6984]	[0.2554]	[0.1945]	[0.4643]	[0.2071]	[0.2884]	[0.6026]	[0.1420]	[0.1665]	[0.4909]
$R_{\Delta 3t}$	γ	-0.4108	-1.2838**	-0.9710	-0.5388	-0.7817	-0.2382	-0.7618	-0.8079*	-0.3731	-1.4622**	-0.9692
		(0.2539)	(0.6118)	(0.7431)	(0.6312)	(0.8111)	(0.5702)	(0.5959)	(0.47195)	(0.6018)	(0.6696)	(0.5941)
		[0.1081]	[0.0408]	[0.1972]	[0.3973]	[0.3398]	[0.6778]	[0.2069]	[0.0930]	[0.5380]	[0.0336]	[0.1098]
	β	-1.9291***	0.4269	-1.4115	-0.3712	0.6127	-0.8198	-1.8388	-1.8743	-2.0033	0.5694	-1.9949
		(0.4869)	(1.5504)	(1.8832)	(1.5996)	(2.0556)	(1.4451)	(1.51)	(1.1959)	(1.5252)	(1.6969)	(1.4172)
		[0.0001]	[0.7842]	[0.4570]	[0.8174]	[0.7668]	[0.5730]	[0.2289]	[0.1232]	[0.1949]	[0.7386]	[0.1661]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. The sample period of FTA is from 3rd Jan. 1978 to 30th April 1997, OI, BM, ID, CG, HL, CS, TM, FN and IT is from 1st Jan. 1986 to 30th April 1997, UT is from 9th Dec. 1986 to 30th April 1997.

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Panel C: Sub-Sample Period 2

		FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}	γ	-0.8422	**-1.7519****	-1.0414	-0.6598	-1.0549	0.1020	-0.6367	-0.7271	**-1.5188****	-1.1208	-0.0872
		(0.5218)	(0.8582)	(0.7305)	(0.7083)	(0.7336)	(0.6349)	(0.6059)	(1.0454)	(0.663)	(1.2482)	(0.5663)
		[0.1090]	[0.0433]	[0.1565]	[0.3533]	[0.1530]	[0.8725]	[0.2954]	[0.4880]	[0.0236]	[0.3709]	[0.8778]
	β	**-7.2626****	**-16.8355*****	0.5894	2.5153	**-11.1333*****	**-6.5228***	4.4770	**-10.8350***	**-10.5070*****	2.7869	**-5.7622***
		(2.8029)	(4.6101)	(3.9242)	(3.8049)	(3.9409)	(3.4104)	(3.255)	(5.615)	(3.5613)	(6.7049)	(3.0421)
		[0.0107]	[0.0004]	[0.8808]	[0.5098]	[0.0055]	[0.0581]	[0.1714]	[0.0559]	[0.0038]	[0.6784]	[0.0605]
R_t	γ	-0.0243	-0.5408	-0.2742	0.0955	-0.5770	0.3402	-0.5141	0.7787	-0.2756	-0.8865	0.3443
		(0.5996)	(0.8574)	(0.9012)	(0.8582)	(0.9132)	(0.6897)	(0.6336)	(1.0673)	(0.7366)	(1.7221)	(0.5352)
		[0.9677]	[0.5293]	[0.7614]	[0.9115]	[0.5286]	[0.6226]	[0.4187]	[0.4670]	[0.7089]	[0.6076]	[0.5212]
	β	4.8632	**9.0688***	3.7258	7.3269	7.1389	5.5157	5.4407	-5.1661	**9.9562****	4.9613	4.2849
		(3.2208)	(4.6058)	(4.8412)	(4.61)	(4.9052)	(3.7048)	(3.4038)	(5.7332)	(3.9569)	(9.2502)	(2.8752)
		[0.1336]	[0.0512]	[0.4430]	[0.1145]	[0.1481]	[0.1390]	[0.1125]	[0.3693]	[0.0131]	[0.5927]	[0.1386]
R_{t+1}	γ	0.6239	-0.1673	-0.3614	0.5102	-0.15915	0.8907	0.4741	1.3710	0.4347	1.7304	0.2833
		(0.5719)	(0.8522)	(0.6936)	(0.6841)	(0.7134)	(0.6022)	(0.593)	(0.9166)	(0.794)	(1.1496)	(0.5126)
		[0.2774]	[0.8446]	[0.6033]	[0.4571]	[0.8238]	[0.1417]	[0.4255]	[0.1372]	[0.585]	[0.1348]	[0.5814]
	β	1.6913	2.0206	3.6360	**13.0753*****	**7.6769****	-5.2716	1.2870	5.1976	2.4298	4.8084	-2.4220
		(3.0722)	(4.5776)	(3.7259)	(3.6747)	(3.8322)	(3.235)	(3.1857)	(4.9235)	(4.2653)	(6.1752)	(2.7536)
		[0.5829]	[0.6597]	[0.3310]	[0.0005]	[0.0473]	[0.1057]	[0.6869]	[0.2931]	[0.5699]	[0.4376]	[0.3808]
$R_{\Delta 3t}$	γ	-0.2425	**-2.4602***	-1.6771	-0.0540	-1.7911	1.3330	-0.6767	1.4226	-1.3597	-0.2769	0.5404
		(0.9665)	(1.2757)	(1.29)	(1.4117)	(1.3733)	(1.123)	(1.12889)	(1.9449)	(1.4039)	(2.7841)	(0.8603)
		[0.8023]	[0.0560]	[0.1960]	[0.9695]	[0.1945]	[0.2374]	[0.5499]	[0.4659]	[0.3346]	[0.9209]	[0.5310]
	β	-0.7081	-5.7460	7.9513	**22.9176*****	3.6825	-6.2787	**11.2048***	-10.8035	1.8790	12.5567	-3.8993
		(5.1916)	(6.8525)	(6.9294)	(7.5829)	(7.3768)	(6.0321)	(6.0637)	(10.4473)	(7.541)	(14.9548)	(4.6214)
		[0.8917]	[0.4033]	[0.2534]	[0.0030]	[0.6185]	[0.2999]	[0.0670]	[0.3031]	[0.8036]	[0.4027]	[0.4004]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. Sample periods of all variables are from 1st May 1986 to 31st December 2007.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 6: The Asymmetric Effect of Unexpected Changes in Interest Rate on Stock Returns

$R_t = \alpha_+ D_+ + \alpha_- D_- + \beta_+ D_+ \Delta i_t^u + \beta_- D_- \Delta i_t^u + \varepsilon_t$

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
α_+	0.0002	0.0012	0.0015	0.0002	0.0011	8.13E-05	-0.0001	0.0011	-0.0004	-0.0007	0.0006
	(0.0008)	(0.0013)	(0.0013)	(0.0012)	(0.0013)	(0.001)	(0.001)	(0.0015)	(0.0012)	(0.0024)	(0.001)
	[0.7854]	[0.3424]	[0.2546]	[0.8700]	[0.4135]	[0.9387]	[0.8932]	[0.4736]	[0.7264]	[0.7575]	[0.5757]
α_-	**0.0011****	-0.0012	**-0.0050****	**-0.0055*****	**-0.0050****	**-0.0057*****	**-0.0033****	-0.0037	**-0.0051*****	-0.0046	-0.0015
	(0.0006)	(0.002)	(0.0021)	(0.0019)	(0.0021)	(0.0016)	(0.0016)	(0.0024)	(0.0018)	(0.0038)	(0.0016)
	[0.0229]	[0.5614]	[0.0203]	[0.0051]	[0.0180]	[0.0005]	[0.0443]	[0.1243]	[0.0064]	[0.2233]	[0.3532]
β_+	**-1.2960*****	0.7604	-1.0346	-0.5090	-0.6931	-0.5787	-0.5483	-0.5470	-0.0328	-0.2241	**-1.5769***
	(0.2716)	(1.0423)	(1.0882)	(0.9919)	(1.0578)	(0.8223)	(0.8229)	(1.2097)	(0.9372)	(1.9154)	(0.8937)
	[0.0000]	[0.4666]	[0.3430]	[0.6084]	[0.5132]	[0.4825]	[0.5061]	[0.6517]	[0.9720]	[0.9070]	[0.0794]
β_-	**-2.1602*****	-0.1183	**-3.8132*****	**-2.2490****	-0.5140	**-2.0020****	**-3.3577*****	**-3.8648*****	**-3.6386*****	-0.6404	**-2.1506****
	(0.4893)	(1.1147)	(1.1639)	(1.0609)	(1.1314)	(0.8794)	(0.8801)	(1.2938)	(1.0023)	(2.0485)	(0.8925)
	[0.0000]	[0.9155]	[0.0013]	[0.0354]	[0.6501]	[0.0240]	[0.0002]	[0.0032]	[0.0004]	[0.7549]	[0.0170]
Hypothesis test (P-values for the Wald Statistics)											
$\beta_+=\beta_-$	[0.0988]	[0.5654]	[0.0829]	[0.2325]	[0.9081]	[0.2387]	[0.0208]	[0.0626]	[0.0093]	[0.8821]	[0.6500]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. The sample period of FTA is from 3rd Jan. 1978 to 31st Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from 1st Jan. 1986 to 31st Dec. 2007, UT is from 9th Dec. 1986 to 31st Dec. 2007.

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 7: Effects of Unexpected Changes in Interest Rate on Stock Market Volatility on the Announcement Date

$R_t = \beta_0 + \beta_1 \Delta i_t^u + \beta_2 R_{t-1} + \mu_t \qquad \mu_t = \sqrt{s_t} e_t \qquad E(e_t|\Omega_{t-1}) = 0 \qquad E(e_t^2|\Omega_{t-1}) = h_t$

$h_t = \alpha_0 + \alpha_1 h_{t-1} + \alpha_2 e_{t-1}^2, \ s_t = 1 + \delta_1 I_t^{BoE}$

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
β_0	**0.0005*****	**5.2e-04*****	**0.0003*****	**0.0003*****	**0.0003*****	**0.0004*****	**0.0004*****	**0.0004*****	**0.0005*****	**0.0004*****	**0.0004*****
	(0.00008)	(0.000138)	(0.0001)	(0.00011)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
	[0.0000]	[0.0001]	[0.0011]	[0.0015]	[0.0047]	[0.0000]	[0.0000]	[0.0016]	[0.0000]	[0.0007]	[0.0009]
β_1	**-1.3825*****	**-0.6140*****	**-1.3250*****	**-1.2010*****	**-1.2808*****	**-1.0792*****	**-1.1715*****	**-1.3524*****	**-1.0690*****	**-1.0604*****	**-1.2257*****
	(0.0836)	(0.1606)	(0.1434)	(0.1621)	(0.1577)	(0.1492)	(0.1195)	(0.1713)	(0.1213)	(0.1535)	(0.1338)
	[0.0000]	[0.0001]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
β_2	**0.0753*****	**0.0701*****	**0.1849*****	**0.1344*****	**0.1159*****	**0.0280****	**0.1114*****	**0.0463*****	**0.0904*****	**0.1714*****	**0.0630*****
	(0.0118)	(0.0133)	(0.014)	(0.0142)	(0.0127)	(0.0131)	(0.0143)	(0.0133)	(0.0145)	(0.0133)	(0.0142)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0332]	[0.0000]	[0.0005]	[0.0000]	[0.0000]	[0.0006]
α_0	**1.0e-6*****	**1.1e-6*****	**2.8e-6*****	**2.7e-6*****	**7.3e-7*****	**2.3e-6*****	**1.7e-6*****	**1.2e-6*****	**2.2e-6*****	**3.1e-6*****	**2.5e-6*****
	(2.0e-7)	(2.01e-7)	(2.8e-7)	(2.5e-7)	(1.0e-8)	(2.6e-7)	(2.1e-7)	(2.2e-7)	(2.2e-7)	(1.5e-7)	(2.0e-7)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0002]	[0.0000]	[0.0000]	[0.0000]
α_1	**0.8829*****	**0.9437*****	**0.8519*****	**0.8774*****	**0.9358*****	**0.9082*****	**0.8813*****	**0.9401*****	**0.8795*****	**0.8834*****	**0.9139*****
	(0.0071)	(0.0003)	(0.0086)	(0.006)	(0.0024)	(0.006)	(0.006)	(0.0037)	(0.0059)	(0.0047)	(0.0041)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
α_2	**0.0888*****	**0.0480*****	**0.1154*****	**0.0925*****	**0.0596*****	**0.0737*****	**0.1005*****	**0.0528*****	**0.1023*****	**0.1012*****	**0.0638*****
	(0.0053)	(0.0003)	(0.0075)	(0.0051)	(0.0029)	(0.0045)	(0.0052)	(0.0034)	(0.0051)	(0.0046)	(0.0033)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
δ_1	**0.0868*****	0.0311	**0.2174*****	**0.2249*****	**0.0418*****	-0.0393	0.0212	0.0186	**0.0874***	0.0579	**-0.0479***
	(0.0325)	(0.0285)	(0.0516)	(0.0376)	(0.0222)	(0.034)	(0.0391)	(0.0341)	(0.0456)	(0.0373)	(0.0278)
	[0.0077]	[0.2756]	[0.0000]	[0.0000]	[0.0000]	[0.2481]	[0.5882]	[0.5855]	[0.0553]	[0.1206]	[0.0850]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. 2007. The GARCH model is estimated by WinRATS 6.0. The optimization algorithm is using the Berndt et al. (1974) and Maximum likelihood is estimated with 500 iterations. Robust test and Wald test are using the Bollerslev and Wooldridge (1992) procedure. Variables and sample periods are defined in the text.

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 8: Effects of Unexpected Changes in Interest Rate on Stock Market Volatility around the Announcement dates

$R_t = \beta_0 + \beta_1 \Delta i_t^u + \beta_2 R_{t\_1} + \mu_t \qquad \mu_t = \sqrt{s_t} e_t \qquad E(e_t|\Omega_{t-1}) = 0 \qquad E(e_t^2|\Omega_{t-1}) = h_t$

$h_t = \alpha_0 + \alpha_1 h_{t-1} + \alpha_2 e_{t-1}^2, \; s_t = 1 + \delta_1 I_{t-1}^{BoE} + \delta_2 I_t^{BoE} + \delta_3 I_{t+1}^{BoE}$

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
β_0	**0.0005*** **	**0.0005*** **	**0.0003*** **	**0.0003*** **	**0.0003*** **	**0.0004*** **	**0.0004*** **	**0.0004*** **	**0.0005*** **	**0.0004*** **	**0.0004*** **
	(0.00009)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
	[0.0000]	[0.0027]	[0.0000]	[0.0018]	[0.0047]	[0.0001]	[0.0000]	[0.0015]	[0.0000]	[0.0004]	[0.0000]
β_1	**-1.2458*** **	**-0.6492*** **	**-1.3280*** **	**-1.2113*** **	**-1.2963*** **	**-1.0909*** **	**-1.1645*** **	**-1.3471*** **	**-1.0705*** **	**-1.0553*** **	**-1.1866*** **
	(0.1352)	(0.1639)	(0.1512)	(0.1635)	(0.164)	(0.149)	(0.1228)	(0.1727)	(0.1224)	(0.1592)	(0.1398)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
β_2	**0.0464*** **	**0.0706*** **	**0.1864*** **	**0.1343*** **	**0.1174*** **	**0.0278** **	**0.1120*** **	**0.0464*** **	**0.0905*** **	**0.1698*** **	**0.0613*** **
	(0.0145)	(0.0133)	(0.0139)	(0.0141)	(0.0127)	(0.0132)	(0.0143)	(0.0133)	(0.0145)	(0.0133)	(0.0143)
	[0.0014]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0354]	[0.0000]	[0.0004]	[0.0000]	[0.0000]	[0.0000]
α_0	**1.0e-6*** **	**1.0e-6*** **	**2.0e-6*** **	**2.0e-6*** **	**6.0e-7*** **	**2.0e-6*** **	**1.0e-6*** **	**1.0e-6*** **	**2.0e-6*** **	**3.0e-6*** **	**2.0e-6*** **
	(2.0e-7)	(2.0e-7)	(2.7e-6)	(2.7e-7)	(1.0e-7)	(2.6e-7)	(2.0e-7)	(2.0e-7)	(2.0e-7)	(1.0e-7)	(2.0e-7)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0002]	[0.0000]	[0.0000]	[0.0000]
α_1	**0.8844*** **	**0.9440*** **	**0.8634*** **	**0.8897*** **	**0.9369*** **	**0.9087*** **	**0.8844*** **	**0.9402*** **	**0.8804*** **	**0.8796*** **	**0.9105*** **
	(0.0077)	(0.0031)	(0.008)	(0.0064)	(0.0024)	(0.006)	(0.0058)	(0.0038)	(0.0062)	(0.0052)	(0.0045)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
α_2	**0.0953*** **	**0.0485*** **	**0.1113*** **	**0.0865*** **	**0.0601*** **	**0.0747*** **	**0.1004*** **	**0.0528*** **	**0.1020*** **	**0.1058*** **	**0.0669*** **
	(0.0064)	(0.0326)	(0.0071)	(0.0052)	(0.0029)	(0.0045)	(0.0053)	(0.0035)	(0.0051)	(0.005)	(0.0036)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
δ_1	-0.0547	0.1196	-0.0537	**0.1796** **	0.1770	**-0.1748** **	0.0435	0.0689	0.0676	**0.3863*** **	0.0777
	(0.0800)	(0.0940)	(0.081)	(0.0822)	(0.1142)	(0.0788)	(0.0883)	(0.1157)	(0.0768)	(0.0793)	(0.0699)
	[0.4935]	[0.2033]	[0.5073]	[0.0290]	[0.1212]	[0.0265]	[0.6218]	[0.5514]	[0.3788]	[0.000]	[0.2664]
δ_2	**0.2871***	0.1564	**0.7075*** **	**0.4522*** **	**0.2285***	0.1584	0.2226	0.0303	0.1229	0.1159	0.1387
	(0.1539)	(0.15)	(0.1877)	(0.1082)	(0.1388)	(0.1605)	(0.1395)	(0.1395)	(0.1218)	(0.1009)	(0.1015)
	[0.0621]	[0.297]	[0.0001]	[0.0000]	[0.0996]	[0.3235]	[0.1106]	[0.8279]	[0.3126]	[0.2509]	[0.1717]
δ_3	**-0.1666** **	**-0.2164*** **	**-0.3300*** **	**-0.3398*** **	**-0.3013*** **	-0.0243	**-0.2388*** **	-0.0770	-0.1014	**-0.3417*** **	**-0.2572*** **
	(0.078)	(0.0809)	(0.0578)	(0.0351)	(0.0459)	(0.0999)	(0.0634)	(0.0877)	(0.0782)	(0.0517)	(0.0591)
	[0.0328]	[0.0074]	[0.0000]	[0.0000]	[0.0000]	[0.8075]	[0.0001]	[0.3801]	[0.1949]	[0.0000]	[0.0000]
Hypothesis test (P-values for the Wald Statistics) $\delta_1=\delta_2=\delta_3=0$											
	[0.1043]	[0.0217]	[0.000]	[0.000]	[0.0000]	[0.0252]	[0.0008]	[0.7405]	[0.1965]	[0.0000]	[0.0000]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. The GARCH model is estimated by WinRATS 6.0. The optimization algorithm is using the Berndt et al. (1974) and Maximum likelihood is estimated with 500 iterations. Robust test and Wald test are using the Bollerslev and Wooldridge (1992) procedure. Variables and sample periods are defined in the text.*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 9: Effects of Unexpected Changes in Interest Rate on Stock Market Volatility before and after May 1997

$$R_t = \beta_0 + \beta_1 \Delta i_t^u + \beta_2 R_{t\_1} + \mu_t \qquad \mu_t = \sqrt{s_t} e_t \quad E(e_t|\Omega_{t-1}) = 0 \quad E(e_t^2|\Omega_{t-1}) = h_t$$

$$h_t = \alpha_0 + \alpha_1 h_{t-1} + \alpha_2 e_{t-1}^2, \; s_t = 1 + I_t^{pre97}(\delta_1 I_{t-1}^{BoE} + \delta_2 I_t^{BoE} + \delta_3 I_{t+1}^{BoE}) + I_t^{aft97}(\delta_4 I_{t-1}^{BoE} + \delta_5 I_t^{BoE} + \delta_6 I_{t+1}^{BoE})$$

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
β_0	0.0005***	0.00005***	0.0003***	0.0003***	0.0003***	0.0004***	0.0004***	0.0004***	0.0005***	0.0004***	0.0005***
	(0.00008)	(0.00001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
	[0.0000]	[0.0001]	[0.0012]	[0.0018]	[0.0043]	[0.0001]	[0.0000]	[0.0021]	[0.0000]	[0.0004]	[0.0000]
β_1	-1.3851***	-0.6856***	-1.3418***	-1.2188***	-1.2670***	-1.083***	-1.1611***	-1.3192***	-1.0668***	-1.0551***	-1.1283***
	(0.0839)	(0.1576)	(0.1495)	(0.1521)	(0.1496)	(0.1452)	(0.1253)	(0.1642)	(0.1204)	(0.1563)	(0.1504)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
β_2	0.0756***	0.0700***	0.1857***	0.1326***	0.1177***	0.0291**	0.1117***	0.0473***	0.0908***	0.1699***	0.0593***
	(0.0118)	(0.0133)	(0.0138)	(0.0141)	(0.0128)	(0.0132)	(0.0143)	(0.0132)	(0.0145)	(0.0133)	(0.0143)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0275]	[0.0000]	[0.0003]	[0.0000]	[0.0000]	[0.0006]
α_0	1.0e-6***	1.0e-6***	2.0e-6***	2.0e-6***	7.0e-7***	2.0e-6***	1.0e-6***	1.0e-6***	2.0e-6***	3.0e-6***	2.0e-6***
	(2.0e-7)	(2.2e-7)	(2.7e-7)	(2.0e-7)	(1.0e-7)	(2.0e-7)	(2.0e-7)	(2.0e-7)	(2.0e-7)	(1.0e-7)	(1.0e-7)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
α_1	0.8843***	0.9417***	0.8657***	0.8897***	0.9369***	0.9124***	0.8845***	0.9370***	0.8828***	0.8772***	0.9054***
	(0.0071)	(0.0034)	(0.008)	(0.0066)	(0.0024)	(0.0058)	(0.0059)	(0.0043)	(0.0063)	(0.0053)	(0.0049)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
α_2	0.0873***	0.0477***	0.1080***	0.0833***	0.0594***	0.0700***	0.1000***	0.0521***	0.0970***	0.1055***	0.0704***
	(0.0052)	(0.0037)	(0.007)	(0.0051)	(0.0029)	(0.0043)	(0.0053)	(0.0036)	(0.005)	(0.0051)	(0.0038)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
δ_1	0.0090	0.0709	-0.1648	-0.1430	0.1550	-0.1042	-0.0563	0.1346	0.2967*	-0.0513	-0.1337
	(0.1173)	(0.2421)	(0.1225)	(0.2136)	(0.2544)	(0.1961)	(0.15)	(0.2476)	(0.1611)	(0.1405)	(0.1494)
	[0.9386]	[0.7694]	[0.1786]	[0.5032]	[0.5424]	[0.5951]	[0.7071]	[0.5866]	[0.0654]	[0.7147]	[0.3708]
δ_2	0.2574*	0.4693	1.5137***	0.5129	-0.1839	0.0731	0.6212*	0.0567	0.3096	0.7114**	1.4593***
	(0.1548)	(0.4103)	(0.5132)	(0.3972)	(0.2034)	(0.3002)	(0.3323)	(0.2721)	(0.2384)	(0.3238)	(0.4965)
	[0.0997]	[0.2526]	[0.0031]	[0.1965]	[0.3659]	[0.8076]	[0.0615]	[0.8347]	[0.1940]	[0.0280]	[0.0032]
δ_3	-0.1388	-0.4101***	-0.5519***	-0.2724***	-0.0007	-0.1291	-0.3861***	-0.2664**	-0.4810***	-0.4563***	-0.5306***
	(0.0873)	(0.1048)	(0.0735)	(0.1075)	(0.1395)	(0.1675)	(0.0926)	(0.1156)	(0.0754)	(0.0769)	(0.0741)
	[0.1119]	[0.0000]	[0.0000]	[0.0112]	[0.9959]	[0.4408]	[0.0000]	[0.0212]	[0.0000]	[0.0000]	[0.0000]
δ_4	-0.0656	0.1791	-0.0069	0.3442***	0.1672	-0.1870**	0.1035	0.0673	-0.0288	0.6170***	0.1414*
	(0.0887)	(0.1114)	(0.1018)	(0.107)	(0.1259)	(0.0856)	(0.1109)	(0.132)	(0.088)	(0.1098)	(0.0821)
	[0.4594]	[0.1078]	[0.9456]	[0.0013]	[0.1842]	[0.0290]	[0.3509]	[0.6100]	[0.7433]	[0.0000]	[0.0850]
δ_5	0.1322	0.0182	0.4375**	0.4346***	0.4181**	0.1974	0.0531	0.0168	0.0177	-0.0496	-0.2456**
	(0.1798)	(0.1602)	(0.1868)	(0.1227)	(0.1835)	(0.1931)	(0.1475)	(0.1648)	(0.1617)	(0.1025)	(0.0979)
	[0.4620]	[0.9096]	[0.0191]	[0.0004]	[0.0227]	[0.3065]	[0.7185]	[0.9186]	[0.9124]	[0.6281]	[0.0121]
δ_6	0.0681	-0.0952	-0.1752**	-0.3422***	-0.3673***	0.0322	-0.1442*	0.0265	0.2184	-0.2699***	-0.0166
	(0.1365)	(0.1169)	(0.0839)	(0.0404)	(0.0496)	(0.1265)	(0.0862)	(0.1232)	(0.1535)	(0.0677)	(0.1096)
	[0.6175]	[0.4155]	[0.0367]	[0.0000]	[0.0000]	[0.7988]	[0.0943]	[0.8291]	[0.1548]	[0.0000]	[0.8795]
Hypothesis test (P-values for the Wald Statistics) $\delta_1=\delta_2=\delta_3=0;\ \delta_4=\delta_5=\delta_6=0$											
	[0.0000]	[0.0000]	[0.0000]	[0.0168]	[0.0789]	[0.0030]	[0.0000]	[0.0023]	[0.0000]	[0.0000]	[0.0000]
	[0.1252]	[0.0854]	[0.0215]	[0.0000]	[0.0000]	[0.1815]	[0.2655]	[0.0901]	[0.0073]	[0.0000]	[0.0000]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. 2007. The GARCH model is estimated by WinRATS 6.0. The optimization algorithm is using the Berndt et al. (1974) and Maximum likelihood is estimated with 500 iterations. Robust test and Wald test are using the Bollerslev and Wooldridge (1992) procedure. Variables and sample periods are defined in the text.

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 10: The Asymmetric Effect of Unexpected Changes in Interest Rate on Stock Market Volatility

$R_t = \beta_0 + \beta_1 \Delta i_t^u + \beta_2 R_{t\_1} + \mu_t \qquad \mu_t = \sqrt{s_t} e_t \qquad E(e_t|\Omega_{t-1}) = 0 \qquad E(e_t^2|\Omega_{t-1}) = h_t$

$h_t = \alpha_0 + \alpha_1 h_{t-1} + \alpha_2 e_{t-1}^2, \quad s_t = 1 + \delta_1 I_t^{BoE} I_t^{Pos} + \delta_2 I_t^{BoE} I_t^{Neg}$

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
β_0	0.0005***	0.0004***	0.0004***	0.0004***	0.0003***	0.0003***	0.0004***	0.0004***	0.0005***	0.0004***	0.0005***
	(0.00009)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
	[0.0000]	[0.0052]	[0.0003]	[0.0005]	[0.0078]	[0.0024]	[0.0000]	[0.0067]	[0.0000]	[0.0012]	[0.0011]
β_1	-1.4083***	-0.3502	-1.5283***	-1.4902***	-1.3373***	-0.9300***	-1.2808***	-1.3104***	-1.2130***	-1.1439***	-1.4626***
	(0.1244)	(0.2454)	(0.1928)	(0.2381)	(0.2212)	(0.2229)	(0.1703)	(0.2651)	(0.1642)	(0.211)	(0.229)
	[0.0000]	[0.1536]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
β_2	-1.3628***	-0.8500***	-1.0990***	-0.9044***	-1.2297***	-1.2386***	-1.0654***	-1.3905***	-0.9250***	-0.9938***	-1.0134***
	(0.1282)	(0.2406)	(0.2144)	(0.232)	(0.225)	(0.2246)	(0.1973)	(0.2334)	(0.2346)	(0.2719)	(0.196)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0002]	[0.0000]
β_3	0.0752***	0.0700***	0.1849***	0.1341***	0.1159***	0.0278**	0.1113***	0.0464***	0.0905***	0.1713***	0.0631***
	(0.0119)	(0.0133)	(0.014)	(0.0142)	(0.0129)	(0.0131)	(0.0145)	(0.0133)	(0.0145)	(0.0133)	(0.0142)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0345]	[0.0000]	[0.0004]	[0.0000]	[0.0000]	[0.0000]
α_0	1.0e-6***	1.0e-6***	2.0e-6***	2.0e-6***	7.0e-7***	2.0e-6***	1.0e-6***	1.0e-6***	2.0e-6***	3.0e-6***	2.0e-6***
	(2.0e-7)	(2.0e-7)	(2.0e-7)	(2.0e-7)	(1.0e-7)	(2.0e-7)	(2.0e-7)	(2.0e-7)	(2.0e-7)	(1.0e-7)	(2.0e-7)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0002]	[0.0000]	[0.0000]	[0.0000]
α_1	0.8826***	0.9439***	0.8512***	0.8782***	0.9357***	0.9080***	0.8827***	0.9401***	0.8801***	0.8839***	0.9168***
	(0.0073)	(0.0031)	(0.0087)	(0.0059)	(0.0024)	(0.0061)	(0.0064)	(0.0038)	(0.0063)	(0.0047)	(0.0041)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
α_2	0.0894***	0.0482***	0.1165***	0.0928***	0.0599***	0.0747***	0.1000***	0.0526***	0.1023***	0.1009***	0.0624***
	(0.0054)	(0.0032)	(0.0075)	(0.0052)	(0.0029)	(0.0045)	(0.0057)	(0.0034)	(0.0052)	(0.0046)	(0.0034)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
δ_1	0.2256***	0.0974*	0.3495***	0.3531***	0.0677	0.0905*	0.2393***	0.0025	0.2747***	0.1309*	0.0631
	(0.0697)	(0.0562)	(0.1004)	(0.0954)	(0.0545)	(0.0549)	(0.0877)	(0.0573)	(0.0856)	(0.076)	(0.0681)
	[0.0012]	[0.0828]	[0.0005]	[0.0002]	[0.2143]	[0.0992]	[0.0063]	[0.9649]	[0.0013]	[0.0848]	[0.1168]
δ_2	0.0378	0.0070	0.1715***	0.1771***	0.0320	-0.0850**	-0.0528	0.0248	0.0223	0.0343	-0.0940***
	(0.0398)	(0.0343)	(0.0594)	(0.0377)	(0.0253)	(0.0427)	(0.0444)	(0.0405)	(0.0554)	(0.0421)	(0.0321)
	[0.3420]	[0.8377]	[0.0039]	[0.0000]	[0.2064]	[0.0465]	[0.2339]	[0.5394]	[0.6869]	[0.4151]	[0.0034]
Hypothesis test (P-values for the Wald Statistics)											
$\beta_1 = \beta_2$	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$\delta_1 = \delta_2$	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. The GARCH model is estimated by WinRATS 6.0. Maximum likelihood is estimated with 500 iterations. The optimization algorithm, Robust test and Wald test are using the Berndt et al. (1974), Bollerslev and Wooldridge (1992) procedure. Variables and sample periods are defined in the text. *, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 11: Effects of Changes in the Money Supply on Stock Returns

$R_{t+B} = \alpha + \beta \Delta M_t + \varepsilon_t$ (B=-1, 0, 1) $R_{3t} = \alpha + \beta \Delta M_t + \varepsilon_t$

		FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}	β	**0.4457***	0.3512	**0.7396****	0.0523	-0.1467	0.2998	**0.3942***	**0.7029****	0.3282	**0.9970****	0.2682
		(0.2479)	(0.3316)	(0.3488)	(0.3156)	(0.3234)	(0.2354)	(0.2151)	(0.3527)	(0.3325)	(0.4636)	(0.2244)
		[0.0754]	[0.2924]	[0.0366]	[0.8686]	[0.6511]	[0.2061]	[0.0700]	[0.0492]	[0.3261]	[0.0341]	[0.2352]
R_t	β	**-0.4706****	-0.2447	-0.4871	**-0.5387****	**-0.7301****	-0.2790	**-0.3803***	**-0.7552****	**-0.5165***	-0.4768	-0.2413
		(0.2321)	(0.3234)	(0.314)	(0.263)	(0.2838)	(0.2446)	(0.2275)	(0.368)	(0.2822)	(0.5876)	(0.2081)
		[0.0455]	[0.4512]	[0.1242]	[0.0434]	[0.0117]	[0.2568]	[0.0980]	[0.0430]	[0.0704]	[0.4192]	[0.2492]
R_{t+1}	β	-0.2241	**-0.5280***	**-0.6412****	**-0.4511***	-0.2095	-0.1111	-0.1447	-0.1509	0.0364	-0.5923	**-0.5300****
		(0.2388)	(0.3057)	(0.3075)	(0.2713)	(0.3342)	(0.2936)	(0.2496)	(0.3654)	(0.2947)	(0.45594)	(0.224)
		[0.3505]	[0.0875]	[0.0398]	[0.0997]	[0.5323]	[0.7060]	[0.5633]	[0.6805]	[0.9020]	[0.1971]	[0.0200]
$R_{\Delta 3t}$	β	-0.2490	-0.4215	-0.3887	-0.9374	**-1.0864***	-0.0904	-0.1308	-0.2032	-0.1518	-0.0721	-0.5031
		(0.3826)	(0.5813)	(0.5704)	(0.5686)	(0.6033)	(0.4219)	(0.4044)	(0.5978)	(0.5009)	(0.9601)	(0.3819)
		[0.5167]	[0.4702]	[0.4973]	[0.1026]	[0.0750]	[0.8308]	[0.7469]	[0.7347]	[0.7624]	[0.9403]	[0.1910]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets.

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 12: Effects of Expected and Unexpected Changes in Money Supply on Stock Returns

$R_{t+B} = \alpha + \gamma \Delta M_t^e + \beta \Delta M_t^u + \varepsilon_t$ (B=-1, 0, 1) $R_{3t} = \alpha + \gamma \Delta M_t^e + \beta \Delta M_t^u + \varepsilon_t$

		FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}	γ	0.4302	0.3173	**0.9451****	0.4824	-0.3673	0.1427	**0.4735***	0.5206	0.4041	**1.0910***	-0.1338
		(0.3108)	(0.4157)	(0.4358)	(0.3886)	(0.4036)	(0.2939)	(0.2693)	(0.441)	(0.4167)	(0.581)	(0.2726)
		[0.1697]	[0.4472]	[0.0327]	[0.2176]	[0.3651]	[0.6284]	[0.0821]	[0.2409]	[0.3347]	[0.0636]	[0.6246]
	β	0.4685	0.4008	0.4374	-0.5801	0.1777	0.5308	0.2776	**0.9711***	0.2166	0.8587	**0.8596*****
		(0.3697)	(0.4946)	(0.5185)	(0.4623)	(0.4801)	(0.3497)	(0.3204)	(0.5247)	(0.4957)	(0.6912)	(0.3243)
		[0.2083]	[0.4198]	[0.4011]	[0.2127]	[0.7120]	[0.1325]	[0.3885]	[0.0674]	[0.6632]	[0.2173]	[0.0095]
R_t	γ	-0.2079	0.2613	-0.3115	-0.1924	-0.4090	-0.0870	-0.1601	-0.5721	-0.2542	-0.1102	-0.3176
		(0.2874)	(0.3959)	(0.3925)	(0.3243)	(0.3514)	(0.3048)	(0.2827)	(0.4603)	(0.3508)	(0.7339)	(0.2606)
		[0.4713]	[0.5108]	[0.4295]	[0.5543]	[0.2475]	[0.7760]	[0.5725]	[0.2170]	[0.4705]	[0.8809]	[0.2260]
	β	**-0.8571****	**-0.9890****	-0.7454	**-1.0479*****	**-1.2025*****	-0.5615	**-0.7042****	**-1.0245***	**-0.9023****	-1.0159	-0.1291
		(0.3419)	(0.4709)	(0.4670)	(0.3858)	(0.4181)	(0.3626)	(0.3363)	(0.5476)	(0.4174)	(0.8731)	(0.3100)
		[0.0139]	[0.0384]	[0.1138]	[0.0079]	[0.0050]	[0.1249]	[0.0390]	[0.0645]	[0.0332]	[0.2476]	[0.6779]
R_{t+1}	γ	-0.1028	-0.0211	**-0.8390****	-0.3357	0.15479	-0.0733	-0.086	-0.0584	0.1133	-0.3194	**-0.7108****
		(0.2987)	(0.3731)	(0.384)	(0.3396)	(0.4142)	(0.3681)	(0.3128)	(0.4578)	(0.3693)	(0.5696)	(0.279)
		[0.7314]	[0.9550]	[0.0314]	[0.3254]	[0.7095]	[0.8426]	[0.7837]	[0.8987]	[0.7597]	[0.5763]	[0.0125]
	β	-0.4024	**-1.2735*****	-0.3501	-0.6208	-0.7453	-0.1668	-0.2311	-0.2870	-0.0766	-0.9937	-0.2641
		(0.3554)	(0.4438)	(0.4568)	(0.404)	(0.4928)	(0.4379)	(0.3721)	(0.5447)	(0.4393)	(0.6776)	(0.332)
		[0.2604]	[0.0051]	[0.4454]	[0.1278]	[0.1338]	[0.7042]	[0.5361]	[0.5995]	[0.8618]	[0.1459]	[0.4284]
$R_{\Delta 3t}$	γ	0.1194	0.5576	-0.2054	-0.0458	-0.6215	-0.0175	0.2272	-0.1100	0.2631	0.6613	**-1.1623****
		(0.4754)	(0.7087)	(0.7144)	(0.6959)	(0.7521)	(0.5289)	(0.5032)	(0.7493)	(0.62387)	(1.1969)	(0.465)
		[0.8023]	[0.4334]	[0.7743]	[0.9476]	[0.4107]	[0.9736]	[0.6526]	[0.8836]	[0.6741]	[0.5819]	[0.0142]
	β	-0.7910	**-1.8616****	-0.6582	**-2.2489*****	**-1.7701***	-0.1976	-0.6576	-0.3403	-0.7624	-1.1509	0.4663
		(0.5656)	(0.8431)	(0.8499)	(0.8279)	(0.8947)	(0.6292)	(0.5986)	(0.8914)	(0.7421)	(1.4239)	(0.5532)
		[0.1653]	[0.0297]	[0.4406]	[0.0079]	[0.0508]	[0.7542]	[0.2748]	[0.7035]	[0.3070]	[0.4210]	[0.4014]

Notes: FFTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 3. 13: The Asymmetric Effect of Unexpected Changes in Money Supply on Stock Returns

$$R_t = \alpha_+ D_+ + \alpha_- D_- + \beta_+ D_+ \Delta M_t^u + \beta_- D_- \Delta M_t^u + \varepsilon_t$$

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
α_+	0.0011	-0.0001	0.0046	-0.0043	-0.0003	-0.0021	0.0003	**0.0109****	-0.0023	-0.0036	0.0002
	(0.003)	(0.0041)	(0.004)	(0.0033)	(0.0036)	(0.0031)	(0.0029)	(0.0046)	(0.0036)	(0.0076)	(0.0027)
	[0.6937]	[0.9798]	[0.2563]	[0.1974]	[0.9197]	[0.5112]	[0.9099]	[0.0202]	[0.5276]	[0.6328]	[0.9329]
α_-	-0.0019	-0.0004	-0.0009	-0.0007	0.0002	-0.0013	-0.0012	**-0.0045****	-0.0019	-0.0044	**-0.0026****
	(0.0013)	(0.0018)	(0.0018)	(0.0015)	(0.0016)	(0.0014)	(0.0013)	(0.0021)	(0.0016)	(0.0035)	(0.0012)
	[0.1521]	[0.8241]	[0.6193]	[0.6478]	[0.8881]	[0.3453]	[0.3485]	[0.0349]	[0.2468]	[0.2045]	[0.0395]
β_+	**-1.3061***	**-1.5240***	-1.3845	-0.8816	**-1.8118****	-0.3469	-0.9085	**-3.3806*****	-0.7395	-1.6839	-0.1039
	(0.6658)	(0.9166)	(0.9066)	(0.7469)	(0.8083)	(0.7075)	(0.6567)	(1.0255)	(0.8166)	(1.7002)	(0.6022)
	[0.0528]	[0.0998]	[0.1302]	[0.2409]	[0.0274]	[0.6251]	[0.1699]	[0.0014]	[0.3675]	[0.3245]	[0.8634]
β_-	-0.8960	-0.3780	-1.0479	-0.3798	-0.0812	-0.6754	-0.7429	-1.1029	-0.9758	-0.2257	-0.7298
	(0.6121)	(0.8427)	(0.8335)	(0.6867)	(0.7431)	(0.6505)	(0.6037)	(0.9429)	(0.7508)	(1.5631)	(0.5537)
	[0.1467]	[0.6548]	[0.2119]	[0.5815]	[0.9131]	[0.3019]	[0.2217]	[0.2451]	[0.1970]	[0.8855]	[0.1907]
Hypothesis test (P-values for the Wald Statistics)											
$\beta_+ = \beta_-$	0.6513	0.3597	0.7852	0.6221	0.1184	0.7332	0.8531	0.1054	0.8318	0.5293	0.4461

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Chapter 4 Inflation and Stock Returns

4.1 Introduction

Despite numerous studies having examined the relationship between inflation and stock returns after the hypothesis put forward by Fisher (1930), the relationship has still been a critical issue in financial economics. The point of contention has been whether or not common stocks provide a good hedge against inflation. As a framework of the Fisher hypothesis (1930) which describes the link between the nominal interest rate and inflation, the expected nominal rates of returns should move one-to-one with expected inflation. If the Fisher proposition is applied to common stocks, common stocks are expected to hedge against inflation, since stocks represent a claim over real assets for which real values are assumed to be independent of the changes in the commodity price level (Bodie, 1976).

However, the empirical findings show that the relationship between the rate of inflation and the rate of returns on common stocks is mixed. It could be positive, negative or neutral, and is more complicated than the theoretically positive relationship suggested by the Fisher hypothesis. Most studies document a negative relationship between inflation and stock returns (Bodie, 1976; Nelson, 1976; Fama and Schwert, 1977; Fama, 1981; Schwert, 1981; Jain, 1988; Kaul, 1990; Fannery and Protopapadakis, 2002; Adams et al., 2004). However, some other studies document a positive relationship as in Ely and Robinson (1997) and Luintel and Paudyal (2006). Some even show that the relationship could be either negative or positive (or insignificant) depending on the time horizons or if it is considered across different inflationary economies or regimes, some examples include Kaul (1987), Marshall (1992), Boudoukh et al. (1994), Hess and Lee (1999), Anari and Kolari (2001) and Pillotte (2003).

Although these inconsistencies between the data and the prediction of economic theory have attracted hundreds of studies examining the relationship between inflation and stock returns, further empirical analyses seems necessary in order to achieve a better understanding of such a vital aspect of the economy. Whether or not common stocks provide a good hedge against inflation is a very important question for the market participants. As with any other risks in the financial market, rising inflation is one of the biggest fears for investors, as it might reduce the real return on investment. Hence, investors might want to know whether the inflation risk exposure can be eliminated by investing in the stock market.

The current state of literature demands further analysis. First, as far as the author knows, there is a lack of research examining the relationship between inflation and stock returns in the UK case in short, medium and long-term at a variety of time horizons (announcements, short horizons and long-term cointegration analysis). A literature review of existing research shows that the inflation-and-stock returns relationship is a complex process that may display diverse signs, and the horizon sensitivity. Empirical findings show that the relationship between inflation and stock returns would be negative in announcement studies, either negative or positive in the short-horizon studies, but positive and greater than unity in the long-horizon or long-term cointegration studies. Horizon sensitivity is very important for investors who have to deal with inflation risk. Based on different term performance, investors might like to change the holding period to deal with the inflation risk. Therefore, investigating whether or not the structure change would affect the hedge potential of stocks resulting in a poor or good hedge against inflation is very important for the investor. Although this relationship has been studied extensively with different estimation techniques, modelling techniques and data sets, most studies have investigated the US market, only a few studies have examined the UK case (see Goodhart and Smith, 1985; Peel and Pope, 1985, 1988; Joyce and Read, 2002). Moreover, although previous studies have compared the performance of short horizon and long horizon, for example, Boudouht and Richarson (1993), Schotman and

Schweitzer (2000), Wong and Wu (2003), Kim and In (2005) and Ryan (2006), no study generally compares the performance of the UK stock returns as hedge against inflation at all time horizons or across all aspects: announcements, short horizons and long-horizon or long-term.

Second, whether the relationship between inflation and stock returns of the UK market varies across different inflationary economies or regimes has not been examined in the existing literature until now. Some studies show that the inflation-stock returns relation is unstable and it varies across different monetary economies or different inflationary regimes. De Alessi (1975) suggests that whether or not common stocks provide a hedge against inflation would depend upon other factors and vary from one inflation value to the next. Similarly, Barnes et al. (1999) find that the inflation-stock returns relation is tied to different economies: negative for low-to-moderate inflation economies, but positive for high inflation economies. Choudhry (2001) who provides supporting evidence showing that a positive relationship between current nominal stock market returns and current inflation occurs in four high inflation countries in Latin and Central America. Thus, stock returns are differently related to inflation in high inflation countries, and stock returns may be differently related to inflation from high- to low-inflation-rate periods in the same country. The UK inflation rate was especially high from early 1971 to the end of 1982. Although many developed countries have higher than 10% annual inflation due to a word-wide boom in the early 1970s, but only a few countries have higher than 20% annual inflation, UK is one of them. Thus, it is important to examine whether this high inflation economy affects the response of stock returns for the UK market. However, there is lack of study that adopts this idea to investigate the inflation-stock returns relation in the UK case across different inflationary economies or regimes.

Third, although the general markets of many countries have been examined, a few studies investigate this relationship across different industry groups in the UK case. Some studies investigate the inflation announcements effect on different industry groups in other countries, for example, Israel (Amihud, 1996). For the UK market, some studies investigate the effect of inflation announcements on aggregate stock returns, for example, Goodhart and Smith (1985) and Joyce and Read (2002) examine whether the announcements of Retail Price Index (RPI inflation) affect the UK aggregate stock returns. Similarly, Gultekin (1983) and Peel and Pope (1985) also test the relationship between aggregate stock returns and both expected and unexpected inflation at short horizon, but at the industrial level for the UK.

Fourth, a limited number of studies conduct the cointegration analysis to stock prices and inflation. Boudoukh and Richardson (1993) suggest that examining the long-run relationship have both the empirical meaning that investors hold the stocks over long holding periods and the theoretical meaning that the true long-run relationship could be obscured by short-term noise which leads to inaccurate conclusions. Hence, it is important to examine the long run relationship between stock returns and inflation. However, there are only a few studies that use cointegration methodology to examine this relationship, for example, Anari and Kolari (2001) who investigate the relationship of stock prices and goods prices using the data of six industrial countries. For the UK market, Luintel and Paudyal (2006) also examine the long-run relationship between stock prices and goods prices at industry level in a cointegrating framework.

Aiming to bridge these gaps, this chapter empirically examines the relationship between inflation and stock returns for the aggregate market and the ten industries in short, medium and long-term at a variety of time horizons: the announcement study, the short horizon study and long-term cointegration analysis. In addition it also investigates whether or not the impact of inflation on stock returns varies in different inflationary economies or regimes. Therefore, this chapter mainly answers the following questions: Are the UK stocks a good hedge against inflation, does the relationship between inflation and stock returns have horizon sensitivity and do inflationary economies or regimes affect the relationship between inflation and stock returns.

This chapter is organized as follows. Section 2 briefly reviews the relevant literature. Section3 describes the data. Section 4 develops empirical models. Section 5 shows the empirical results and the conclusion is presented in Section 6.

4.2 Brief Review of Literature

The empirical studies can be sorted into three distinct groups: event studies, short horizon studies, long horizon and long-term studies (Luintel and Paudyal, 2006). From the event studies, evidence shows that there is a negative (or insignificant) effect of unexpected inflation announcements on stock returns. Schwert (1981), Cutler et al. (1989), Pearce and Roley (1985), Jain (1988) McQueen and Roley (1993), Fannery and Protopapadakis (2002), Graham et al. (2002) and Adams et al. (2004) all find a significant negative effect of inflation news on the stock returns. But Joyce and Read (2002) find no significant evidence of unexpected inflation impacting on stock prices on the day of the RPI announcement in the UK market.

From the short horizon studies, a large number of studies document the cross-sectional negative relationship between stock returns and inflation. Examples include Bodie (1976), Nelson (1976), Jaffe and Mandelker (1976), Fama and Schwert (1977), French et al.(1983), Geske and Roll (1983), James et al. (1985), Kaul (1987, 1990), Peel and Pope (1988) Lee (1992), Graham (1996), Hess and Lee's (1999), Pilotte (2003), Osamah (2004) and Samer (2005). They all find that common stock returns are negatively related to inflation. However, some short-horizon studies show that the relationship could be either positive or negative varying over different time horizons, across countries, or even across different industries (see Boudouht and Richarson, 1993; Schotman and Schweitzer, 2000; Ryan, 2006) or depending on different monetary regimes, different components of inflation, inflationary economies or regimes (see Kaul, 1987, 1990; Graham, 1996; Barnes et al., 1999). Boudouht and Richarson (1993) show that there is a horizon sensitivity in the inflation-stock returns relationship and Gultekin (1983) suggests that the relationship varies across different countries. Marshall (1992) point out that the relationship varies with different components of inflation and Barnes et al. (1999) and Choudhry (2001) furthermore show that the relationship varies across different inflationary regimes. Similarly, a monetary-regime varying relationship is suggested by Kaul (1987, 1990).

In the long-horizon, most studies find that a positive relationship between inflation and stock returns while others show mixed results (Boudoukh et al., 1994; Schotman and Schweitzer, 2000; Engsted and Tanggaard, 2002; Wong and Wu 2003; Kim and In, 2005). Similarly, Ryan (2006), Ely and Robinson (1997), Anari and Kolari (2001) and Luintel and Paudyal (2006) examine the long-run relationship between inflation and stock returns in a cointegrating framework and find that goods price elasticity is greater than unity. However, also in a cointegrating framework, Ahmed and Cardinale (2005) find for the US, the UK, Germany and Japan, the results are mixed, sensitive to the data horizon and the lag length chosen. Laopodis (2006) uses the bivariate and multivariate vector autoregressive cointegrating specifications, only to find a weak negative relation.

In conclusion, the relationship between inflation and stock returns has been examined by numerous studies. Although it is still too early to conclude the inflation-stock returns relationship, more and more literatures show that this relationship varies across different time horizons. The empirical findings are mixed, could be positive, negative or neutral: negative relations are found in inflation announcement studies while positive, negative or insignificant relations are found in short horizon studies and a positive relationship is found in most long horizon or long-term cointegration analysis. In addition empirical results also show that the relationship between inflation, stock returns and inflationary economies or regimes varies in the short horizon study.

4.3 Data and Descriptive Statistics

4.3.1 Data

This study is composed of daily and monthly FTSE All Share Index (FTA), 10 industry indices named Oil and gases (OI) Basic materials (BM), Industrials (ID), Consumer goods (CG), Healthcare (HL), Consumer services (CS), Telecoms (TM), Financials (FN), Information technologies (IT) and Utilities (UT). Performance for the indices was measured by their log returns. The sample period for the investigation of the inflation announcements, determined by the availability of the indices, is from December 1962 to December 2007 for the aggregate market (FTS), from 1st January 1986 to 31st December 2007 for nine industry indices (OI, BM, ID, CG, HL, CS, TM, FN, IT) and from 9th December 1986 to 31st December 2007 for the industry index of Utilities (UT). The sample period for the short horizon study and long-term cointegration study, is from January 1955 to December 2007 for the FTA, from January 1986 to December 2007 for nine industry indices (OI, BM, ID, CG, HL, CS, TM, FN, IT) and from January 1987 to 31st December 2007 for the industry index of Utilities (UT). Daily data of FTA Share index (FTA) from December 1962 to December 1969 are collected from the Financial Times, remains of daily data of FTA are obtained from the DATASTREAM. Monthly data of the FTA from January 1955 to December 2002 are obtained from the London Stock Exchange and the remains of monthly FTA from January 2003 to December 2007 and both daily and monthly data of 10 industries are obtained from the Datastream. Daily and monthly returns for all the market indices (R_t) are the first difference of the logarithm of the price index.

The RPI over the period from June 1948 to current day is widely used as a good proxy for the UK inflation (O'Donoghue, Goulding and Allen, 2004), differing from the US in which Producer Price Index (PPI) or Consumer Price Index (CPI) is the preferred measure of inflation. Monthly announcements of the Retail Prices Index figure from December 1962 to December 2005, released regularly by the corresponding department of the UK government in the mid of each month, were hand-collected from the public press (most of them are from the Financial Times, remains are from the Times). Therefore, day t is the announcement date (or the first working day after it, if the real announcement date is a holiday), thus investors can observe the changes in inflation and adjust stock prices.[8] However, there is a lag of almost half a month between the time that the UK government collects the price data and the time when the RPI is announced, e.g. RPI figure for May 1980 is announced on the 13th June 1980. Monthly RPI data from June 1948 to December 2005 are obtained from the National Statistics Office, the base we use here is January 1987 =100.

Hence, the actual inflation rates (P_t) are equal to the first differences of logs of RPI ($P_t = \text{Ln}RPI_t - \text{Ln}\ RPI_{t-1}$), whereas the expected inflation rate is estimated from the corresponding ARIMA model of the actual inflation rate while controlling for seasonality.[9] Seasonal components are based on a lag of 12 months.[10] The expected inflation rate is estimated based on the data sample from Jun 1948 to the month before expected. For example, for the expected inflation rate in Jan 1955, the actual inflation rates from June 1948 to December 1954 are used to build a best ARIMA model and the first out of sample forecast from this ARIMA model is used to as the expected inflation rate in Jan 1955. Then, for the expected inflation rate in February 1955, the actual inflation rates from June 1948 to January 1955 are used to build a new best ARIMA model and the first out of sample forecast from this new ARIMA model is used as the expected inflation rate in February 1955, and this repeated processes are used to get all the expected inflation rates in this chapter. The expected inflation rates are the difference between actual inflation rates and the expected inflation rates ($P_t - P_t^e$).

[8] The government released the RPI on the Saturday morning sometimes happened in 1960s and early 1970s, but not afterwards.

[9] Since the RPI is not seasonally adjusted, the monthly inflation rate will be affected by seasonality. Thus we estimated both the controlling for seasonality ARIMA models and normal ARIMA models without controlling for seasonality. The figures we report and use in our following study are from the controlling for seasonality ARIMA models.

[10] Both ACF and PACF graphs suggest that the time-series of actual inflation got seasonality at a lag of 12 months.

4.3.2 Data Description

Figure 4.1 and 4.2 show the monthly and annual RPI inflation from January 1955 to December. During the whole sample period, the median annual inflation rate is 4.3% and average annual inflation is 5.90%, but was 3.64% from December 1985 to December 2007. According to a word-wide boom which causes the prices of raw materials to rise sharply in the early 1970, annual inflation rose to over 10% in most developed countries, but only a few exceeded 20%, such as UK (Artis, 1996, p.14). Figure 4.2 shows that Inflation of the UK also rose to over 10% per annum from 1971 to 1982, and even exceed 20%, higher than most of the developed countries. The annual inflation for each month from January 1971 to December 1982 is higher than 5.90% and the average rate is 13.23%, whereas the average annual inflation rate is 3.65% from January 1955 to December 1970, 4.10% from December 1962 to December 1970 and 3.82% from January 1983 to December 2007, respectively.

Panel B of Table 4.1 presents the summary statistics for inflation from January 1955 to December 2007. The sample mean of actual monthly inflation is 0.46% (S.E.= 0.0062), the mean of expected monthly inflation is 0.45% (S.E.=0.0052) and the mean of unexpected inflation is 0.0167% (S.E.=0.0046). The results of the ADF test in Table 4.7 show that actual RPI inflation (first differences of logs of Retail Price Index) is not stationary. More unit-root tests for RPI and its first difference (actual inflation rate) are conducted in the following long-run cointegration study. Since there is not a conclusive answer of whether the UK RPI is I(1) or I(2), some studies, for example, Luintel and Paudyal (2006), suggest that UK RPI can be applied as I(1). We adopted this opinion and use RPI as I(1), thus, actual inflation is used as stationary series in the following research.

Figure 4.3 and 4.4 show the monthly and annual the FTSE All Shares Index (FTA) returns. It grew at 9.85% per annum, as Figure 3.4 shows, it was fluctuant during January 1955 to December 2007 and has two important shifts: one is in January 1975, when FTA jumped by 53.66%, the other is in October 1987, when FTA dropped by 30.92%. At the industry level, Oil and gases rose to 11.53% per annum from January 1986 to December 2007, Basic materials 9.86%, Industrials 6.60%, Consumer goods 6.77%, Healthcare 9.08%, Consumer services 6.47%, Telecoms 8.94%, Financials 9.87%, Information Technology 13.91% and Utilities 11.64%. Thus, Consumer service got the minimum average while Information Technology got the maximum return during our sample period. All the industries index show higher than 20% drop in October 1987, similar as FTA. During the sample period the average annual stock market returns is 1.67 times the annual inflation rate. Similarly, at the industry level, all the industries is over one times the annual inflation, for example, Oil and gases is 1.95, Basic materials 1.67, Industrials 1.12, Consumer goods 1.14, Healthcare 1.54, Consumer services 1.10, Telecoms 1.52, Financials 1.67, Information technologies 2.36 and Utilities 1.97.

Table 4.1 Panel A presents most of the sample means of stock returns in all day horizons (one day, three days and five days) are lower than zero, thus also lower than expected inflation and unexpected inflation. However, panel C of Table 4.1 shows that all monthly stock returns both aggregate and industries is higher than zero from a low of 0.32% (S.E.= 0.0947) for Information technologies to a high of 0.90% of Utilities and some of them have higher means than both expected and unexpected inflation.

4.4 Methodology and Hypothesis Development

In order to examine the relationship between inflation and stock returns on the UK market for aggregate market and ten industries in short, medium and long-term at a variety of time horizons: announcement, short horizons and long-term cointegration, and across different inflationary economies or regimes, we impose the event study methodology, Two Stage Least Square methodology and Johansen technique of cointegration with structure breaks to test whether inflation affects stock returns. The possible pre-announcement effect, delay effect or asymmetric response of stock market to good news and bad news are also examined for the announcements investigation. The impact of inflation on stock returns varying in different inflationary economies is also examined by separate the full sample into three sub samples, before January 1971, January 1971 to December 1982, after December 1982, in the announcement study and the short-horizon study. The relationship between inflation and stock returns varying in different inflationary regimes is also estimated in the short-horizon study.

4.4.1 Announcement Effect Study

Previous studies, some examples being Schwert (1981), Goodhart and Smith (1985), Pearce and Roley (1985) Hardouvelis (1987), Jain (1988), Cutler et al. (1989), McQueen and Roley (1993), Amihud (1996), Fannery and Protopapadakis (2002), Graham et al. (2002), Adams et al. (2004), suggest that inflation announcements would affect the stock returns and provide evidence that stock returns negatively respond to inflation announcements. In this section, the impact of inflation announcements on stock returns is investigated in an event study framework. The possible pre-announcement effect, delay effect or asymmetric response of the stock market to good news and bad news is investigated. Furthermore, if the inflationary economies affect the impact of inflation news on stock returns, the inflation news might affect FTA differently in different high or low inflationary economies divided by inflation rates, thus whether inflation rate level affect the response of stock returns on inflation news will also be examined in our study.

According to the efficient market hypothesis, stock prices reflect all available public information, therefore, only unpredictable information will affect the stock prices. Consequently, only unexpected inflation which contains new information will affect the stock returns at the time when the announcement is released while expected inflation will not (Joyce and Read, 2002). We test the effect of RPI inflation (both expected and unexpected) news on stock returns of the general market (FTA) and different industry groups in five days event window following Joyce and Read (2002) and Adams et al. (2004), using equations (4.1) and (4.2). Peel and Pope (1985, 1988) argue that although equations (4.1) and (4.2) might potentially get the problem of omitted variables without other relevant news that simultaneously affect the stock returns on the same day as the inflation news, this problem could be minimized if use daily data and only focus on the relationship between stock returns and inflation. Due to the prediction of the efficient market hypothesis, we expect significant coefficients for the unexpected inflation response to stock returns but insignificant coefficients for the expected inflation. Moreover, according to the discounted cash flow model shown in equation (2.3), the effect of unexpected inflation on stock price is ambiguous, because unexpected higher inflation increases the discount rates, which lowers returns, and increases the future dividends, which increase returns, but the price elasticity of future cash flows is not necessary equal to one. Thus we do not expect the coefficients for unexpected inflation to be unity. Therefore, for each regression, we test for a stock response to inflation news consistent with the null hypothesis H_1: $\gamma = 0$, expected inflation news have no effect on the stocks, and against the null hypothesis H_2: $\beta = 0$, negative estimates of β are associated with positive unexpected inflation announcements being the bad news for stocks.

In accord with the efficient market hypothesis, no leakage of information occurs before inflation news is released by the government on the official announcement date, then the stock returns fully reflect the inflation news on the announcement date but no longer change after the announcement date. However, Goodhart and Smith (1985) suggest that the UK stock market reacts slowly to stock inflation news after testing not only the stock return on the date of the RPI announcements but also the two days stock returns (the day and the day after the announcements) and three days stock returns (the day, the day after and two days after the announcement). They find that unexpected inflation negatively affects all three days horizon stock returns and suggest that inflation news have a delay effect on the UK stock market. Thus, significant estimates of β on the date before or after the announcement imply that the preannouncement effect or the delay effect occurs.

$$R_{t+B} = \alpha + \gamma P_t^e + \beta P_t^u + \varepsilon_t \tag{4.1}$$

$$R_{\Delta At} = \alpha + \gamma P_t^e + \beta P_t^u + \varepsilon_t \tag{4.2}$$

where

R_{t+B} for B (-2, -1, 0, 1,2): the stock returns on the day $t+B$, hence, R_{t-2} the stock return on $t-2$ (two days before the announcement date), R_{t-1}, the stock returns on $t-1$ (one day before the announcement date), R_t, the stock returns on t (the announcement date), R_{t+1}, the stock returns on $t+1$ (one day after the announcement date) and R_{t+2}, the stock returns on $t+2$ (two days after the announcement date);

$R_{\Delta At}$ for A (3,5): indicates the interval over days of return are measured around the announcement date, hence, A=3, three days stock returns (the stock returns of the announcement date t, the day before and the day after); A=5, five days stock returns (the stock returns of the announcement date t, two days before and two days after);

P_t^e: expected inflation rate, which is derived from the forecast of the corresponding ARIMA model;

P_t^u: unexpected inflation rate, equal to difference between the actual inflation and expected inflation.

Moreover if a directional asymmetric effect exists in the response of stock returns to inflation, the response to bad news might be different from the one to good news. Although many studies find the evidence that the stock response to different news is hard to detect, for example, Joyce and Read (2002) find that none of them display a significant effect on stock market suggesting no asymmetric effect for the UK stock market, Adams et al. (2004) on the contrary find that both bad PPI and CPI news tends to have a greater impact than good news, thus providing evidence of this asymmetric effect for the US stock market. Therefore, we also test whether stock response to good news is different from the response to bad inflation news, following Adams et al. (2004) who suggest that asymmetric effects could be tested by the model shown in equation (4.3). For each regression, we test whether the response to higher-than-expected inflation (bad news) is of the same absolute magnitude as the response to lower-than-expected inflation (good news) against the null hypothesis H_3 : $\beta_+ = \beta_-$, the coefficients for good and bad news are different meaning that asymmetric effect occurs. D_+ are dummy variables for bad news (positive unexpected inflation) while D_- are dummy variables for good news (negative unexpected inflation).

$$R_{\Delta 3t} = \alpha_+ D_+ + \alpha_- D_- + \beta_+ D_+ P_t^u + \beta_- D_- P_t^u + \varepsilon_t \tag{4.3}$$

where

D_+=1 if unexpected inflation is larger than zero, P_t^u>0 and 0 otherwise;
D_- =1 if unexpected inflation is less than zero, P_t^u <0 and 0 otherwise.

4.4.2 Short Horizon Study

According to the extended Fisher hypothesis stock returns should move one-to-one with unanticipated inflation as well as anticipated inflation in the long run. However, most previous studies find that there is negative relationship between inflation and stock returns, which is contrary to the Fisher hypothesis. Thus, the relationship between inflation and stock returns in the short-run is examined in this section. Moreover, since two important shifts in January 1975 and October 1987 have important economic meaning for the financial market, we also test whether these two shifts affect the relationship between inflation and stock returns. Furthermore, because inflationary regimes are suggested as affecting the relationship between inflation and stock returns (De Alessi, 1975; Barnes et al. 1999 and Ahmed and Cardinale, 2005), we look at whether high or low inflationary economies affect the relationship between aggregate stock returns (FTA) in three sub-periods and further examine whether the relationship between inflation and stock returns varies in a two inflationary regimes.

We follow the methodology of Peel and Pope (1985, 1988) and the notion of Boudoukh et al. (1994) to test the relationship between stock returns and inflation (both expected and unexpected). Peel and Pope (1985, 1988) suggest that expectation and unexpected inflation should be included in the same model when testing the Fisher effect or it will get the omitted variable problem. Thus they estimate the model shown in equation (4.4) to test the relationship between inflation and stock returns. Moreover, since two important shifts occurred in January 1975 and October 1987: the FTA jumped by 53.66% in January 1975 and the FTA dropped by 30.92% while all industries dropped over 20% in October 1987. The two shifts that occurred in our sample period have very important economic meaning for the financial market. Thus we incorporate them as dummy variables in the model, shown in equation (4.5), and test whether these two shifts affect the relationship between inflation and stock returns.

Boudoukh et al. (1994) suggest that the Fisher hypothesis still holds, even allowing for variation in the coefficients of the aggregate stock market and different industry groups, since they possess different cyclical tendencies with the overall economy. Thus we adopt the notion of Boudoukh et al. (1994) to run equations (4.4) and (4.5), and the variation coefficients for the expected and unexpected inflation, positive or negative are both consistent with our expectation. Therefore, for each regression, we test for the relationship between stock returns and inflation 1) against the null hypothesis H_1: $\lambda = 0$, stock returns are either positively or negatively related to expected inflation; 2) against the null hypothesis H_2: $\phi = 0$, stock returns are either positively or negatively related to unexpected inflation. 3) against the null hypothesis H_3: $f_1 = 0$ and H_4: $f_2 = 0$, positive estimates of f_1 are associated with that the jump in January 1975 might have a positive influence on the stock returns, and the negative estimates of f_2 are associated with the crash in October 1987 have a negative influence on the stock returns.

$$R_t = \varphi + \lambda P_t^e + \phi P_t^u + \varepsilon_t \tag{4.4}$$

$$R_t = \varphi + \lambda P_t^e + \phi P_t^u + f_1 D_1 + f_2 D_2 + \varepsilon_t \tag{4.5}$$

where

R_t: ex post nominal return;

P_t^e: expected inflation rate;

P_t^u: unexpected inflation rate;

D_1 : dummy variable of the jump in January 1975;

D_2 : dummy variable of the drop in October 1987.

It is now established that sustained high inflation has a detrimental effect on an economy's long-run level of real activity while low-to-moderate rates of inflation has good consequences for economies. Ahmed and Cardinale (2005) provide empirical evidence to support that inflation does matter for equity returns. They examine the dynamic relationship between general inflation and stock returns in an inflationary regime framework and show that on the UK market, lower mean equity returns exist in higher or lower inflation. Thus, different inflationary regimes might have adverse consequences for financial markets and for long run capital performance (Barnes et al. 1999), which might affect the relationship between inflation and stock returns. Some studies suggest that common stocks ability to provide a hedge against inflation would vary from inflation to inflation (De Alessi, 1975) or varies in different inflationary economies (e.g. Barnes et al., 1999 and Choudhry, 2001). Therefore, we test whether the relationship between inflation and stock returns might vary in an inflationary regime framework following Shawky and Marathe (1995) who provide a switching regression model between two regimes: the rising stock market and the falling stock market using the Two Stage Least Square method shown in equation (4.6).[11] We suggest that the across sectional relationship between inflation and stock returns might vary in different inflationary regimes depending on the nature of the inflationary regimes under which an investor has to make his decision. Estimation of equation (4.6) requires an identifier for each regime in the sample. The inflationary regimes are defined by actual inflation rates, thus, we divide the months in our sample into two regimes by the median of actual annual inflation rate, 4.3%: "low" inflationary regime (less than 4.3%) and "high" inflationary regime (equal to or higher than 4.3%). We test for coefficient stability across low and high inflationary regimes with the

[11] Paudyal and Saldanha (1997) use Maximum Likelihood method as an alternative.

following regression of stock returns on expected and unexpected inflation using the Two Stage Least Square method:

$$R_t = \varphi_1 + \lambda_1 P_t^e + \phi_1 P_t^u + (\varphi_2 - \varphi_1)D_t + (\lambda_2 - \lambda_1)P_t^e D_t + (\phi_2 - \phi_1)P_t^u D_t + U_t \tag{4.6}$$

Where $D_t = 0$ if the actual inflation rate is lower than 4.3% at time t and $D_t = 0$ for all t identified as regime 1.

Where $D_t = 1$ if actual inflation rate is equal to or higher than 4.3% at time t and $D_t =$ 1 for all t identified as regime 2.

U_t satisfies all the basic conditions of a classical regression model. So, equation (4.6) is estimated as follows.

For $D_t = 0$, equation (4.6) becomes

$$R_t = \varphi_1 + \lambda_1 P_t^e + \phi_1 P_t^u + \varepsilon_t \tag{4.7}$$

For $D_t = 1$, equation (4.6) becomes

$$R_t = \varphi_2 + \lambda_2 P_t^e + \phi_2 P_t^u + \varepsilon_t \tag{4.8}$$

We thus test the inflation-stock returns relationship in a two inflationary regimes against the null hypothesis 1) H_1: $\lambda_1 = \lambda_2$, the relationship between expected inflation varies in the inflationary regimes 2) H_2: $\phi_1 = \phi_2$, the relationship between unexpected inflation varies in the inflationary regimes.

4.4.3 Long-Term Cointegration Study

Previous studies suggest that there is a positive long-term cointegration relationship between inflation and stock prices, some examples such as Ely and Robinson (1997) show that stocks maintain their value relative to movements in overall price over a long sample period; Anari and Kolari (2001) show that long-run elasticity of stock prices with respect to goods prices exceed unity and the initial response of stock prices is negative and thereafter becomes positive and permanent; Luintel and Paudyal (2006) apply the cointegration methodology to investigate the long-run relationship between stock prices and goods prices and find that in most of the cases, goods price elasticity is above unity; although other studies, for example Ahmed and Cardinale (2005) and Laopodis (2006), suggest mixed (either positive or negative) relations. In order to examine the long-term relationship between Retail Price Index (RPI) and the price indices of aggregate market (FTA) and different industry groups, this section tests whether stock price indices are related to inflation index in a cointegrating framework and whether structural shifts affect the relationship.

We adopt the methodology of Luintel and Paudyal (2006) to conduct the tests. Equation (4.9) shows a long-run relationship between stock prices index and inflation index. According to the Fisher hypothesis that the coefficient (*d*) should be equal to one, thus, stock prices move one-to-one with inflation. However, Luintel and Paudyal (2006) extend the Fisher effect to the tax-augmented hypothesis and explain that the return on stocks should exceed the inflation rate to compensate for the loss in the real wealth of tax-paying investors, thus, the size of coefficient (*d*) should exceed one.

$$\ln S_t = c + d \ln RPI_t \tag{4.9}$$

where

S_t: stock price in period t;

RPI_t: Retail Price Index in period t;

c, d: coefficients (d coefficient is the elasticity of stock prices with respect to goods prices).

Johansen's (1992, 1995) and Johansen et al. (2000) technique is suggested to estimate the long run relationship in Luintel and Paudyal (2006). Johansen's model and the method of reduced rank regression are also used in our tests.

Sims (1980) suggests a type of VAR model shown in equation (4.10), Where Z_t is (n x 1) and each A_i is an (n x n) matrix of parameters. Equation (4.10) can be reformulated into a VECM form, shown in equation (4.11), where Γ_i = - ($I-A_1-\ldots-A_i$) (i = 1, ..., k-1) and Π =-($I-A_1-\ldots-A_i$). $\Pi = \alpha\beta'$ where α represents the speed of adjustment to disequilibrium and β is a matrix of long-run coefficients such that the term $\beta' Z_{t-k}$ represent up to (n-1) cointegration relations in the multivariate model, which ensures that Z_t converge with their long-run steady state solutions. Allowing the entrance of the intercept and dummy variables as deterministic variables in the cointegration space, the model is rewritten as the final model shown in equation (4.12).

$$Z_t = A_1 Z_{t-1} + \ldots + A_k Z_{t-k} + \varepsilon_t \quad (4.10)$$

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \ldots + \Gamma_{k-1} \Delta Z_{t-k-1} + \Pi Z_{t-k} + \varepsilon_t \quad (4.11)$$

$$\Delta Z_t = \mu + \Gamma_1 \Delta Z_{t-1} + \ldots + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-k} + \phi D_t + \varepsilon_t \quad (4.12)$$

In our study, we only test the pare relationship between stock prices and inflation index, thus, ΔZ_t is an (2x1) vector, Z_t = [S_t, RPI_t], Γ_i and Π are (2x2) coefficient matrices, D_t are deterministic components (seasonal and structure break dummies). A cointegrated system implies that $\Pi = \alpha\beta'$ is reduced rank, r, for r<2. We expect that r =1, which means there is a relationship between stock prices and inflation index.

The following procedures are imposed in applying Johansen's techniques: Firstly, unit root test to test the order of integration of each variable that enters the multivariate model. Both ADF (Dickey and Fuller, 1979, MacKinnon, 1991) under the null hypothesis of a unit root and KPSS (Kwiatkowski et al. 1992) under the null hypothesis of stationary are used in our study. Moreover, since Harris and Sollis (2003, p76) suggest that the Ng and Perron test (Ng and Perron, 2001) based on de-trending the ADF test with lag structure set is an appropriate test to macroeconomic factors which might have negative MA coefficients, we also adopt Ng and Perron GLS detrended test to test the RPI. In order to test whether the data series has any structure breaks and when these breaks occur and whether or not a break dummy should enter the cointegration space, we also conduct Perron (1997) sequential unit root test which allows the breaks in intercept and/or the trend.

Secondly, we determine VAR lag length setting. The appropriate lag length of the vector autoregrssion (VAR) model are selected following likelihood ration (LR) (Sims, 1980) tests and multivariate Akaike information criterion (AIC) and Hannan-Quinn (HQ) criterion. The AIC search between k-max = 20 and k-min=10 is restricted in our study. We prefer HQ criterion if AIC and HQ suggest different values of k following Johanson's (2000) suggestion for common practice. Between the lags suggested by different criterions, the lag is selected by the uncorrelated VAR residuals.

Thirdly, we identify intercepts, trends, seasonality or structure breaks. Aiming to find whether there are intercept or trends or seasonality or structure breaks in the data and whether the deterministic variables (a constant and trend) or the seasonal dummy variables or structure breaks should enter the cointegration space, we follow Johansen (1995) which uses centered seasonal dummy variables that shift the mean without contributing to the trend if seasonality exists and employ Perron (1997) sequential unit root tests to identify the break date endogenously. The Perron (1997) test considers three models: 1) Those with a break in the intercept, 2) Those with a break in the trend and 3) Those with a break in both the intercept and trend, and then endogenously search for the breakpoints by the smallest t-statistic.

Finally, running equation (4.12) and testing for unique cointegration vectors and performing a joint test involving restrictions on α and β.

4.5 Empirical Results

This section empirically examines the relationship between inflation and stock returns of the UK aggregate market and ten industry sectors in the following order. Firstly, the announcements effect of inflation news on stock returns is estimated using the event study methodology. The pre-announcement effect, delay effect, asymmetric effect and three subsamples periods are also examined. Secondly, the relationship between inflation and stock returns at short horizon is estimated and whether or not the relationship varies in different inflationary economies or regimes is estimated using two stage least square. Finally, the long-term relationship between the Retail Price Index and stock indices is estimated using Johansen cointegration methodology and the structure breaks and seasonality are also considered.

4.5.1 Effects of Inflation Announcements on Stock Returns

This section extends Goodhart and Smith (1985) and Joyce and Read (2002) research and use far longer sample periods and industry-level indexes to examine the announcement effect of inflation on stock returns and the different response of aggregate market in three sub-sample periods. Table 4.2 reports the results of estimating equations (4.1) and (4.2): inflation response coefficients, standard errors and p-values from a series of regressions of stock returns on expected inflation and unexpected inflation. The table reports calendar return horizons including 1 day, 3 days and 5 days. Table 4.2 shows that expected inflation has no significant effect on stock returns on and around the announcement date. The hypothesis H_1: $\gamma = 0$ almost always cannot be rejected for the aggregate market, only with two exceptions, that a positive effect of expected inflation on the aggregate market (FTA) two days after the announcements day and at three days horizon in full sample period. Table 4.1 also show that expected inflation affect FTA two days before the announcement, on the announcement day, at three days horizon and at five days horizon in the subsample period 12/1962-12/1970. However, in the subsample periods of 1/1971-12/1982 and 1/1983-12/2007, the expected inflation has no impact on stock returns of aggregate and all industries.

Table 4.2 also shows a strong negative correlation between unexpected inflation and stock returns at three days horizon but not on and around the announcement day. For the full sample period of the aggregate market (FTA), the estimates of the coefficients β for the unexpected inflation shows a significantly negative figure, -0.31, which means the three days returns of FTA falls by 0.31% in response to an increase in unexpected inflation of 1%. It also shows that for the full sample period, seven out of ten industries named Basic materials, Industrials, Consumer goods, Consumer services, Telecoms, Financials and Utilities respond significantly and negatively to the unexpected inflation varying from a low of -1.03 for Telecoms to a high of -0.71 for Consumer services at three days horizon while only Financials (FN) responded negatively to the unexpected inflation on the announcement day and the rest nine industries have no significant responses. The response of the aggregate market to unexpected inflation is different in three subsample period. The unexpected inflation negatively affects the aggregate stock market on the announcement day, the day before and within the three days horizon in the subsample period 12/1962-12/1970 and on the announcement day and within the three days horizon in the subsample period 01/1971-12/1982, while it has no significant effect on aggregate market in the subsample period 01/1983-12/2007.

This table yields three important insights. Firstly, consistent with the efficient market hypothesis, our findings provide evidence of the negative effect of unexpected inflation on stock returns while little evidence has been found for expected inflation. The significantly negative effect found for the RPI inflation announcements is consistent with that expected and means that we see unexpected increase in inflation as bad news for the stock market since this leads to a reduction in stock prices. Our findings are also consistent with previous studies suggesting inflation announcements negatively affect the stock market for example Goodhart and Smith (1985) who report unexpected inflation has a significantly negative effect on the UK stock market and studies on other countries, e.g. the US evidence of effects of CPI announcements, PPI announcements (or both) provided by Schwert (1981), Pearce and Roley (1985), Hardouvelis (1987), Culter et al. (1988), Jains (1988), McQueen and Roley (1993), Flannery and Protopapadakis (2002), Graham et al. (2003) and Adams et al. (2004) or Israel general stock market evidence provided by Amihud (1996). Moreover, our results also suggest that returns of industry groups are affected by the RPI inflation announcements, which is consistent with Amihud (1996) that provides strong evidence of the effect of inflation on industry level indexes in Israel market.

Secondly, in contrast to the efficient market hypothesis that the stock returns only fully respond to the inflation news on the announcement date, not before or after the announcement date, the inflation announcements in our study significantly affect stock returns within the three days horizon, but not on the announcement day, the day before or the day after. It reveals that unexpected inflation news impact the stock market slowly and provides weak evidence that a leakage of official inflation figures might exist one day before announcement released by the government precipitating a delay effect. Although the magnitude of the reaction is small and insignificant, the evidence that the stock returns accumulate so that they significantly react to the unexpected inflation at the three days horizon still suggest the leakage and a delay effect, consistent with Schwert (1981) that reports the leakage of inflation information occurs for the days prior to the announcement in the US. This finding contradicts our expectations but is also consistent with Goodhart and Smith (1985) who find that RPI inflation news affects aggregate stock markets on the day of announcement and the day after the announcement which implies that inflation announcements affect the stock market slowly, but inconsistent with Joyce and Read (2002) who find that neither expected nor unexpected inflation news have any significant influence on stock returns on the day of RPI announcements or previous studies which show that that the UK inflation announcements (CPI, PPI or both) have a negative effect on daily returns of the announcement day.

Thirdly, consistent with previous studies which suggest that the relationship between inflation and stock returns vary in different inflationary economies, for example, Barnes et al. (1999), our findings also suggest that high inflation rates also impact the response of stock returns to inflation announcements. There is the huge difference in the annual inflation for three subsample periods, 4.10% for 12/1962-12/1970, 13.23% for 01/1971-12/1982 and 3.82% for 01/1983-12/2007. Table 4.2 shows that there is no significant coefficient found for inflation news at any time horizon in the high inflation period (01/1971-12/1982) whereas significantly negative effect of unexpected inflation are found on the announcement day and at three days horizon in the low inflation periods of 12/1962-12/1970 and 01/1983-12/2007. Thus our finding is consistent expectations. We expected to see in high inflation periods, stock prices that fully reflected information of inflation, and unexpected inflation has no effect on stock returns. Market participants already have an expectation for higher inflation rates during the high inflation period, therefore, any higher than expected inflation does not affect the stock prices since that has already been anticipated and a slightly lower than expected inflation does not matter for the stock market either, since the inflation rate is high enough.

Since we find that unexpected inflation negatively affects stock returns at three days horizon, whether or not the three-day stock returns responds differently to positive unexpected inflation and negative unexpected inflation is tested in this section. Table 4.3 presents the results of response coefficients, standard errors and p-values from a series of regressions of stock returns on two groups of unexpected inflation and to higher-than-expected inflation (bad news) and lower-than-expected inflation (good news) of estimating equation (4.3). Our results show little evidence of the directional asymmetric effect, since the hypothesis H_3: $\beta_+ = \beta_-$ only can be rejected for Consumer goods (CG) but not for the aggregate market or the rest of the nine industries.

Therefore, our results suggest that stocks do respond to unexpected component of RPI announcements (unexpected inflation) but not to the expected component of RPI announcement (expected inflation) and the response to unexpected inflation are slow. During the higher inflation period, inflation news (both expected and unexpected) has no impact on stock returns. Moreover, our results provide no evidence of directional asymmetry and suggest that investors have no preference for bad news or good news.[12]

4.5.2 The Relationship between Inflation and Stock Returns at Short Horizons

We estimate the relationship between inflation and stock returns using equation (4.4). Table 4.3 reports estimated results of coefficients and p-values from a series of regressions of stock returns on expected inflation and unexpected inflation. Table 4.3 shows that for the full sample period, only expected inflation significantly and positively affects the aggregated stock market (FTA) while unexpected inflation has no significant effect. For three subsample periods, neither expected nor unexpected inflation has any effect on aggregate market in subsample period 1/1955-12/1970, only expected inflation significantly and positively affects the aggregate market while unexpected inflation does not in the subsample period 1/1971-12/1982, and only unexpected inflation significantly and negatively affects the aggregate market while expected inflation has no effect in the subsample period 1/1983-12/2007. Table 4.3 also shows that for the full sample period, all industries have no significant coefficients for expected inflation, but seven out of ten industry groups named Basic materials, Industrials, Consumer goods, Consumer services, Telecoms, Financials and

[12] We also use the expected inflation rates from the ARIMA models without controlling for seasonality to handle all the tests here. We compared previous results with the results using expected inflation rate from the ARIMA model without controlling for seasonality, we got the similar results in both tests, but the results from the tests using the expected inflation rates from the ARIMA model controlling for seasonality had more significant coefficients. It showed that seasonality does affect the tests but does not affect the basis information revealed by the tests and if controlling for seasonality we get better results. Hence, we only report the results of the expected inflation rate from ARIMA models while controlling for seasonality.

information technology have significantly negative coefficients for unexpected inflation varying from a low of -6.29 for information technology to a high of -2.92 for Basic materials.

In order to find out whether or not the important shifts in Jan. 1975 and Oct. 1987 affect the relationship between inflation and stock returns, we also examine the response of stock returns to inflation and these two shifts using equation (4.5). Table 4.5 reports coefficients and p-values from a series of regressions of stock returns on expected inflation and unexpected inflation with two dummies (January 1975 and October 1987). It shows that the two dummies variables do affect the stock returns. The jump in January 1975 positively affects the stock returns at a highly significant level, the coefficients of which are 0.406 for FTA in full sample period and 0.395 in subsample period1/1971-12/1982. Similarly the crash in October 1987 also has a negative effect on stock returns at a highly significant level for the FTA and all ten industries varying from a low of -4.16 for Consumer goods to a high of -1.119 for Utilities. The relationship between inflation and stock returns is not affected by these two events. After adding these two dummies, the significant observations or the sign of the coefficients for the aggregate market and ten industries in Table 4.5 are almost the same as the ones in Table 4.4.

Our results shown in Table 4.4 and 4.5 suggest that the relationship between inflation and the aggregate stock returns (FTA) in the short horizon could be positive, negative, or insignificant. These two tables show that expected inflation could either positively or insignificantly affect stock returns and unexpected inflation could either negatively or insignificantly affect stock returns, consistent with some studies as Gultekin (1983), Kaul (1987, 1990) and Graham (1996). During the higher inflation period 1/1971-12/1982, significantly positive coefficients are found for expected inflation, consistent with the Fisher hypothesis, while in the two lower inflation periods no significant coefficients are found for expected inflation. Similarly, significantly negative coefficients for unexpected inflation are only found in one of lower-inflation sample period, 1/1983-12/2007, but not in the rest of the two sample periods. This is inconsistent with Fisher hypothesis. Thus the extended Fisher hypothesis which states that both expected and unexpected inflation should move one-to-one with stock returns can be partly rejected in our study.

These results generally support previous studies suggesting that the aggregate UK market, different from other stock markets, positively or insignificantly responds to expected inflation, for example, Peel and Pope (1985, 1988) provide evidence of significant positive relationship between expected inflation and the UK stock returns, Gultekin (1983) shows an insignificant relationship between expected inflation and the UK stock returns, Kaul (1987, 1990) and Liu et al. (1993) show an insignificant relationship between expected inflation and the UK real stock returns allowing the real activity (industrial production or real GNP) as an explanatory factor in the model. However, our finding is contrary to most of the studies examining the US market and other stock markets which report negative relationship between expected inflation and stock returns. Similarly, our results also provide mixed support for previous studies either suggesting an insignificant relationship between unexpected inflation and stock returns or a significantly negative relationship between them. while others show a negative relationship between them, for example, Solnik (1983) and Peel and Pope (1985, 1988) both show a significant negative relationship between unexpected inflation and stock returns and Gultekin (1983), Kaul (1987, 1990) and Liu et al. (1993) who show an insignificant one.

Our finding, that the relationship between expected inflation and aggregate stock returns is positive in the high inflation period 1/1971-12/1982 while the relationship between unexpected inflation and aggregate stock returns is strongly negative in the low inflation period 1/1983-12/2007 is consistent with some studies which suggest that the relationship between inflation and stock returns vary across different inflationary economies, for example, Barnes et al. (1999) who find that inflation-stock returns relationship is related to different economies: negative for low-to-moderate inflation economies, but positive for high inflation economies and Choudhry (2001) who finds that a positive relationship between current nominal stock market returns and current inflation occurs in four high inflation countries in Latin and Central American.

The results we found, that the relationship between unexpected inflation could be either negative or insignificant for the aggregate market and strong negative for industries groups in the section can be explained by Boudoukh et al. (1994). Boudoukh et al. (1994) suggest that the Fisher hypothesis still holds, even allowing for variation from negative to positive in the coefficients for the unexpected inflation, since unexpected inflation influence expectations of future real economy and a negative relationship between unexpected inflation and stock returns only signals the negative relationship between inflation and real economic activity.

Previous results suggest that inflationary economies might affect the inflation-stock returns relation, thus, we examine whether the relationship between inflation and stock returns varies in a two inflationary regime framework using equations (4.6), (4.7) and (4.8). Table 4.6 presents coefficients from a series of regressions of stock returns on expected inflation and unexpected inflation in a two inflationary regime market, regime 1 presents periods of low inflation (< 4.3%) whereas regime 2 presents periods of high inflation (>= 4.3%). Table 4.6 shows that the relationship between expected inflation and the aggregate market for the full sample period do vary in different inflationary regimes: insignificant in low inflationary regime but significantly positive at 0.963 in high inflationary regime, whereas this variation is not found in period 1/1986-12/2007. For the sample period 1/1986-12/2007, the relationship between unexpected inflation and the FTA vary across two inflationary regimes: insignificant in low inflationary regime but significantly negative in high inflationary regime. Similarly, all 10 industries show regime difference with two exceptions, Telecoms and Information technology. The relationship between unexpected inflation and stock returns of eight industries is insignificant in low inflationary regime but significantly negative varying from a low of -7.81 for Utilities to a high of -4.86 for Oil and gases while the relationship between expected inflation and stock returns of all industries is all insignificant in both regimes. Therefore, consistent with what we expected, our finding show that the relationship between inflation (either expected or unexpected) and stock returns varies in different inflationary regimes. Inflation (expected or unexpected) only significantly affect stock returns in the high inflationary regimes in the short horizon study. Our findings are consistent with previous studies, for example, De Alessi (1975) who suggests that whether or not common stocks provide a hedge against inflation would depend upon other factors and vary from inflation to inflation.

4.5.3 The Long-Run Relationship between Inflation and Stock Returns

Since previous studies suggest that there is a positive long-term cointegration relationship between inflation and stock prices, this section investigates the relationship between the Retail Price Index and the price indices of the general market and different industries in a Johansen cointegrating framework. We also consider whether or not structural shifts affect the relationship.

Figure 4.5 and 4.6 show log levels of the RPI, FTA and ten industry price indices as well. Although none of the time series are stationary and even contain stochastic trends, Figure 4.5 and 4.6 shows that they tend to move together over the long run, suggesting the existence of a long-run equilibrium relationship. Two or more variables are cointegrated if one or more linear combinations of the variables are stationary. It might happen in our study, from these two figures, we can see that stock prices and inflation index might be cointegrated, since it appears that the stochastic trends of the variables moving towards the same long term equilibrium.

We conduct the unit root test before doing the cointegration test. Panel A of Table 4.7

reports the results of unit root tests for all the indices. Results for ADF (Dickey and Fuller, 1979, MacKinnon, 1991) under the null hypothesis of a unit root and KPSS (Kwiatkowski et al. 1992) under the null hypothesis of stationary show that except RPI all other indices show as I(1) process although ADF and KPSS tests give slightly conflict with the results for the Oil and gases and the Consumer goods, both tests all mainly suggest that these two series are I(1) process. The ADF test cannot reject RPI has a unit root at the log level and the first difference. Similarly, KPSS test reject RPI is stationary neither at the log level nor at the first difference. All of them suggest that RPI might be I(2) or a higher process. Since Harris and Sollis (2003, p.76) suggest that the Ng and Perron test (Ng and Perron, 2001) based on a de-trending ADF test with lag structure set is an appropriate test for macroeconomic factors which might have negative MA coefficients. Since RPI got negative MA coefficients, we also adopt the NP GLS detrended test to test RPI. However, Panel B of Table 4.7 shows that RPI could be a higher process than I(1). Previous studies argue that RPI is either I(1) or I(2) and since previous studies are inconclusive, we adopt Luintel and Paudyal's (2006) idea which uses RPI as I(1) in the following tests.

We also select the possible structure breaks from the tests based on Perron (1997) sequential unit root tests to identify the break date endogenously. Table 4.8 reports RPI has a significant structure break in August 1973, two industries: Basic materials and Industrials show a significant structure break in April 2002 and Consumer services has significant structure break in July 2001. These breaks will enter the Johansen cointegrating framework as the dummy variables. Two important events: the jump in January 1975 and the crash in April 1987 as mentioned in previous sections cannot be detected in any of the series. However, since these two events have important economic meanings and show significant effect in previous tests (see Table 4.5), we also use them as the structure break dummies in the following cointegration test (Luintel and Paudyal, 2006).

The VAR lag length setting is conducted following the likelihood ration (LR) (Sims,

1980) tests and multivariate Akaike information criterion (AIC) and Hannan-Quinn (HQ) criterion to get the appropriate lag. The AIC search between k-max = 20 and k-min=10 is restricted in our study as Luintel and Paudyal (2006). Thus depending on the uncorrelated residual, we start by selecting the lag from the lag indicated by AIC and HQ to that indicated by the LR. If AIC and HQ suggest different values of k, e.g. AIC suggests lag 20 for Utilities while HQ suggests lag 13, we prefer HQ criterion following Johanson's (2000) suggestion. If different criterions suggest different lags, we select the lag by the uncorrelated VAR residuals. Table 4.9 reports the results of VAR lag length setting.

Based on the selected lags, the Johansen cointegration test is conducted using equation (4.11). Panel A of Table 4.10 reports the trace statistics between pairs of stock indexes and RPI and the cointegrating vectors from the cointegration tests without dummy variables but with intercepts in the cointegration framework. The trace tests show that the FTSE All Share Index and the Retail Price Index are cointegrated and suggest a long-run relationship between them. Moreover, coefficient beta, 1.20, is significantly positive. 4 pairs of stock indexes (Oil and gases, Basic materials, Telecoms and Utilities) and RPI are cointegrated and their coefficients beta is 3.35, 2.03, 0.61 and 3.44, respectively but the coefficient beta for Telecoms, 0.61, is insignificant while the rest of the three are all significant. Thus the retail price elasticity of stock returns is over unity.

Our findings are generally consistent with what we expected. We expected to see the coefficient beta greater than unity, thus, consistent with the tax-augmented hypothesis which states that the long-run cointegrated beta for inflation should be greater than unity to compensate the stock holders for taxpaying. Our finding is generally consistent with Luintel and Paudyal (2006) who show that most cointegrating betas are positive and above unity.

We also test that long-term cointegration relationship between inflation and stock prices in a Johansen cointegrating framework with structure breaks and seasonality using equation (4.12). Since RPI show strong seasonality in previous tests, we allow the seasonal dummy variables to be included in the cointegration space following Johansen (1995) which uses centred seasonal dummy variables that will shift the mean without contributing to the trend. The structure breaks detected by Perron (1997) shown in Table 4.8 and two important economic events: January 1975 and October 1987 are also allowed to enter the cointegration space as dummy variables. Panel B of Table 4.10 reports the results of the estimated model including seasonality dummies and structure breaks dummies. The trace tests show that the FTSE All Share Index and the Retail Price Index is cointegration and the coefficient beta, 1.21, is significantly positive. 4 pairs of stock indexes (Basic materials, Telecoms, Financials and Utilities) and RPI are cointegrated and their coefficients beta is 1.73, 0.77, 0.92 and 0.61 and 3.43, respectively but the coefficient beta for Financials is insignificant while the rest of the three are all significant. Thus most of the retail price elasticity of stock returns is greater than unity.

We expected to see more industries and RPI are cointegrated after controlling for seasonality and structure breaks. However, our findings are contrary to those expected, and hence inconsistent with Luintel and Paudyal (2006) which show that more industries and RPI are cointegrated after controlling for seasonality and structure breaks.

Therefore, our results suggest that there is a long-run relationship between stock prices and the Retail Price Index and the estimates retail price elasticity are significantly above unity and controlling for seasonality and structure breaks does not produce improvements in the tests.

In conclusion, our results suggest that the relationship between inflation and stock returns has horizon sensitivity: the relationship is negative in the announcements studies, could be either positive or negative in the short-horizon studies, and positive in the in the long-horizon or long-term cointegration studies, which is consistent with most former studies, for example, Boudouht and Richarson (1993), Schotman and Schweitzer (2000), Wong and Wu (2003), Kim and In (2005) and Ryan (2006). In addition, we also find that the relationship between inflation and stock returns relations varies in inflationary economies and different inflationary regimes.

The results also show that only unexpected inflation announcements have a negative impact on the UK stock market while expected inflation announcements have little impact, but unexpected inflation affect the stock market slowly and no directional asymmetry effects occur. Moreover, although two important shifts occurring in January 1975 and October 1987 significantly affect the stock returns, they do not affect the relationship between inflation and stock returns in the short-horizon study. Similarly, in the long-term cointegration analysis, these two events along with other structure breaks and seasonality do not affect the long-run relationship between stock prices and the Retail Price Index.

4.6 Summary

Investors have considered whether common stocks are a good hedge against inflation for a long time. Many studies that investigate the relationship between inflation and stock returns either use the event study method to examine the inflation announcements effect, or the short-run relationship between them, or the long-term cointegration analysis and provide mixed evidence (positive, negative or insignificant). This chapter aims to examine the relationship between the inflation and stock returns on the UK market for aggregate market and ten industries as well in short, medium and long-term at a variety of time horizons: announcement, short horizon and long-term cointegration analysis. This chapter also attempts to provide insights into pre-announcement effect, delay effect or asymmetric effect of inflation announcements on stock returns. Moreover, since previous studies show that the inflation-stock returns relationship is not stable, it might vary across different inflationary economies or regimes, this chapter also attempts to examine the impact of inflation on stock returns varying in different inflationary economies or regimes.

Results presented in this chapter are consistent with most former studies, for example, Boudouht and Richarson (1993), Schotman and Schweitzer (2000), Wong and Wu (2003), Kim and In (2005) and Ryan (2006), who suggest that the relationship between inflation and stock returns has horizon sensitivity. We find that unexpected inflation announcements negatively, but slowly, affect stock returns while expected inflation has little impact in the announcement study. A positive relationship between expected inflation and stock returns and a negative relationship between unexpected inflation and stock returns are found in the short-horizon study. A positive and greater than unity long-term relationship is documented in the long-term cointegration analysis. Therefore, our findings are consistent with studies which show that the relationship between inflation and stock returns is negative in the announcements studies, could be either positive or negative in the short-horizon studies, and positive in the in the long-horizon or long-term cointegrated studies. Thus, the UK stock market provides a good hedge against inflation in the long run but fails to hedge against inflation in the short run.

Furthermore, consistent with previous studies, it is found that the relationship between inflation and stock returns relations vary in both inflationary economies and regimes. In the announcement study, we find that inflation news has no impact on the aggregate stock returns in high inflation economy while it negatively affects the aggregate stock returns in the low inflation economy. Similarly, it is found that in the short-horizon study, the relationship between expected inflation and aggregate stock returns is positive in high inflation economy while the relationship between unexpected inflation and aggregate stock returns is strong negative in the low inflation economy. Therefore, our findings generally suggest that the relationship between inflation and stock returns vary in different inflationary economies. Moreover, in the short-horizon study, we find that inflation (either expected or unexpected) only significantly affects stock returns in the high inflationary regimes but not in the low inflationary regime, which suggests that the relationship between inflation (either expected inflation or unexpected inflation) and stock returns varies in different inflationary regimes. Therefore, whether the stockholders could avoid inflation risk also depends on the inflationary economies and inflationary regimes.

The results in this chapter also show that only unexpected inflation announcements have a negative impact on the UK stock market while expected inflation announcements have little impact, but unexpected inflation affect the stock market slowly, providing a weak evidence of the preannouncement and delay effect. Moreover, no evidence of directional asymmetry effect is found in this chapter. Therefore, our finding implies that the announcements of higher-than-expected inflation will be the bad news for the stock while the announcements of lower-than-expected will on the contrary be the good news. A leakage of information might occur before the inflation news is officially announced and stock market responds to the inflation news slowly. And investors have no preference for bad news or good news of inflation.

A mixed relationship between inflation and stock returns, which could be positive, negative, or insignificant, is shown in this chapter. Two important shifts in January 1975 and October 1987 significantly affect the stock returns but the relationship between inflation and stock returns are not affected by these two events in the short-horizon study. After adding these two dummies, the significant observations or the sign of the coefficients do not change. Similarly, in the long-term cointegration analysis, these two events along with other structure breaks and seasonality do not affect the long-run relationship between stock prices and the Retail Price Index. It is found that the estimates of retail price elasticity are significantly above unity. Controlling for seasonality and structure breaks does not produce improvements in the long-term cointegration test.

In conclusion, our findings suggest that whether or not the UK common stocks provide a hedge against inflation would depend upon not only the stock-holding periods but also on different inflationary economies or different inflationary regimes. Thus stockholders can change the holding period to deal with the inflation risk since in a short run, stocks fail to hedge against inflation while in a long run they provide a good hedge against inflation. However, different inflationary economies or different inflationary regimes also affect the relationship between inflation and stock returns. Investors need to consider what inflationary economies they are in as well.

Figure 4.1: Monthly Inflation Rate (Retail Price Index) in Percentages

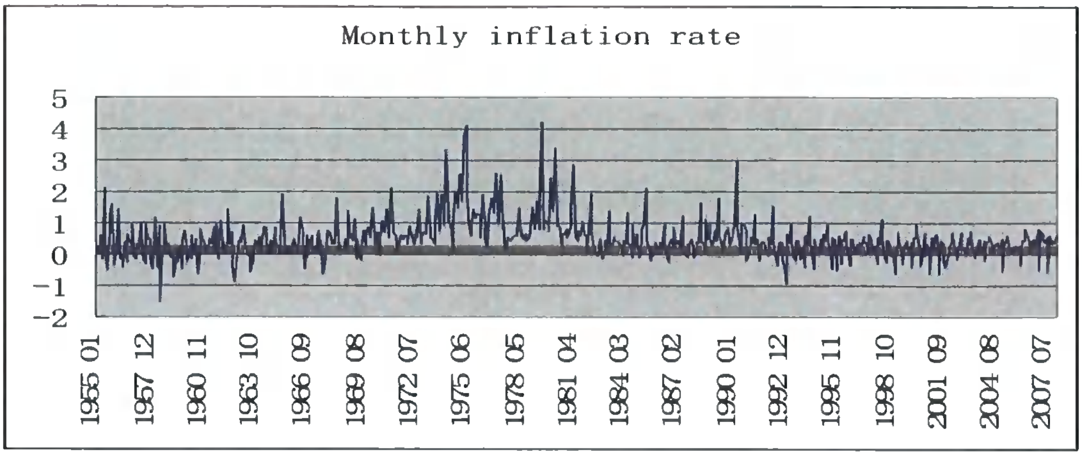


Figure 4.2: Annual Inflation Rate (Retail Price Index) in Percentages

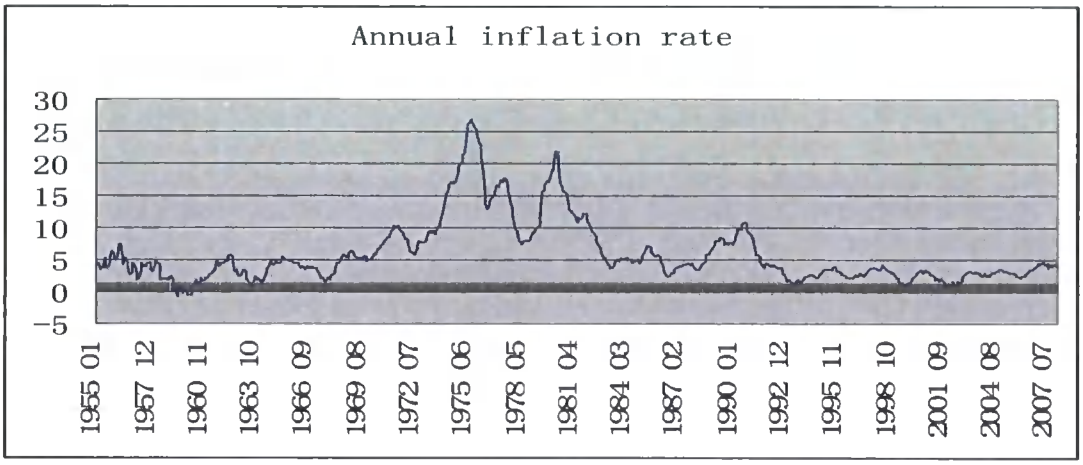


Figure 4.3: Monthly Stock Returns (FTSE All Share Index) in Percentages

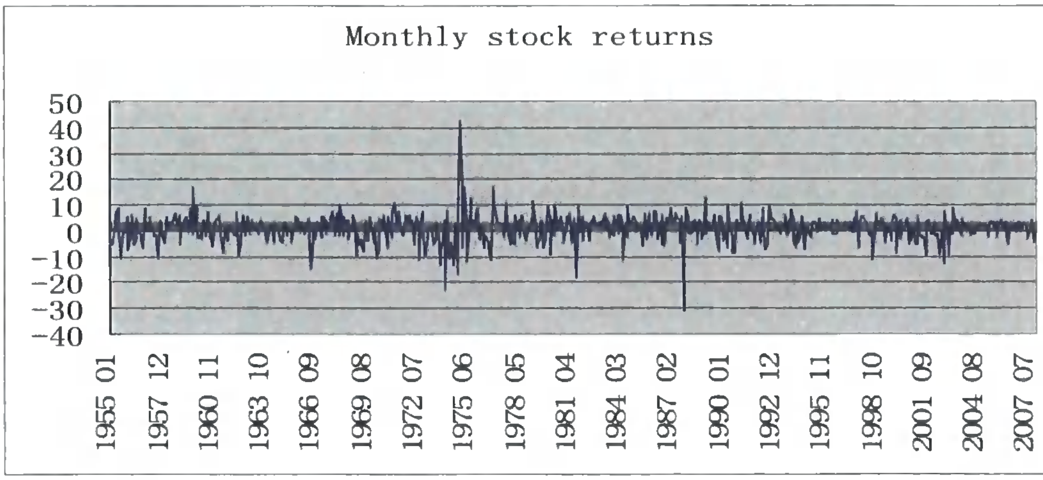


Figure 4.4: Annual Stock Returns (FTSE All Share Index) in Percentages

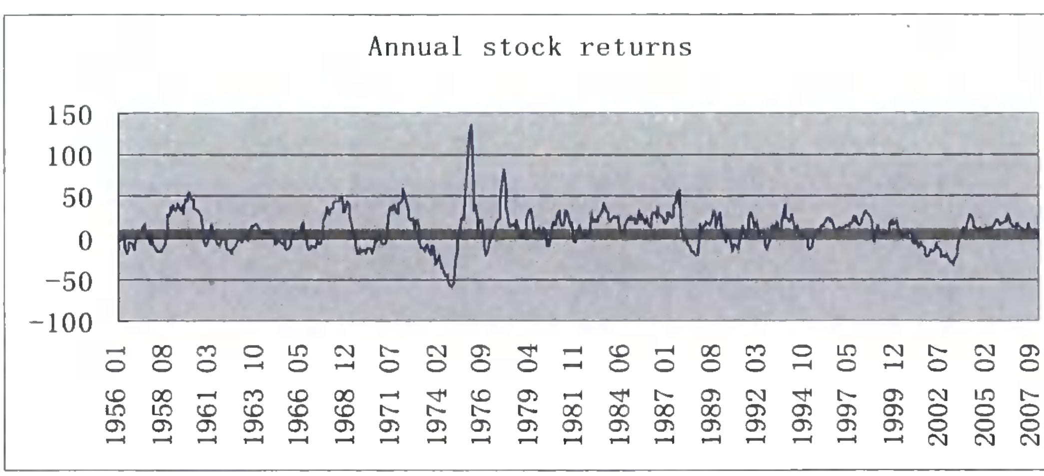
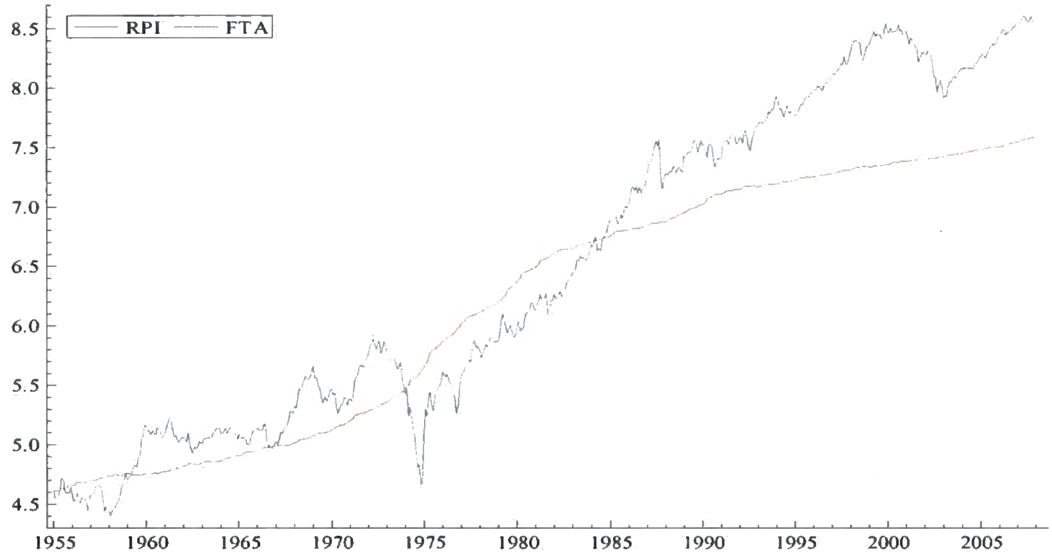
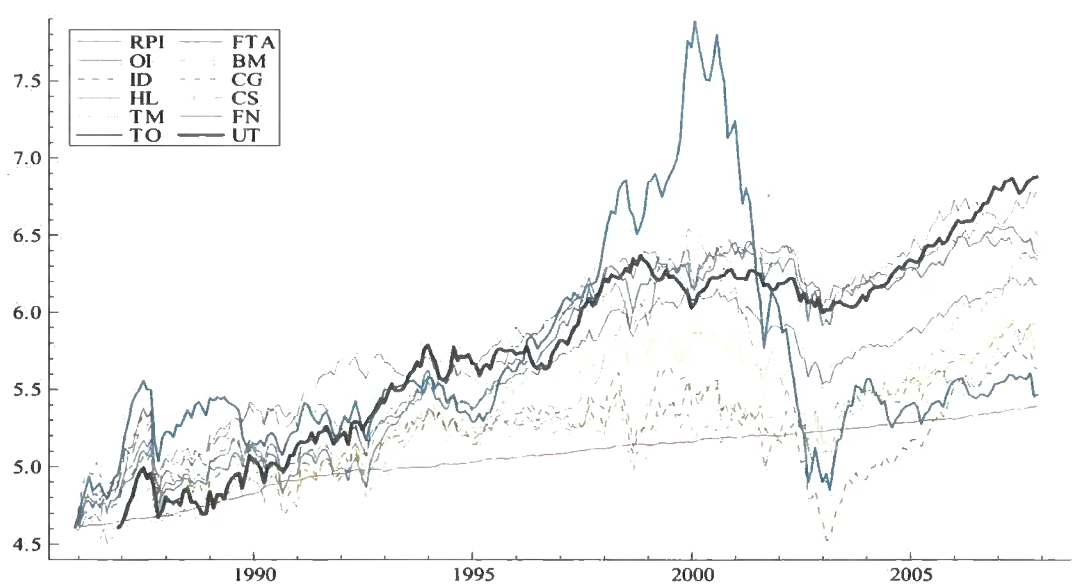


Figure 4.5: Retail Price Index and FTSE All Share Index



Note: RPI is the log level of Retail Price Index and FTA is the log level of FTSE All Share Index. Sample period is from January 1955 to December 2007.

Figure 4.6: Retail Price Index, FTSE All Share Index and Industry Indices



Note: RPI is the log level of Retail Price Index and FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT is the log level of FTSE ALL Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively. Sample period is from December 1986 1955 to December 2007.

Table 4. 1: Summary Statistics

Panel A: Daily Stock Returns

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
R_{t-1}											
mean	0.0007	0.0010	0.0026	-0.0007	0.0016	0.0007	0.0004	-0.0004	0.0006	-0.0001	0.0017
medi	0.0012	-0.0002	0.0013	0.0008	0.0002	0.0008	0.0006	-0.0026	0.0000	0.0001	0.0012
Max	0.0361	0.0384	0.0605	0.0266	0.0517	0.0282	0.0267	0.0530	0.0526	0.0687	0.0380
Min	-0.0378	-0.0432	-0.0621	-0.0700	-0.0377	-0.0264	-0.0309	-0.0326	-0.0502	-0.0541	-0.0271
S-d	0.0110	0.0146	0.0156	0.0138	0.0141	0.0104	0.0096	0.0157	0.0146	0.0207	0.0099
Skew	0.0743	-0.2534	-0.1856	-1.7400	0.6636	-0.1385	-0.3033	0.6972	0.3303	0.5100	0.4151
J-B	27.39	4.5065	75.24	215.59	20.68	1.1957	14.74	12.02	47.41	18.38	20.95
R_t											
mean	-0.0016	-0.0014	0.0001	-0.0022	-0.0015	-0.0014	-0.0011	-0.0026	-0.0020	-0.0056	-0.0014
medi	0.0006	0.0007	0.0004	-0.0007	-0.0012	-0.0011	-0.0002	-0.0018	-0.0005	-0.0015	-0.0010
Max	0.0236	0.0273	0.0316	0.0158	0.0271	0.0200	0.0255	0.0360	0.0269	0.0508	0.0156
Min	-0.0542	-0.0608	-0.0891	-0.0563	-0.0511	-0.0481	-0.0395	-0.0726	-0.0600	-0.1212	-0.0465
S-d	0.0104	0.0142	0.0139	0.0117	0.0128	0.0107	0.0101	0.0164	0.0125	0.0257	0.0091
Skew	-1.7787	-1.3952	-2.7342	-2.1704	-1.3443	-1.2517	-0.6777	-1.1111	-1.5782	-1.3019	-1.5436
J-B	236.37	74.50	1309.26	287.82	92.58	72.42	35.13	73.60	196.47	91.61	160.01
R_{t+1}											
mean	-0.0008	-0.0003	-0.0006	0.0000	-0.0020	-0.0008	-0.0004	-0.0022	-0.0007	-0.0035	0.0012
medi	0.0002	0.0009	0.0000	-0.0004	-0.0014	-0.0005	-0.0004	-0.0011	0.0001	-0.0020	0.0008
Max	0.0289	0.0331	0.0326	0.0383	0.0220	0.0355	0.0459	0.0363	0.0535	0.0575	0.0331
Min	-0.0425	-0.0536	-0.0536	-0.0385	-0.0881	-0.0614	-0.0312	-0.0492	-0.0376	-0.0617	-0.0344
S-d	0.0105	0.0136	0.0137	0.0120	0.0146	0.0128	0.0109	0.0160	0.0129	0.0201	0.0101
Skew	-0.6614	-0.9304	-1.0175	-0.4171	-2.5294	-1.0980	0.5226	-0.2561	0.1979	0.0302	-0.2844
J-B	37.37	36.78	61.82	22.42	661.09	116.02	42.209	2.2288	53.15	6.7563	35.290
$R_{\Delta 3t}$											
mean	-0.0017	-0.0008	0.0021	-0.0029	-0.0020	-0.0014	-0.0010	-0.0051	-0.0021	-0.0092	0.0015
medi	-0.0002	0.0013	0.0023	0.0013	-0.0011	0.0000	0.0007	-0.0035	-0.0009	-0.0027	0.0032
Max	0.0339	0.0418	0.0773	0.0410	0.0469	0.0411	0.0307	0.0681	0.0419	0.1575	0.0714
Min	-0.0905	-0.1228	-0.0997	-0.1612	-0.1665	-0.0645	-0.0634	-0.0945	-0.1331	-0.1735	-0.0541
S-d	0.0167	0.0254	0.0250	0.0252	0.0268	0.0184	0.0177	0.0261	0.0219	0.0419	0.0168
Skew	-1.6924	-1.4347	-0.9588	-3.1523	-2.5251	-0.4477	-0.8822	-0.5494	-2.2990	-0.1725	-0.2685
J-B	256.81	119.89	89.10	1157.30	835.46	5.8968	22.09	13.49	684.85	57.61	68.54
$R_{\Delta 5t}$											
mean	0.0005	0.0006	-0.0004	-0.0021	0.0010	0.0015	0.0007	0.0013	0.0018	-0.0003	0.0026
medi	0.0010	0.0012	0.0007	0.0006	0.0019	0.0025	0.0015	0.0005	0.0032	0.0032	0.0013
Max	0.1733	0.0926	0.0946	0.0915	0.0978	0.0785	0.1013	0.0887	0.1323	0.1533	0.1578
Min	-0.1030	-0.0818	-0.1572	-0.2044	-0.1637	-0.0807	-0.1217	-0.0883	-0.1373	-0.1766	-0.0627
S-d	0.0239	0.0274	0.0306	0.0309	0.0320	0.0230	0.0245	0.0293	0.0298	0.0398	0.0253
Skew	0.4072	-0.1740	-0.6334	-1.4262	-0.7916	0.0734	-0.4030	-0.0138	-0.2200	-0.6325	1.1232
J-B	1196.05	4.7287	144.12	817.66	202.21	20.97	161.89	13.35	145.96	210.43	397.84
Obs	541	264	264	264	264	264	264	264	264	264	253

Notes: FTA is the first difference of logs of FTSE All Share Index, OI is the first difference of logs of Oil and gases index, BM is the first difference of logs of Basic materials index, ID is the first difference of logs of Industrials index, CG is the first difference of logs of Consumer goods index, HI is the first difference of logs of Healthcare index, CS is the first difference of logs of Consumer services index, TM is the first difference of logs of Telecoms index, FN is the first difference of logs of Financials index, IT is the first difference of logs of Information technologies index and UT is the first difference of logs of Utilities index. Sample period of FTA is from Dec. 1962 to Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007, UT is from Jan. 1987 to 31st Dec. 2007.
Medi, Max, Min, S-d, Skew, J-B and obs refer to Median, Maximum, Minimum, Standard Deviation, Skewness, Jarque-Bera test and observations, respectively.

Panel B: Monthly RPI Inflation

	Actual Inflation	Expected Inflation	Unexpected Inflation
mean	0.0046	0.0045	0.0001
Medi	0.0038	0.0036	1.78E-05
Max	0.0422	0.0262	0.0303
Min	-0.015	-0.0077	-0.0159
S_d	0.0062	0.0052	0.0046
Skew	1.7853	1.1556	0.6522
B_J	1575.183	222.3049	544.1178
Obs	636	636	636

Note: RPI refer to Retail Price Index from January 1955 to December 2007.
Medi, Max, Min, S-d, Skew, J-B and obs refer to Median, Maximum, Minimum, Standard Deviation, Skewness, Jarque-Bera test and observations, respectively.

Panel C: Monthly Stock Returns

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
mean	0.0062	0.0083	0.0071	0.0038	0.0050	0.0065	0.0044	0.0050	0.0066	0.0032	0.0090
medi	0.0099	0.0123	0.0105	0.0136	0.0078	0.0075	0.0086	0.0108	0.0103	0.0132	0.0115
Max	0.4231	0.1621	0.1496	0.1546	0.1735	0.1407	0.1295	0.1530	0.1497	0.3829	0.1468
Min	-0.309	-0.351	-0.346	-0.337	-0.413	-0.339	-0.275	-0.209	-0.315	-0.359	-0.174
S-d	0.0537	0.0580	0.0615	0.0626	0.0688	0.0477	0.0521	0.0594	0.0571	0.0947	0.0485
Skew	0.0594	-0.887	-0.9495	-1.263	-0.984	-1.312	-1.006	-0.5310	-1.028	-0.6445	-0.2117
J-B	1765.4	328.73	197.56	278.205	282.41	1113.87	182.77	20.624	203.93	97.533	7.211
Obs	635	264	264	264	264	264	264	264	264	264	252

Notes: FTA is the first difference of logs of FTSE All Share Index, OI is the first difference of logs of Oil and gases index, BM is the first difference of logs of Basic materials index, ID is the first difference of logs of Industrials index, CG is the first difference of logs of Consumer goods index, HI is the first difference of logs of Healthcare index, CS is the first difference of logs of Consumer services index, TM is the first difference of logs of Telecoms index, FN is the first difference of logs of Financials index, IT is the first difference of logs of Information technologies index and UT is the first difference of logs of Utilities index. Sample period of FTA is from Jan. 1955 to Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007, UT is from Jan. 1987 to Dec. 2007.
Medi, Max, Min, S-d, Skew, J-B and obs refer to Median, Maximum, Minimum, Standard Deviation, Skewness, Jarque-Bera test and observations, respectively.

Table 4. 2: Effects of Inflation Announcements on Stock Returns

$R_{t+B} = \alpha + \gamma P_t^e + \beta P_t^u + \varepsilon_t \quad (B = -2, -1, 0, 1, 2) \quad R_{\Delta 3t} = \alpha + \gamma P_t^e + \beta P_t^u + \varepsilon_t \quad R_{\Delta 5t} = \alpha + \gamma P_t^e + \beta P_t^u + \varepsilon_t$

		FTA				OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
		12/1962 -12/2007	12/1962 -12/1970	1/1971 -12/1982	1/1983 -12/2007										
R_{t-2}	γ	-0.097	**-0.501****	0.083	-0.190	-0.193	0.162	0.154	-0.183	-0.225	-0.007	-0.036	-0.046	0.129	-0.095
		(0.0800)	(0.234)	(0.16)	(0.154)	(0.204)	(0.179)	(0.173)	(0.21)	(0.168)	(0.158)	(0.244)	(0.195)	(0.247)	(0.164)
		[0.2304]	[0.042]	[0.6035]	[0.2183]	[0.3458]	[0.3659]	[0.3766]	[0.3833]	[0.1824]	[0.964]	[0.8830]	[0.8109]	[0.6018]	[0.5629]
	β	0.005	0.035	0.112	-0.294	0.263	0.182	0.118	-0.018	0.169	0.291	0.458	0.182	0.239	-0.018
		(0.0940)	(0.1670)	(0.1360)	(0.2080)	(0.2820)	(0.2460)	(0.2390)	(0.2890)	(0.2320)	(0.2180)	(0.3350)	(0.2690)	(0.3400)	(0.2260)
		[0.9599]	[0.8343]	[0.4124]	[0.1583]	[0.3508]	[0.4610]	[0.6203]	[0.9492]	[0.4653]	[0.1830]	[0.1735]	[0.4994]	[0.4818]	[0.9353]
R_{t-1}	γ	0.044	**0.479***	0.045	0.039	-0.035	-0.129	-0.133	-0.211	-0.243	-0.175	-0.243	-0.310	-0.086	-0.289
		(0.0810)	(0.262)	(0.185)	(0.14)	(0.223)	(0.186)	(0.177)	(0.194)	(0.188)	(0.16)	(0.26)	(0.208)	(0.277)	(0.185)
		[0.5809]	[0.0708]	[0.8042]	[0.7773]	[0.8724]	[0.4882]	[0.4518]	[0.2782]	[0.1992]	[0.2756]	[0.3509]	[0.1375]	[0.7555]	[0.1196]
	β	0.068	**0.411****	-0.020	0.138	-0.185	**-0.537****	-0.368	-0.226	-0.265	-0.281	-0.506	-0.330	-0.169	**-0.506****
		(0.095)	(0.18)	(0.157)	(0.189)	(0.308)	(0.257)	(0.244)	(0.267)	(0.26)	(0.221)	(0.358)	(0.286)	(0.381)	(0.255)
		[0.475]	[0.0248]	[0.8973]	[0.4644]	[0.5473]	[0.0375]	[0.1325]	[0.3976]	[0.3075]	[0.2044]	[0.1586]	[0.2501]	[0.6584]	[0.0487]
R_t	γ	-0.126	**-0.855*****	0.111	-0.146	0.021	-0.085	0.152	-0.106	-0.026	-0.084	-0.054	-0.269	0.012	-0.097
		(0.076)	(0.224)	(0.162)	(0.14)	(0.202)	(0.183)	(0.181)	(0.189)	(0.172)	(0.165)	(0.268)	(0.198)	(0.255)	(0.209)
		[0.1000]	[0.0003]	[0.4941]	[0.2974]	[0.9149]	[0.6425]	[0.4012]	[0.5750]	[0.8787]	[0.6091]	[0.8392]	[0.1760]	[0.9605]	[0.6426]
	β	**-0.174***	**-0.510*****	-0.016	**-0.324***	-0.003	-0.338	-0.219	-0.310	-0.320	-0.247	-0.320	**-0.574****	-0.354	-0.205
		(0.089)	(0.154)	(0.138)	(0.189)	(0.279)	(0.252)	(0.25)	(0.26)	(0.236)	(0.228)	(0.369)	(0.272)	(0.351)	(0.288)
		[0.0520]	[0.0014]	[0.9028]	[0.0880]	[0.9900]	[0.1819]	[0.3820]	[0.2349]	[0.1770]	[0.2802]	[0.3876]	[0.0364]	[0.3145]	[0.4756]
R_{t+1}	γ	-0.090	-0.364	-0.087	0.153	0.226	0.053	0.235	-0.153	0.217	0.081	0.317	0.081	0.258	0.134
		(0.08)	(0.244)	(0.181)	(0.143)	(0.22)	(0.19)	(0.19)	(0.208)	(0.167)	(0.153)	(0.225)	(0.198)	(0.285)	(0.169)
		[0.2644]	[0.1386]	[0.6282]	[0.2849]	[0.3053]	[0.7777]	[0.2181]	[0.4603]	[0.1963]	[0.5947]	[0.1594]	[0.6804]	[0.3649]	[0.4281]
	β	-0.035	-0.199	0.029	-0.060	-0.097	-0.131	-0.216	-0.466	0.026	-0.183	-0.202	-0.075	0.0007	-0.154
		(0.094)	(0.168)	(0.154)	(0.193)	(0.303)	(0.282)	(0.262)	(0.286)	(0.23)	(0.211)	(0.309)	(0.273)	(0.392)	(0.234)
		[0.7101]	[0.2379]	[0.8504]	[0.7553]	[0.7494]	[0.6181]	[0.4102]	[0.1051]	[0.9091]	[0.3863]	[0.5149]	[0.7816]	[0.9984]	[0.5114]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets; Full sample period of FTA is from Dec. 1962 to Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007, UT is from Jan. 1987 to Dec. 2007.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 4.2: Effects of Inflation Announcements on Stock Returns (continued)

$R_{t+B}=\alpha+\gamma P_t^e+\beta P_t^u+\varepsilon_t$ $(B=-2,-1,0,1,2)$ $R_{\Delta 3t}=\alpha+\gamma P_t^e+\beta P_t^u+\varepsilon_t$ $R_{\Delta 5t}=\alpha+\gamma P_t^e+\beta P_t^u+\varepsilon_t$

		FTA				OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
		12/1962 -12/2007	12/1962 -12/1970	1/1971 -12/1982	1/1983 -12/2007										
R_{t+2}	γ	**0.191****	-0.298	0.1365	0.063	0.217	0.053	0.159	0.088	0.122	0.091	0.147	0.088	-0.038	-0.071
		(0.078)	(0.301)	(0.159)	(0.141)	(0.218)	(0.201)	(0.187)	(0.219)	(0.157)	(0.155)	(0.239)	(0.191)	(0.29)	(0.168)
		[0.0149]	[0.3240]	[0.3934]	[0.6540]	[0.3209]	[0.7777]	[0.3978]	[0.6871]	[0.4377]	[0.5547]	[0.5370]	[0.6442]	[0.8941]	[0.6705]
	β	0.090	-0.031	0.083	0.032	0.187	-0.131	0.043	-0.119	0.265	0.087	0.049	0.120	-0.060	0.050
		(0.091)	(0.207)	(0.135)	(0.19)	(0.301)	(0.277)	(0.258)	(0.302)	(0.216)	(0.213)	(0.329)	(0.263)	(0.399)	(0.231)
		[0.3231]	[0.8778]	[0.5419]	[0.8635]	[0.5344]	[0.6181]	[0.8675]	[0.6921]	[0.2214]	[0.6811]	[0.8806]	[0.6485]	[0.8788]	[0.826]
$R_{\Delta 3t}$	γ	**0.313****	**-1.721*****	0.1060	-0.1830	0.2120	-0.1600	0.2540	-0.4710	-0.0520	-0.1780	0.0190	-0.4970	0.1850	-0.2510
		(0.142)	(0.469)	(0.327)	(0.232)	(0.328)	(0.359)	(0.35)	(0.362)	(0.302)	(0.292)	(0.394)	(0.34)	(0.478)	(0.335)
		[0.0278]	[0.0004]	[0.7446]	[0.4388]	[0.5190]	[0.6546]	[0.4686]	[0.1940]	[0.8627]	[0.5411]	[0.9600]	[0.1454]	[0.6991]	[0.4529]
	β	-0.205	**-0.674****	0.124	**-0.679****	-0.286	**-1.006****	**-0.804***	**-1.003****	-0.560	**-0.712***	**-1.029***	**-0.980****	-0.522	**-0.866***
		(0.166)	(0.323)	(0.279)	(0.319)	(0.452)	(0.494)	(0.482)	(0.498)	(0.416)	(0.402)	(0.543)	(0.468)	(0.658)	(0.462)
		[0.2179]	[0.0395]	[0.6559]	[0.0342]	[0.5275]	[0.0429]	[0.0971]	[0.0452]	[0.1802]	[0.0780]	[0.0596]	[0.0375]	[0.4286]	[0.0619]
$R_{\Delta 5t}$	γ	-0.077	**-1.540****	0.289	-0.080	0.2363	0.122	0.567	-0.567	-0.155	-0.094	0.131	-0.455	0.275	-0.418
		(0.198)	(0.66)	(0.451)	(0.342)	(0.463)	(0.518)	(0.522)	(0.54)	(0.39)	(0.416)	(0.496)	(0.503)	(0.674)	(0.438)
		[0.6972]	[0.0219]	[0.5223]	[0.8138]	[0.6108]	[0.8140]	[0.2782]	[0.2947]	[0.6903]	[0.8209]	[0.7910]	[0.3665]	[0.6831]	[0.3407]
	β	-0.046	-0.294	0.187	-0.507	0.164	-0.338	-0.642	-1.142	-0.124	-0.332	-0.520	-0.677	-0.343	-0.833
		(0.233)	(0.454)	(0.384)	(0.46)	(0.638)	(0.713)	(0.719)	(0.743)	(0.537)	(0.573)	(0.684)	(0.693)	(0.928)	(0.604)
		[0.8412]	[0.5182]	[0.6269]	[0.2713]	[0.7967]	[0.6354]	[0.3727]	[0.1258]	[0.8163]	[0.5624]	[0.4472]	[0.3293]	[0.7117]	[0.169]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. Full sample period of FTA is from Dec. 1962 to Dec. 2007; OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007; UT is from Jan. 1987 to Dec. 2007.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 4. 3: The Asymmetric Effect of Inflation Announcement on Stock Returns

$R_{\Delta 3t} = \alpha_+ D_+ + \alpha_- D_- + \beta_+ D_+ P_t^u + \beta_- D_- P_t^u + \varepsilon_t$

	FTA	OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
α_+	-3.94e-5	-0.001	0.0009	0.0008	**0.006****	0.002	0.0003	0.001	0.003	0.003	0.0005
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
	[0.978]	[0.6045]	[0.7423]	[0.764]	[0.0161]	[0.3413]	[0.8627]	[0.5559]	[0.2408]	[0.3702]	[0.8414]
α_-	0.0002	-0.0002	-0.001	0.002	0.003	0.001	0.002	**0.005***	0.002	0.003	**0.004***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
	[0.8856]	[0.9410]	[0.7074]	[0.4487]	[0.1801]	[0.4633]	[0.244]	[0.0532]	[0.3655]	[0.3442]	[0.0945]
β_+	-0.185	0.332	-1.069	-1.314	**-2.739*****	-0.603	-0.506	-1.319	-1.030	-1.849	-0.349
	(0.287)	(0.96)	(1.05)	(1.023)	(1.051)	(0.885)	(0.854)	(1.1496)	(0.999)	(1.384)	(0.969)
	[0.5196]	[0.7294]	[0.3098]	[0.2004]	[0.0097]	[0.4958]	[0.5538]	[0.252]	[0.3037]	[0.1828]	[0.7187]
β_-	-0.016	-0.645	-1.400	-0.097	0.007	-0.633	-0.244	0.312	-0.930	0.711	-0.284
	(0.381)	(0.914)	(1.001)	(0.975)	(1.002)	(0.843)	(0.814)	(1.095)	(0.952)	(1.319)	(0.936)
	[0.9666]	[0.4809]	[0.1633]	[0.9202]	[0.9942]	[0.4535]	[0.7640]	[0.7758]	[0.3294]	[0.5902]	[0.7612]
Hypothesis test (P-values for the Wald Statistics)											
$\beta_+ = \beta_-$	[0.7883]	[0.4614]	[0.8197]	[0.3897]	[0.0587]	[0.9807]	[0.8246]	[0.305]	[0.9427]	[0.1818]	[0.9617]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. Full sample period of FTA is from Dec. 1962 to Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007, UT is from Jan. 1987 to Dec. 2007.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 4. 4: The Relationship between Inflation and Monthly Stock Returns

$R_t = \varphi + \lambda P_t^e + \phi P_t^u + \varepsilon_t$

	FTA				OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
	1/1955 -12/2007	1/1955 -12/1970	1/1971 -12/1982	1/1983 -12/2007										
γ	**1.222*** **	1.292	**3.062*** **	0.494	0.670	0.798	1.149	0.715	1.156	0.432	-0.039	-0.334	-0.208	0.222
	(0.413)	(0.936)	(1.091)	(0.698)	(0.983)	(1.034)	(1.047)	(1.153)	(0.802)	(0.869)	(0.987)	(0.954)	(1.582)	(0.842)
	[0.0032]	[0.1694]	[0.0057]	[0.4795]	[0.4960]	[0.4410]	[0.2738]	[0.5357]	[0.1507]	[0.619]	[0.9681]	[0.7259]	[0.8953]	[0.7916]
β	0.242	0.533	1.353	**-2.500*** **	-0.583	**-2.916** **	**-3.386** **	**-3.751** **	-1.489	**-3.388*** **	**-4.549*** **	**-3.854*** **	**-6.289*** **	-1.682
	(0.467)	(0.718)	(0.928)	(0.949)	(1.352)	(1.422)	(1.441)	(1.587)	(1.104)	(1.196)	(1.358)	(1.312)	(2.177)	(1.167)
	[0.6038]	[0.4583]	[0.1471]	[0.0089]	[0.6665]	[0.0414]	[0.0196]	[0.0188]	[0.1786]	[0.0050]	[0.0009]	[0.0036]	[0.0042]	[0.1508]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets; Full sample period of FTA is from Jan. 1955 to Dec. 2007; OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007; UT is from Jan. 1987 to Dec. 2007.

*, **, *** Significant at 10%, 5% and 1% level, respectively.

Table 4. 5: The Relationship between Inflation and Monthly Stock Returns with Dummy Variables

$R_t = \varphi + \lambda P_t^e + \phi P_t^u + f_1 D_1 + f_2 D_2 + \varepsilon_t$ D_1=1 in Jan. 1975; D_2=1 in Oct. 1987

	FTA				OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
	1/1955 -12/2007	1/1965 -12/1970	1/1971 -12/1982	1/1983 -12/2007										
γ	**0.848****	1.292	**2.253****	0.559	0.772	0.897	1.245	0.832	1.254*	0.511	0.011	-0.244	-0.115	0.257
	(0.385)	(0.936)	(0.991)	(0.639)	(0.909)	(0.968)	(0.988)	(1.07)	(0.717)	(0.821)	(0.971)	(0.895)	(1.547)	(0.834)
	[0.028]	[0.1694]	[0.0246]	[0.3824]	[0.3967]	[0.3548]	[0.2088]	[0.4375]	[0.0818]	[0.5342]	[0.9908]	[0.7849]	[0.9408]	[0.7581]
β	-0.044	0.533	0.750	**-2.326*****	-0.348	**-2.686****	**-3.165****	**-3.480****	-1.263	**-3.207*****	**-4.431*****	**-3.646*****	**-6.074*****	-1.601
	(0.434)	(0.718)	(0.841)	(0.869)	(1.252)	(1.332)	(1.359)	(1.473)	(0.987)	(1.13)	(1.336)	(1.232)	(2.129)	(1.155)
	[0.919]	[0.4583]	[0.374]	[0.0079]	[0.7812]	[0.0448]	[0.0207]	[0.0189]	[0.2020]	[0.0049]	[0.0010]	[0.0034]	[0.0047]	[0.1670]
D1	**0.406*****	-	**0.395*****	-	-	-	-	-	-	-	-	-	-	-
	(0.050)		(0.067)											
	[0.0000]		[0.0000]											
D2	**-0.314*****	-	-	**-0.315*****	**-0.361*****	**-0.352*****	**-0.339*****	**-0.416*****	**-0.346*****	**-0.277*****	**-0.179*****	**-0.319*****	**-0.330*****	**-0.119****
	(0.049)			(0.041)	(0.053)	(0.057)	(0.058)	(0.063)	(0.042)	(0.048)	(0.057)	(0.053)	(0.091)	(0.048)
	[0.0000]			[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.002]	[0.0000]	[0.0004]	[0.0136]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets; Full sample period of FTA is from Jan. 1955 to Dec. 2007; OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007; UT is from Jan. 1987 to Dec. 2007.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 4. 6: The Relationship between Inflation and Monthly Stock Returns in a Two Regime Market

$R_t = \varphi_1 + \lambda_1 P_t^e + \phi_1 P_t^u + (\varphi_2 - \varphi_1)D_t + (\lambda_2 - \lambda_1)P_t^e D_t + (\phi_2 - \phi_1)P_t^u D_t + U_t$,

$D_t = 0$, $R_t = \varphi_1 + \lambda_1 P_t^e + \phi_1 P_t^u + \varepsilon_t$, $D_t = 1$, $R_t = \varphi_2 + \lambda_2 P_t^e + \phi_2 P_t^u + \varepsilon_t$

where Regime 1 (D_t=0) Represent the Lower Actual Inflation (<4.3%); Regime 2 (D_t=1) Represent the Higher Actual Inflation (>=4.3%)

		FTA		OI	BM	ID	CG	HL	CS	TM	FN	IT	UT
		1/1955 -12/2007	1/1986 -12/2007										
Regim 1 (<4.3%)	γ	0.820	0.608	1.666	1.241	1.452	1.227	**1.792***	0.699	-0.875	0.2011	-0.218	0.343
		(0.813)	(0.929)	(1.172)	(1.243)	(1.262)	(1.388)	(0.961)	(1.051)	(1.194)	(1.154)	(1.896)	(1.024)
		[0.3135]	[0.5135]	[0.1562]	[0.319]	[0.2509]	[0.3775]	[0.0635]	[0.5063]	[0.4641]	[0.8618]	[0.9085]	[0.738]
	β	-0.332	-1.543	1.728	-1.828	-2.302	-2.544	0.651	-2.093	**-3.892****	-2.448	**-7.140*****	1.394
		(0.95)	(1.314)	(1.656)	(1.756)	(1.783)	(1.962)	(1.359)	(1.485)	(1.687)	(1.631)	(2.68)	(1.452)
		[0.7268]	[0.2413]	[0.2977]	[0.2988]	[0.1979]	[0.1958]	[0.6323]	[0.1600]	[0.0219]	[0.1346]	[0.0082]	[0.3379]
Regim 2 (>4.3%)	γ	**0.963****	0.099	-0.369	0.039	0.360	-0.065	0.234	0.128	1.084	-0.524	-0.369	0.532
		(0.41)	(0.875)	(1.243)	(1.32)	(1.341)	(1.474)	(1.014)	(1.108)	(1.264)	(1.215)	(2.041)	(1.023)
		[0.0192]	[0.9186]	[0.7667]	[0.9763]	[0.7885]	[0.9644]	[0.8176]	[0.9076]	[0.3918]	[0.6661]	[0.8566]	[0.6033]
	β	0.334	**-5.829*****	**-4.858****	**-4.914***	**-5.461****	**-5.967****	**-5.634*****	**-6.019*****	**-6.691*****	**-6.580*****	-4.444	**-7.814*****
		(0.537)	(1.87)	(2.383)	(2.531)	(2.571)	(2.826)	(1.944)	(2.124)	(2.423)	(2.329)	(3.913)	(1.963)
		[0.5338]	[0.002]	[0.0425]	[0.0533]	[0.0346]	[0.0357]	[0.0041]	[0.0050]	[0.0062]	[0.0051]	[0.2572]	[0.0001]

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively; Standard errors are shown in parentheses and p-values are shown in square brackets. Full sample period of FTA is from Jan. 1955 to Dec. 2007; OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007; UT is from Jan. 1987 to Dec. 2007.

*, **, *** Significant at 10%, 5% and 1% level, respectively.

Table 4. 7: Unit Root Tests

Panel A: ADF and KPSS

	Log Levels				First Differences	
	ADFτ_μ	ADFτ_τ	KPSSη_μ	KPSSη_τ	ADFτ_μ	KPSSη_μ
RPI	-0.932[19]	-1.615[19]	**2.946*** **	**0.451*** **	-2.414[18]	**0.535*** **
FTA	-0.244[5]	-2.588[5]	**2.935*** **	**0.310*** **	**-11.586***[4]**	0.061
OI	-1.338[0]	**-3.289*[0]**	**2.058*** **	**0.153** **	**-17.203***[0]**	0.066
BM	0.071[2]	-1.643[1]	**1.478*** **	**0.287*** **	**-14.267***[0]**	0.176
ID	-2.343[1]	-2.761[1]	**0.804*** **	**0.166** **	**-14.430***[0]**	0.066
CG	-1.282[4]	-3.055[4]	**1.604*** **	0.109	**-9.290***[3]**	0.046
HL	-2.435[0]	-2.364[1]	**1.968*** **	**0.369*** **	**-14.916***[0]**	0.29
CS	-1.754[2]	-2.599[1]	**1.642*** **	**0.302*** **	**-11.935***[1]**	0.107
TM	-1.456[5]	-1.823[5]	**1.341*** **	**0.258*** **	**-6.275***[4]**	0.118
FN	-1.332[2]	-1.886[2]	**2.01*** **	**0.272*** **	**-12.537***[1]**	0.124
IT	-1.846[1]	-1.599[1]	**0.512** **	**0.273*** **	**-12.206***[0]**	0.190
UT	-0.841[1]	-2.160[1]	**1.898*** **	**0.262*** **	**-16.716***[0]**	0.076

Notes: [a] RPI, FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to Retail Price Index, FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively. Full sample period of RPI and FTA is from Jan. 1955 to Dec. 2007; OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007; UT is from Jan. 1987 to Dec. 2007. Lag lengths are shown in square brackets; *, **, ***Significant at 10%, 5% and 1% level, respectively.

[b] For ADF tests, τ_μ denotes the only constant term in the estimating equation, whereas τ_τ denotes both the constant term and linear time trend. Similarly, for KPSS tests, η_μ denotes only denotes the only constant term in the estimating equation, whereas η_τ denotes both the constant term and linear time trend; for NP tests, θ_μ denotes the only constant term in the estimating equation, whereas θ_τ denotes both the constant term and linear time trend.

Critical values

	ADFτ_μ	ADFτ_τ	KPSSη_μ	KPSSη_τ
1%	-3.46	-4.00	0.739	0.216
5%	-2.87	-3.43	0.463	0.146
10%	-2.57	-3.14	0.347	0.119

Panel B: Ng-Perron (NP) Tests

	Log Levels								First Differences			
	NPθ_μ MZa	MZt	MSB	MPT	NPθ_τ MZa	MZt	MSB	MPT	NPθ_μ MZa	MZt	MSB	MPT
RPI	0.733 [19]	0.717	0.977	63.652	-9.685 [19]	-2.144	0.221	9.665	-3.078 [18]	-1.193	0.387	7.887

		MZa	MZt	MSB	MPT
	1%	-13.8000	-2.58000	0.17400	1.78000
Asymptotic critical values*: NPθ_μ (Log level)	5%	-8.10000	-1.98000	0.23300	3.17000
	10%	-5.70000	-1.62000	0.27500	4.45000
	1%	-23.8000	-3.42000	0.14300	4.03000
Asymptotic critical values*: NPθ_τ (Log level)	5%	-17.3000	-2.91000	0.16800	5.48000
	10%	-14.2000	-2.62000	0.18500	6.67000
	1%	-13.8000	-2.58000	0.17400	1.78000
Asymptotic critical values*: NPθ_μ (First difference)	5%	-8.10000	-1.98000	0.23300	3.17000
	10%	-5.70000	-1.62000	0.27500	4.45000

Notes: The Ng-Perron tests are based on AR GLS detrended method, and the lag length is selected by Modified Akaike Information Criterion.

Table 4. 8: Structure Break Tests

	TB	Statistic	Lag
RPI	**1973:08***	-5.039	12
FTA	1982:07	-3.945	9
OI	2002:04	-4.467	9
BM	**2002:04*** **	-6.531	1
ID	**2002:04*** **	-5.932	1
CG	**2001:07****	-5.332	3
HL	2002:03	-4.679	10
CS	2001:04	-4.718	1
TM	2001:11	-3.713	11
FN	1996:06	-3.986	0
IT	1997:10	-3.981	10
UT	2000:11	-4.257	12

Notes: This test is based on Perron (1997) unit root test. RPI, FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to Retail Price Index, FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively. Full sample period of FTA is from Jan. 1955 to Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007, UT is from Jan. 1987 to Dec. 2007.
Critical Values: 1% -5.57
5% -5.08
10% -4.82
50% -3.98
*, **, *** Significant at 10%, 5% and 1% level, respectively.

Table 4. 9: LR, AIC and HQ for Vector Autoregression (VAR) Lengths Specification

	LR: $(T-c)(\log\|\sum_R\|-\log\|\sum_U\|)$			AIC: $T\log\|\sum\|+2N$	Hannan-Quinn (HQ)	Lags Adopted
FTA	20	χ^2 = 10.360**	[0.0348]	14	14	17
OI	20	χ^2 = 10.926**	[0.0274]	13	13	18
BM	20	χ^2 = 10.849**	[0.0283]	14	14	18
ID	14	χ^2 = 15.666***	[0.0035]	14	14	14
CG	14	χ^2 =13.908 ***	[0.0076]	14	13	13
HL	14	χ^2 = 10.183**	[0.0374]	14	13	14
CS	20	χ^2 = 9.862**	[0.0428]	14	14	14
TM	20	χ^2 = 9.963**	[0.0410]	14	14	18
FN	20	χ^2 =14.309***	[0.0063]	14	13	19
IT	14	χ^2 = 10.314**	[0.0354]	14	13	13
UT	20	χ^2 =19.304***	[0.0006]	20	13	14

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively. Full sample period of FTA is from Jan. 1955 to Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007, UT is from Jan. 1987 to Dec. 2007; p-values are shown in square brackets.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 4. 10: Cointegration Tests

Panel A: Tests without Dummy Variables

	R=0	R<=1	Cointegrating Vectors		
			Beta	Constant	Alpha
FTA	**30.721***** [0.0009]	5.436 [0.2390]	**1.202***** (0.0612)	-0.305 (0.4022)	**-.0.030***** (0.0066)
OI	**18.837*** [0.0776]	7.1968 [0.1164]	**3.349***** (0.3883)	**-11.464***** (2.0589)	-0.021 (0.0197)
BM	**25.803***** [0.0077]	**11.304**** [0.0194]	**2.029***** (0.3654)	**- 5.532***** (1.9201)	-0.002 (0.0199)
ID	11.469 [0.4975]	4.295 [0.3699]	0.032 (0.6007)	**5.459*** (3.1615)	-0.027 (0.0157)
CG	11.670 [0.4788]	3.840 [0.4364]	**1.558***** (0.3791)	**-2.757*** (1.9946)	**-0.043**** (0.0247)
HL	10.322 [0.6081]	3.902 [0.4269]	**1.230***** (0.5992)	-0.138 (3.1572)	-0.010 (0.0128)
CS	12.142 [0.4362]	3.996 [0.4128]	**0.814**** (0.4550)	1.672 (2.400)	**-0.037***** (0.0161)
TM	**21.007**** [0.0394]	9.094 [0.0516]	0.612 (0.656) .	3.038 (3.464)	-0.012 (0.0115)
FN	**18.905*** [0.0760]	7.139 [0.1192]	**2.331***** (0.4856)	**-5.611**** (2.5782)	**-0.049***** (0.0156)
IT	10.408 [0.5997]	3.004 [0.5800]	-1.552 (1.741)	**14.974*** (9.159)	**-0.013**** (0.0079)
UT	**19.223*** [0.0690]	5.875 [0.2006]	**3.436***** (0.317)	**-11.637***** (1.658)	**-0.049***** (0.019)

Panel B: Tests Including Dummy Variables: Seasonal Dummies and Structure Break Dummies

	R=0	R<=1	Cointegrating Vectors		
			Beta	Constant	Alpha
FTA	**32.460***** [0.0006]	5.438 [0.2474]	**1.209***** (0.062)	-0.313 (0.413)	**-.0.026***** (0.0059)
OI	15.677 [0.1900]	5.077 [0.2751]	**3.719***** (0.599)	**-13.677***** (3.175)	-0.007 (0.0123)
BM	**20.141*** [0.0519]	5.703 [0.2150]	**1.726***** (0.328)	**- 3.957***** (1.722)	-0.026 (0.0209)
ID	12.361 [0.4170]	2.683 [0.6415]	0.107 (0.498)	**6.107***** (2.626)	**-0.037***** (0.0153)
CG	8.267 [0.8020]	1.960 [0.7856]	**1.791***** (0.695)	-4.349 (3.653)	**-0.036***** (0.0140)
HL	11.027 [0.5395]	3.102 [0.5619]	**1.364***** (0.448)	-0.632 (2.361)	**-0.025***** (0.0136)
CS	12.699 [0.3883]	2.938 [0.5924]	0.439 (0.476)	3.6411 (2.514)	**-0.033***** (0.0131)
TM	**18.437*** [0.0874]	6.537 [0.1531]	**0.768*** (0.605)	2.119 (3.199)	-0.019 (0.0122)
FN	**18.379*** [0.0889]	5.462 [0.2365]	0.920 (0.824)	**2.160**** (4.376)	**-0.025***** (0.0082)
IT	11.337 [0.5100]	2.609 [0.6559]	-1.715 (1.563)	**15.607*** (8.223)	**-0.018***** (0.0090)
UT	**18.737*** [0.0799]	5.397 [0.2427]	**3.428***** (0.317)	**-11.593***** (1.656)	**-0.050***** (0.0192)

Notes: FTA, OI, BM, ID, CG, HL, CS, TM, FN, IT and UT refer to FTSE All Share Index, Oil and gases index, Basic materials index, Industrials index, Consumer goods index, Healthcare index, Consumer services index, Telecoms index, Financials index, Information technologies index and Utilities index, respectively. Full sample period of FTA is from Jan. 1955 to Dec. 2007, OI, BM, ID, CG, HL, CS, TM, FN and IT is from Jan.1986 to Dec. 2007, UT is from Jan. 1987 to Dec. 2007; Standard errors are shown in parentheses and p-values are shown in square brackets.
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Chapter 5 Corporate Financing Mix and Inflation Exposure

5.1 Introduction

The question whether or not common stocks are a good hedge against inflation has engendered a large body of literature attempting to explain this empirical mixture of results found to exist in the relationship between inflation and stock returns. The previous chapter reports that the relationship between inflation and stock returns is mixed, which is consistent with most empirical studies. Theoretical approaches might be able to explain the puzzling issue in this case. Among the existing explanations which focus on the aggregate market, the nominal contracting hypothesis introduced by (Kessel, 1956) which provides a microeconomic-level explanation for the empirical mixture of relationship focusing on the inflation risk that firms are faced with, is one of the most influential. The nominal contracting hypothesis is important for the firm managers who would opt for a financing mix to reduce the inflation exposure of their shareholders.

Kessel (1956) explains how nominal contracts affect the sensitivity of stock returns to unexpected inflation. Firms normally hold different kinds of nominal contracts, such as cash, accounts receivable, depreciation tax shields, contracts to sell products at fixed prices, accounts payable, debts, raw materials contracts, labour contracts and pension commitments which are all set at fixed nominal interest rate. The dealing prices of nominal contracts agreed by the parties involved in are only estimated depending on the future payment by considering inflation that is expected to occur over the course of the contract. Thus when unexpected inflation occurs it causes the nominal interest rate changes, the former interest rates or returns of the nominal contracts agreed by the parties at the beginning might later be lower or higher than the current interest rate. When this estimated bias happens, the value of the nominal contract might be lower or higher than the primary value. Hence, for two parties holding these nominal contracts, there is a wealth transfer between them: when positive unexpected inflation occurs, the interest rate will rise and the present value of nominal contracts will drop, therefore, the creditor will lose while the debtor will gain. Furthermore, since most firms that have many nominal contracts on both the asset side and the liability side are debtors and creditors at the same time, net debtor firms which hold more nominal contracts at the liability side than the asset side gain while the net creditor firms which hold more nominal contracts at the asset side than the liability side lose when the positive unexpected inflation occurs and vice versa. Therefore, Kessel (1956) suggests that net debtor firms benefit from unexpected inflation while the net creditor firms lose from unexpected inflation, as a result, an industry or a market at a negative net nominal position (holding more nominal liabilities than assets) will gain from unexpected inflation and its stock returns respond positively to unexpected inflation while an industry or a market at a positive net monetary position (holding more nominal assets than liabilities) will lose from unexpected inflation and its stock returns respond negatively to unexpected inflation.

Debate on this wealth redistribution effect caused by unexpected inflation has been intense in the last fifty years. The empirical findings regarding the nominal contracting hypothesis are also conflicting. Some studies, such as Bradford (1974), Bach and Stephenson (1974), Hong (1977), French et al. (1983), Chang et al. (1985), Wei and Wong (1992) and Chang et al. (1992), empirically test this hypothesis by focusing on many nominal contracts but find no supportive evidence. Other studies, such as Bernard (1986), Pearce and Roley (1988) and Dokko (1989), however, find confirmative evidence to support or at least partly support the nominal contracting hypothesis.

Due to the debates and controversial results shown in the literature after the initiate paper of Kessel (1956), on whether or not the wealth redistribution effect caused by unexpected inflation exists or whether or not the nominal contracting hypothesis could explain the empirical mixture of the results found to exist in the relationship between inflation and stock returns is still one of the inconclusive issues in modern finance. Investigating the nominal contracting hypothesis and inflation risk that the firm faced is important for the firm managers who want to know whether or not firms can control the inflation risk by adjusting debt ratios, wage budget, pension plans or other financial plans, since inflation exposure is one of the biggest risks that firms take into account.

This chapter seeks to fill some of the void existing in the current literature. Firstly, there is lack of study that empirically examines the nominal contracting hypothesis on the UK market. Previous papers aiming to investigate this wealth transfer effect caused by nominal contracts due to unexpected inflation suggested by the nominal contracting hypothesis only focus on the US market and non-US countries drive little attention, although some investigations examine the aggregate debt ratios of the UK stocks as comparable results to the US market, for example De Alessi (1964). Because the UK monetary policymaking process and inflation target is different from those in the US, the US evidence found in previous literature might be inapplicable for the UK market. Thus investigating the UK market seems necessary. Also the latest literature on nominal contracting hypothesis is Change et al (1992) and Wei and Wong (1992). No more research in this field has been done after 1990. Moreover most previous research neglects the possible heterogeneous wealth redistribution impacts of nominal contracts due to unexpected inflation on individual industries. Only two papers, Change et al (1992) and Wei and Wong (1992), investigate the nominal contracting hypothesis for different industries on the US market. Common stocks in different market sectors claimed in particular industries which possess distinct characters (e.g. different debt ratios) might react differently to the unexpected inflation. Therefore, although the nominal contracts might have no effect on the sensitivity of the aggregate stock returns to unexpected inflation, it might not be so at the industrial level. Obviously, a general investigation for the aggregate market and across industry sectors with a more up-to-date sample period is worth considering on this issue.

Secondly, previous studies focus on some specific firm characteristics, for example, short- and long-term monetary position and depreciation tax shield focused by French et al. (1983) and Bernard (1986); inventories, depreciation tax shield, long-term debt-to-equity ratio and pensions examined by Pearce and Roley (1988) and Wei and Wong (1992); inventories, net property, plant and equipment, short-term debt and long-term debt investigated by Dokko (1989), and results found for these characteristics vary. All these variables might be important in explaining the wealth transferring effect caused by nominal contracts due to unexpected inflation for the UK market, although some of them seem unimportant for the US market in previous studies. Some studies (e.g. Chang et al. 1992) only focus on one of the nominal contracts, for example long-term debt contract and test the wealth transfers. These studies have some limitations, because a firm has many other nominal contracts that can influence the sensitivity of stock returns to unexpected inflation. Thus, even though they find no evidence to support the nominal contracting hypothesis, they cannot simply reject the nominal contracting hypothesis, since they do not control for as the majority of the possible nominal contracts. Thus, examining each of these variables seems necessary. Moreover, Dokko (1989) suggests joint tests of the nominal contracting hypothesis and the capital gains tax effect of inflation using the inventories, net property, plant and equipment, short- and long-term debt, since all of them relate to the wealth redistribution effect due to unexpected inflation in two different paths: tax or interest rate or both. Therefore, in order to provide detailed evidence of the nominal contracting hypothesis as well as the capital gains tax effect of inflation, it would be sufficient to investigate as many nominal contracting variables as possible.

Thirdly, the methodology used in former studies, Ordinary Least Square (OLS) or Seemingly Unrelated Regression (SUR), are not suitable for the firm-level data they use. Although previous research e.g. French et al. (1983) uses the firm-level data to test the nominal contracting hypothesis, the methodology they suggest is not suitable for the firm-level data because firm-level data that normally consist of large cross-sections of firms observed for short time periods has problems of heteroscedasticity, simultaneity, endogeneity and random measurement error (Arellano, 2003, p1-2). OLS and SUR estimation methods suggested by previous studies cannot overcome the problems brought by firm-level data. A more recent method suggested by Paudyal et al. (2008) which applies the linear dynamic panel data model of Arellano (2003) and two-step system-generalised method of moments (GMM-SYS) by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) to examine the capital structure of firms might be more suitable for the firm-level data we use to test the nominal contracting hypothesis. According to Arellano (2003) a dynamic panel data model could avoid the problems firm-level data brings and GMM-SYS would be a better method to estimate the model since GMM-SYS that includes both lagged first-differenced and lagged levels instruments can reduce the finite sample bias. Thus, a more recent methodology with linear dynamic panel data model and an estimation method of two-step GMM-SYS would be possible and would help shed light on this issue.

Therefore, to contribute to the literature, this chapter aims to extend the models suggested by previous studies to the linear dynamic panel data model with an estimation method of two-step GMM-SYS and to empirically examine the effect of nominal contracts on the sensitivity of stock returns to unexpected inflation suggested by the nominal contracting hypothesis for the UK market to find out whether nominal contracting hypothesis can explain the empirical relationship between inflation and stock returns. It also attempts to use all the available data on none-financial none-utility firms from 1982 to 2006 to investigate the nominal contracting hypothesis, thus, provide a more up-to-date look at this hypothesis. Both the aggregate market and eight different none-financial none-utility industries will be examined by investigating as many nominal contracting variables as possible, for example, net monetary position, short-term monetary position, long-term monetary position, depreciation tax shield, debt-to-equity ratio, inventories and net property, plant and equipment.

The remainder of this chapter is organized as follows: Section 2 briefly reviews the relative literature. Section 3 describes the data. Section 4 explains the methodologies and develops the testable models. Section 5 shows the empirical results and the conclusion is presented in Section 6.

5.2 Brief Review of Literature

Previous studies have investigated the nominal contracting hypothesis for the US market and the empirical findings of the nominal contracting hypothesis are conflicting in available literature after the publication of the seminal paper by Kessel (1956).

Empirical results of some studies show very weak support or even no evidence of the nominal contracting hypothesis, contrary to Kessel's theory, some examples as Bradford (1974), Bach and Stephenson (1974), Hong (1977), French et al. (1983), Chang et al. (1985), Wei and Wong (1992) and Chang et al. (1992). Bradford (1974) finds that the net monetary assets may not gain or lose from inflation and the effect, against the nominal contracting hypothesis. Bach and Stephenson (1974) show that redistribution effects caused by nominal contracts due to inflation are complex and they doubt the wealth redistribution effect suggested by the hypothesis. Hong (1977) firstly uses companies' accounting variables as explanatory factors to examine the nominal contracting hypothesis, but finds no evidence of transfers from creditors to debtors. Similarly, French et al. (1983) firstly distinguish net monetary position to test whether the sensitivity of stock returns to unexpected inflation (coefficient) is related to the nominal contracting variables, but find little evidence. Chang et al. (1985) find that net creditors gain during positive unexpected inflation, contrary to the nominal contracting hypothesis and Wei and Wong (1992) fail to find evidence for the nominal variables. Chang et al. (1992) directly examine the nominal contracting hypothesis by focusing on long-term bonds issued by the same firms to unexpected inflation, but find no evidence for the hypothesis.

However, other studies provide evidence that the nominal position that firms hold is relative to the relationship between inflation and stock returns and the wealth redistribution between debtors and creditors is caused by nominal contracts due to unexpected inflation, thus, supports or at least partly supports the nominal contracting hypothesis, e.g. Bernard (1986), Pearce and Roley (1988) and Dokko (1989). Moreover, many nominal contracting variables, such as long-term and short-term monetary position and debt ratios are found to be important in explaining the wealth transferring effect due to unexpected inflation.

Bernard (1986) extends the model of French et al. (1983) by including systematic risk in his model and finds that the relationship between unexpected inflation and stock returns differs across firms. Pearce and Roley (1988) form their own model to test the nominal contracting hypothesis, Their model also allows the response to depend on different individual firm characteristics, for example inventories use accounting methods of first in first out (FIFO) or last in first out (LIFO), long-term debt-to-equity ratio, pensions and depreciate tax shields, which are all adjusted by the firm's β_i and the average characteristics of the market, shown in equation (5.1). Using this model, he finds that time-varying firm characteristics related to inflation affect the effect of unanticipated inflation on a stock's rate of return.

$$R_{it} = a_i + \beta_i R_{mt} + \lambda_i P_t^e + [\gamma_i + \delta_1 (IN_{it-1} - \beta_i \overline{IN}_{t-1}) / S_{it-1}$$
$$+ \delta_2 (L_{it-1} IN_{it-1} - \beta_i L_{it-1} \overline{IN}_{t-1}) / S_{it-1} + \delta_3 (DEBT_{it-1} - \beta_i \overline{DEBT}_{t-1}) / S_{it-1} \quad (5.1)$$
$$+ \delta_4 (TAX_{it-1} - \beta_i \overline{TAX}_{t-1}) / S_{it-1} + \delta_5 (PENS_{it-1} - \beta_i \overline{PENS}_{t-1}) / S_{it-1}] P_t^u + \varepsilon_{it}$$

where

R_{it}: returns of firm i at time t;
P_t^e: expected inflation at time t;
P_t^u: unexpected inflation at time t;
S_{it-1}: the market value of firm i in period $t-1$;
$IN_{i,t-1}$: inventories of firm i in period $t-1$;
$\overline{IN}_{t-1}$: average inventories of the market in period $t-1$;
L_{it-1}: a dummy variable with value of unity if firm i predominately uses LIFO in period $t-1$ and zero is it predominately uses FIFO;
$DEBT_{i,t-1}$: book value of long-term debt of firm i in period $t-1$;
$\overline{DEBT}_{t-1}$: average book value of long-term debt of the market in period $t-1$;
$TAX_{i,t-1}$: depreciation tax yields of firm i in period $t-1$;
$\overline{TAX}_{t-1}$: average depreciation tax yields of the market in period $t-1$;
$PENS_{it-1}$: pension expense of firm i in period $t-1$;
$\overline{PENS}_{t-1}$: average pension expense of the market in period $t-1$;
β_i, λ_i, γ_i, $\delta_1, \dots \delta_5$: coefficients.

Dokko (1989) jointly testing the nominal contracting hypothesis, the nominal capital gains tax effect hypothesis and the inflation risk hypothesis in the same firm and find strong support for the nominal contracting hypothesis, which suggests that the wealth redistribution effect caused by nominal contracts due to inflation between bondholders and shareholders does exist.

In conclusion, although only a limited number of studies examine the nominal contracting hypothesis and some studies even show no evidence of the nominal contracting hypothesis, other studies do provide support for this hypothesis.

5.3 Data and Descriptive Statistics

5.3.1 Data

This study is composed of all non-financial and non-utility UK domestic firms (dead or alive) listed on the London Stock Exchange. All the data will be constructed as the panel data. The sample period, guided by the availability of survey data of expected inflation, is from 1982 to 2006. Annual stock prices, FTSE All Share Index and firms' accounting data are used in the study. A firm which has at least three continual annual data available on all of the accounting variables including net property, plant and equipment, inventories, cash and equivalents, net receivables, long term debt, current liabilities, deferred tax, total debt, common equity, preferred stock and total assets in its fiscal year ends and has the available annual stock return data will be included in our sample. Since our dynamic models require at least three consecutive observations, firms with less than continual three-year data are excluded. All the in-sample firms are divided into eight industries named Oil and gases (OI), Basic materials (BM), Industrials (ID), Consumer goods (CG), Healthcare (HL), Consumer services (CS), Telecoms (TM) and Information technologies (IT) on the basis of its industry categories. Therefore the total number of non-financial and non-utility firms is at 2110, the total number of observation is 23549 from 1982 to 2006. The number of firms in sample varies from a low of 215 for the 1982 to a high of 2187 for 1997. The number of firms for each industry varies from the lowest for Telecoms at 25 with number of observations at 203 to the highest for Industrials at 665 with number of observations at 8280. The details on the samples are shown in Table 5.3. All the data are obtained from Datastream.

Performance for each firm was measured by their log returns and the market return was measured by the log returns of FTSE All Share Index, which is a proxy for the common macroeconomic (systematic) factor. The annual accounting data are classified into two categories, monetary and real. Following French et al. (1983), some nominal contracts were segregated into groups by maturity and they are measured as net monetary position (NMP), its two sub-categories: short-term monetary position (SMP) and long-term monetary position (LMP) and depreciation tax shield (TAX). According to Pearce and Roley (1988), debt-to-equity ratio (DE) is important in determining the effects of nominal contracts, thus, debt-to-equity ratio is also included as the variable of nominal contracts in the investigation. Two real variables: net property, plant and equipment (PP) and inventories (IN) are used in our study to test the tax effect shown by Dokko (1989). Thus net monetary position (NMP), its two sub-categories: short-term monetary position (SMP) and long-term monetary position (LMP), depreciation tax shield (TAX), debt-to-equity ratio (DE), net property, plant and equipment (PP) and inventories (IN) are firm-characteristic variables for each firm. Following Pearce and Roley (1988), all of these variables are adjusted by the average value of the full sample for the tests of full market or adjusted by the average value of the relevant industry for the tests of different industries, and deflated by the market value of the firm's outstanding equity, with one exception DE, which only adjusted by the average value of its industry or the full sample. Individual variables are calculated as follows:

Net monetary position (NMP) and its two sub-categories: short-term monetary position (SMP) and long-term monetary position (LMP) is defined in terms of nominal assets as was done by French et al. (1983). NMP is determined each year from the difference between all monetary assets including cash and equivalents, net receivables and monetary liabilities including current liabilities, long term debt and Preferred stocks, adjusted by the average NMP of the full sample or of its industry, and deflated by the market value of firm's outstanding equity. Preferred stocks issued by the firms are included in monetary liabilities since they are regarded as fixed obligations for the firms. Thus net monetary position (NMP) is defined on the basis of its end-of-year balance sheet, NMP= (cash and equivalents - net receivables - current liabilities - long term debt - Preferred stocks-average NMP)/market value.

This net monetary position is classified as short-term monetary position (SMP) and long-term monetary position (LMP): SMP= (cash and equivalents - net receivables - current liabilities - average SMP)/market value, LMP= [- (long term debt - Preferred stocks)-average NMP)]/market value.

Depreciation tax shield (TAX) is also defined in terms of nominal assets, following French et al. (1983). Since each year the firm credits the difference between its actual tax liabilities computed using the financial accounts and its actual taxes paid to deferred tax account, TAX is the difference between the net property, plant and equipment and the deferred tax account adjusted by the average TAX of the full sample or of its industry, and deflated by the market value of firm's outstanding equity. According to the figures revealed by the HM Revenue & Customs, the average UK main corporate tax rate is 34.44% from 1982 to 2006 and the average small companies' rate is 24.2%. Thus we assume the marginal tax rate is 33.3% and the depreciation tax shield (TAX) = (net property, plant and equipment - 3* deferred tax - average TAX)/ market value.

Debt to equity ratio (DE) is the ratio of total debt to common equity adjusted by the average debt to equity ratio, DE= ratio of total debt to common equity- average DE.

Net property, plant and equipment (PP) is determined each year from the net property, plant and equipment adjusted by the average PP of the full sample or of its industry, and deflated by the market value of the firm's outstanding equity, thus, PP= (net property, plant and equipment-average PP)/market value.

Inventories (IV) are defined each year from the inventories adjusted by the average PP of the full sample or of its industry, and deflated by the market value of firm's outstanding equity. Since only FIFO (first-in-first-out) is allowed to calculate the inventories and LIFO (last-in-first-out) accounting method is not allowed in the UK, the different effects of inventories on LIFO and FIFO is not considered. Therefore, IN= (inventories-average IN)/market value.

Tests of the nominal contracting hypothesis require a good measure of expected and unexpected inflation. Survey data on financial market analysts' expected RPI inflation for the UK is provided by Informa Global Markets (IGM) (former Money Market Services International (MMS)). Since the IGM monthly expected RPI inflation enable go back to December 1981, the sample period is from 1982 to 2006.[13] According to Joyce and Read (2002), the survey data of analysts' forecast needs to be determined if it is actually representative of the consensual opinion of the whole market which is assumed to be rational. Until the data can pass through the tests of unbiasedness and (weak) efficiency, which are the requirements for the assumption of rationality, this survey data cannot be used as the forecast of RPI. Therefore, we follow Joyce and Read (2002) to examine whether the underlying IGM data on RPI inflation expectations satisfy rationality and do the unbiasedness and (weak) efficiency tests as follows:

An unbiasedness test is conducted as given by equation (5.2). If α=0, β=1 and ε_t is serially uncorrelated, then the IGM data is the unbiased forecast of RPI inflation.

[13] IGM (or former MMS) conducts the survey the Friday before the official RPI is announced, which covers 30-40 money-market brokers' forecast of the month-on-month percentage changes in RPI (Burrows and Wetherilt, 2004).

$$P_t = a + \beta P_t^e + \varepsilon_t \tag{5.2}$$

The weak-form test of efficiency shown in equation (5.3) examines whether the forecast error could be explained by past values of inflation. If the null hypothesis, H_0: $\beta_1=\beta_2=...=\beta_{12}=0$ is accepted, then the IGM data satisfies the weak form efficiency.

$$P_t - P_t^e = a + \beta_1 P_{t-1} + ... + \beta_{12} P_{t-12} + e_t \tag{5.3}$$

The table 5.1 shows that the null hypothesis that α is equal to zero cannot be rejected while β has a significant value, 1.02, rejected the null hypothesis that $\beta = 0$. It also reveals no evidence of serial correlation, and the joint hypothesis $(\alpha, \beta) = (0,1)$ cannot be rejected. Thus, the IGM data are unbiased forecasts of RPI inflation.

The table 5.2 shows that on the basis of the F-statistic, the null hypothesis H_0: $\beta_1=\beta_2=...=\beta_{12}=0$ cannot be rejected, therefore, the IGM data meets the weak efficiency. Results of previous tests reveal that the survey data of IGM expected RPI inflation satisfy the rationality requirement and can therefore represent the consensus opinion of the whole market.

Therefore, the annual expected RPI inflation rate are compounded from the monthly IGM forecasts RPI by the following process: (1+expected inflation in January)*(1+expected inflation in February)*......*(1+expected inflation in December)-1. The annual unexpected inflation is the difference between annual actual inflation and the annual expected inflation we got from the previous process.

5.3.2 Descriptive Statistics and Correlation Analysis

Table 5.4 presents the summary statistics for average stock returns (R_i), the market index (R_m), the expected inflation (P^e), unexpected inflation (P^u) and the average values of seven the firm characteristic variables: equipment (PP), inventories (IN), net monetary position (NMP), short-term monetary position (SMP), long-term monetary position (LMP), depreciation tax shield (TAX) and debt-to-equity ratio (DE). Due to the method we use to define the firm characteristic variables, figures of the means of

PP, IN, NMP, SMP, LMP and TAX are far larger that the rest of the variables, for example, the mean of expected inflation is 0.15% (S.E.= 0.0062) while the mean of average net monetary position (NMP) is 1641% (S.E.= 292.75). It won't affect estimations in the following chapters.

The correlation matrix which examines the possible collinearity among variables is presented in table 5.5. Different industries are also classified. Table 5.5 Panel A shows that for the aggregate market, serious multicollinearity in six firm characteristic variables (PP, IN, NMP, SMP, LMP and TAX) occurs. All pair-wise correlations of them are higher than 89%. Similarly, multicollinearity in these six firm characteristic variables also occurs for different industries. Table 5.5 Panel B shows that all pare correlations of are higher than 70% for the Oil and gases and the rest of the Panels of Table 5.5 provide similar results. Therefore, if two more of these variables are inserted into the sample equation in the following tests, controlling for the multicollinearity is required.

5.4 Methodology and Hypothesis Development

5.4.1 Estimation Method

This chapter, differs from all previous studies which either apply Seemingly Unrelated Regression (SUR) or Ordinary Least Square (OLS) to test the models of the nominal contracting hypothesis. Following a more recent methodology (See Paudyal et al. 2008), we use the panel data and a new estimation technique, two-step system-generalised method of moments (GMM-SYS).

Arellano (2003, p.1-2) states that the firm-level data that normally consists of large cross-sections of firms observed for short time periods has many problems, such as heteroscedasticity, simultaneity, endogeneity and random measurement error. In this chapter, the total number of firms in the sample we use is 2110 and the annual observations cover a maximum of 25 years, this is a typical sample of a large cross-section of firms with a small number of observations in the given time periods. Therefore a suitable methodology needs to be observed to overcome the problems introduced by the data.

A dynamic model with error-components suggested by Arellano (2003, p.31-144) might overcome the problems brought by the firm-level data as given by equations (5.4) and (5.5).

$$Y_{it} = \lambda_1 Y_{i,t-1} + \sum_{k=2} \lambda_k X_{ki,t} + v_i + v_t + \varepsilon_{it} \tag{5.4}$$

$$\Delta Y_{it} = \lambda_1 \Delta Y_{i,t-1} + \sum_{k=2} \lambda_k \Delta X_{ki,t} + \Delta v_t + \Delta \varepsilon_{it} \tag{5.5}$$

where

v_i :unobservable individual firm-specific effects which do not change overtime;
v_t :some effects which are common to all firms and can change through time;
ε_{it} : the third component of the model's error term for firm i at time t.

According to Arellano (2003), these dynamic models with error-components which allow for the lags of the dependent variables as additional explanatory variables and different error-components has many advantages: 1) it captures the dynamic effect of x on y for which the speed of adjustment is governed by the coefficient of lagged y; 2) it allows for the serial correlation of unknown form since lagged y appears to capture time series dependence; 3) it overcomes the simulation of unknown form if using GMM estimation by selecting instruments: current x_{it} is uncorrelated with past, present and future values of error term ε(strictly exogenous), x_{it} is correlated with past values of error term ε, but uncorrelated with present and future values of error term ε (predetermined or weakly exogenous), or x_{it} is correlated with past and present values of error term ε but uncorrelated with future values of error term ε (endogenous). Thus, the idea of linear dynamic models is adopted in testing the nominal contracting hypothesis in this chapter.

The estimation methods that previous studies use, such as Ordinary Least Square (OLS) (Pearce and Roley, 1988, Wei and Wrong, 1992 and Chang et al. 1992) and Seemingly Unrelated Regression (SUR) (French et al. (1983); Bernard, 1986; Dokko, 1989) are abandoned in this chapter since they are not sufficient enough to control the problems introduced by firm-level. A simple OLS methodology cannot handle any of the problems mentioned before. Although SUR can control the cross-sectional correlation of disturbance terms of firms since SUR directly estimates cross-sectional correlation in disturbance terms and takes them into account when generating estimated coefficients, it cannot handle most of the problems mentioned before either. Moreover, it has the disadvantage that the number of cross-sectional unites (firms) must be less than the number of available time series observations, which is unsuitable for large samples. Thus neither OLS nor SUR is the suitable method for performing estimations.

Panel data and a two-step GMM-SYS are chosen to estimate our models because they can overcome the problems introduced by firm-level data and are suitable for the linear dynamic models we adopt. Panel data has many advantages over cross-section or time series data, especially in handling large samples, since: 1) Techniques of panel data estimation allow for individual-specific variables by considering the heterogeneity which is bound to exist in different firms. 2) Panel data can give more variability, more degrees of freedom, more efficiency and less collinearity when combining time series of cross-section observations. 3) Panel data is suitable for the dynamics of change and more complicated models (Gujarati, 2003, p.637). The 2110 firms in our sample will be aggregated into a full market and eight individual industries. Panel data can minimize the bias brought by the aggregation and give more efficiency to our estimation.

We apply a two-step system-generalised method of moments (GMM-SYS) suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). GMM estimation is based upon the assumption that disturbances in the equation are uncorrelated with a set of instrumental variables and it is robust to unknown forms of disturbances. Arellano and Bond (1991) suggest that a two-step GMM estimation which uses one-step residuals to construct an asymptotically optimal weighting matrix is more efficient than one-step GMM if the residuals are expected to show heteroscedasticity in the large sample data with a long time span, and is more suitable for the previous dynamic panel data models than OLS, because it can control for the correlation of errors over time, heteroscedasticity across firms, simultaneity and measurement errors brought by firm-level data. However, a standard GMM specification of the first differences (GMM-DIF) that uses instruments in levels for first differences equations has the problem of weak instruments (Arellano and Bond, 1991). Arellano and Bover (1995) and Blundell and Bond (1998) suggest that the extended version GMM-SYS that use instruments in first-differences for equations in levels in addition to instruments used by GMM-DIF perform better than GMM-DIF, because GMM-SYS including both lagged first-differenced and lagged levels instruments can reduce the finite sample bias.

The procedures of instrument determination for GMM-SYS are following Arellano and Bond (1998), Blundell et al. (1992) and Blundell et al. (2000). 1) if X_{it} is predetermined or weakly exogenous, $E(Y_{it-s}\Delta u_{it})=0$, for t=3,...T and $2\leqslant s\leqslant t-1$, $E(u_{it}\Delta Y_{it-1})=0$, for t=3,...T, $E(X_{it-s}\Delta u_{it})=0$, for t=3,...T and $1\leqslant s\leqslant t-1$, and $E(u_{it}\Delta X_{it})=0$, for t=2,...T.; 2); if X_{it} is strictly exogenous, $E(Y_{it-s}\Delta u_{it})=0$, for t=3,...T and $2\leqslant s\leqslant t-1$, $E(u_{it}\Delta Y_{it-1})=0$, for t=3,...T, and $E(u_{it}\Delta X_{it})=0$, for t=2,...T.; 3); if X_{it} is endogenous, $E(Y_{it-s}\Delta u_{it})=0$, for t=3,...T and $2\leqslant s\leqslant t-1$, $E(u_{it}\Delta Y_{it-1})=0$, for t=3,...T, $E(X_{it-s}\Delta u_{it})=0$, for t=3,...T and $2\leqslant s\leqslant t-1$, and $E(u_{it}\Delta X_{it})=0$, for t=3,...T. The test procedure is to test the validity of the instrument by Sargan tests and serial correlation of disturbances ε_{it} (Arellano and Bond, 1998). The null hypothesis of the Sargan tests is the validity of the instruments, thus, if Sargan tests values over 10%, the instruments are valid. The disturbances ε_{it} need to be serially uncorrelated, there should be evidence of significant negative first order serial correlation in differenced residuals and no evidence of second order serial correlation in the differenced residuals (Arellano and Bond, 1998). Therefore, the p-value for AR(1) test should less than 10%, while the p-value for AR(2) should over 10%.

5.4.2 The Expanded Models

Consider the following regression of the single-index model of individual stock returns, $R_{it,}$ against the market index, R_{mt}. The model describes that the market index as a proxy for the common macroeconomic factors which can capture the macro (systematic) component effect on the stock returns.

$$R_{it} = a_i + \beta_i R_{mt} + \varepsilon_{it} \tag{5.6}$$

However, in reality, a single market index might not fully capture the effects of all macroeconomic factors on the individual stock return, although it might capture most of them. We therefore assume R_{mt} might not fully capture the effect of inflation, P_t, and inflation assumed to capture the effect that market index could not capture is included in the model, shown in equation (5.7). Thus the full effect of inflation on stock returns can be views as the gather of the c_i and part of β_i.

$$R_{it} = a_i + \beta_i R_{mt} + c_i P_t + \varepsilon_{it} \tag{5.7}$$

In the long run, two components of inflation, expected and unexpected are split, P_t^e and P_t^u, coefficient b_i will be referred to as an "adjusted unexpected inflation coefficient" which measures the unexpected inflation effect that has not been captured by the market index, if there is any, in the long-run.

$$R_{it} = a_i + \beta_i R_{mt} + \lambda_i P_t^e + b_i P_t^u + \varepsilon_{it} \tag{5.8}$$

The nominal contracting hypothesis suggests that the sensitivity of individual stock returns to unexpected inflation should be related to the nominal variable of individual firms, $X_{k,i,t}$, which brings in the wealth-redistribution effect due to unexpected inflation.[14] Therefore, the nominal contracting hypothesis attempts to explain part of the cross sectional differences of the unexpected inflation coefficient. The coefficient b_i which measures the rest of the effect of unexpected inflation apart from what has already been captured by R_{mt}, and the nominal contracting variables that need to be adjusted for the cross-sectional average of the nominal contracting variables, $\overline{X}_{k,t}$, which have been represented by the market index R_{mt}, and divided by the market value, $MV_{i,t}$ are generalized into equation (5.9).

$$b_i = b_1 + b_2\left(\frac{X_{1,i,t} - \overline{X}_{1,t}}{MV_{i,t}}\right) + \ldots + b_k\left(\frac{X_{k,i,t} - \overline{X}_{k,t}}{MV_{i,t}}\right) \tag{5.9}$$

Equation (5.9) can be substituted into (5.8) to allow the sensitivity to unexpected inflation to vary as the nominal contracting variables of firm i changes over time after controlling for the macro (systematic) component.

[14] If the market is efficient, the wealth-redistribution effect due to expected inflation will be impounded in stock prices.

$$R_{it} = a_i + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + \sum_{k=2} b_k \frac{X_{k-1,i,t} - \overline{X}_{k-1,t}}{MV_{i,t}} P_t^u + \varepsilon_{it} \quad (5.10)$$

According to Arellano (2003, p.31-144), a dynamic model with error-components which allows for the lags of the dependent variables as additional explanatory variables and different error-components, shown in equation (5.4) and (5.5), has many advantages for the firm level panel data. Although the independent variables in our model are mixed with the macroeconomic and firm level data, which are more complicate than Arellano (2003) suggested, the main part of the data and independent variables we are focusing on are at firm level. We therefore adopt the idea of Arellano (2003) and extend equation (5.10) into a linear dynamic model (5.11).

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + \sum_{k=2} b_k \frac{X_{k-1,i,t} - \overline{X}_{k-1,t}}{MV_{i,t}} P_t^u + v_i + v_t + \varepsilon_{it} \quad (5.11)$$

The linear dynamic panel data model (5.10) can also be viewed as the extension of the model (equation 5.1) suggested by Pearce and Roley (1988), but has a more complete specification than the model of Pearce and Roley (1988). Firstly, it captures a dynamic effect and allows for serial correlation of unknown form by including one lag of stock returns as an additional explanatory variable. Secondly, it overcomes the simulation of unknown form between the independent variables and residuals, ε_{it}, strictly exogenous, predetermined or weakly exogenous or endogenous. Thirdly, the current year's value of the firm-characteristic variables are used, instead of previous year's values suggested by prior research, since annual firm level data that we use can be treated as moving in step with the changes in unexpected inflation. The UK RPI inflation of previous month is released regularly by the UK government in the mid of each month, thus the firms have half a month gap for the inflation news and can immediately adjust their money, material or product plans for the correspond inflation news after the announcement. Therefore, a half month gap for the inflation news is ignored as we use annual data and the firm characteristics variables are assumed to move with the same step as the unexpected inflation. Fourth, firm characteristic variable are adjusted by the cross-sectional average of firm characteristic variables, instead of by a firm's systematic risk β and the cross-sectional average of firm characteristic variables suggested by Pearce and Roley (1988). This difference would not affect the interpretation of the model at all and it is more suitable for our estimation method, GMM-SYS.

Moreover, both equation (5.1) of Pearce and Roley (1988) and equation (5.11) that we derived have the advantage of permitting control of systematic risk. As suggested in previous studies [see Rozeff (1977), Hong (1977), Chang et al. (1985), Bernard (1986) and Chang et al. (1992)], systematic risk is a very important aspect of the explanatory factors for the variance in stock returns and it might cause the re-distribution effect caused by nominal contracts due to unexpected inflation, to vanish since the debtor and creditor differ in leverage and are therefore bound to have different systematic risk. Thus, systematic risk needs to be considered when testing the nominal contracting hypothesis. Although models of Bernard (1986), Dokko (1989) (equation 2.8) and Wei and Wong (1992) all consider the systematic risk, they use the systematic risk (β_i) as an additional explanatory variable which is controversial. The model of Pearce and Roley (1988) and ours also take systematic risk into account but avoid this problem by including market index as an additional variable in the model.

Therefore, following the idea of previous studies such as Pearce and Roley (1988), French et al. (1983), Bernard (1986) and Dokko(1989), the model we improve upon has many advantages and is suitable for the firm level data we use, which isn't the case with previous models.

5.4.3 Nominal Contracting Effects

French et al. (1983) suggest that testing the nominal contracting hypothesis of wealth redistribution depends on the extent to which the rate of inflation is anticipated correctly, on the sign and size of the firm's net position of nominal contracts, and observing as many as possible nominal contracts as well. Since the survey data of forecast of IGM expected RPI inflation we obtained could represent the consensus opinion of the whole market and satisfy the requirements of the expected inflation, observing the nominal contracting variables is another important thing.

Prior research tests the debtor-creditor assumption of nominal contracting hypothesis since most nominal contracts related to debts or other monetary claims are observable, such as cash, accounts receivable, depreciation tax shields, accounts payable, debts and even pension commitments. Of course it's impossible to observe all the nominal contracts that firms hold, such as labour contracts, therefore, none of the prior research could test the labour-capitalists assumptions. Neither could we fully test the nominal contracting hypothesis due to the lack of some nominal contracts. Therefore, we would follow prior research and only partly test the debtor-creditor assumption of nominal contracting hypothesis and observe as many nominal contracts as possible.

Apart from pension commitments, since the pension commitments are hard to obtain for UK firms, most of the nominal contracts examined in previous studies that depended upon the monetary claims recorded in the balance sheets are also investigated, such as net monetary position (NMP), its two sub-categories: short-term monetary position (SMP) and long-term monetary position (LMP), depreciation tax shield (TAX) and debt-to-equity ratio (DE) suggested by French et al. (1983) and Pearce and Roley (1988). Moreover, apart from the cross-sectional variations of nominal contracts other sources might come into play in the association between stock returns and unexpected inflation. Feldstein (1980) shows that the negative inflation-stock returns relationship results from the basic features of the tax system, particularly historic cost depreciation and the taxation of nominal capital gains, since when prices rise, the accounting methods of historic-cost depreciation cause the real value of depreciation to fall and while real taxable profits increase, and as a result, real net profits of the corporate income tax vary adversely with inflation. Dokko (1989) suggests the joint tests of nominal contracting hypothesis and capital gains tax effect of inflation suggested by Feldstein (1980), which include the inventories, net property, plant and equipment, short-term debt and long-term debt into the testable model, since all of them relate to the wealth redistribution effect due to unexpected inflation in two different paths: tax or interest rate.[15] Therefore, in order to provide detailed evidence of the nominal contracting hypothesis as well as the capital gains tax effect of inflation, the firm characteristic variables including NMP, SMP, LMP, TAX, PP and IN which have been adjusted by the cross-section averages of each variable and

[15] Pearce and Roley (1988) also include IN as a variable in their model by classifying it as a nominal contracting variable. However, according to Feldstein (1980), inventories should belong to the nominal tax gain variable.

divided by the firm market value and DE which has been adjusted by the cross-section average of total debt-to-common equity ratio are examined in this chapter.

The debtor-creditor assumption of nominal contracting hypothesis implies that: 1) the debtors will gain and creditors will lose when higher than expected inflation arises and vice versa, 2) the inflation may be more profitable for larger debtors than it is for smaller debtors. An aggregate market, an industry or a firm will therefore gain from inflationary periods if they are on the nominal position of net debtors and vice versa. Hence, if unexpected inflation is positive, stockholder of firms with nominal assets will lose, while stockholder of firms with nominal liabilities will benefit, ceteris paribus. Meanwhile, the magnitude of the impact on stock returns should depend on the magnitude of individual firm's characteristics. Hence, the larger the debt ratios, the higher the profit gained by the debtors.

These two implications according to the nominal contracting hypothesis and the implication of the nominal capital gains tax effect of inflation which implies that firms that have PP and IN should lose during inflationary period, but gain during deflationary period will be considered by our tests.

The individual testing models for different firm variables are explained as follows. For each equation, 1) significant coefficients, γ_i, are associated with the appropriation of the dynamic model in which the lag dependent variable is included as an explanatory variable; 2) coefficients, β_i, are associated with the systematic risk; 3) coefficients, λ_i, are associated with that part of the expected inflation effect on stock returns, which is not captured by the systematic risk, if there is any left; 4) significant coefficients, b_l, are associated with that part of unexpected inflation effect on stock returns, which is neither related to the nominal contracting variables we selected nor those that have been captured by the systematic risk.

The net monetary position relative to many nominal contracts with other firms is the most important nominal variable for the investigation of the nominal contracting hypothesis, because debts or other relative monetary claims are directly observable from the balance sheet, which provides comparable evidence of markets all over the world, and according to the debtor-creditor assumption the effect of net monetary position provides the strongest evidence of the nominal contracting hypothesis. The nominal contracting hypothesis suggests that firms with a net debtor position will benefit during unexpected inflation and net creditors will lose, ceteris paribus, since unexpected inflation increases the real values of nominal liabilities while on the other hand reducing the real values of nominal assets, thus the net debtor gains from positive unexpected inflation, while the net creditor loses. The testable models for net monetary position (NMP) and its two sub-categories: short-term monetary position (SMP) and long-term monetary position (LMP) are shown as equations (5.12), (5.13) and (5.14).

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 NMP_{i,t} P_t^u + v_i + v_t + \varepsilon_{it} \tag{5.12}$$

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 SMP_{i,t} P_t^u + v_i + v_t + \varepsilon_{it} \tag{5.13}$$

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 LMP_{i,t} P_t^u + v_i + v_t + \varepsilon_{it} \tag{5.14}$$

French et al. (1983) assume that the magnitude of impact of the nominal contracts should depend on the time maturity of the debt, the longer the debt maturity the more sensitive the firms reflect the unexpected inflation, therefore, in theory a long-term monetary position should have a larger negative coefficient than a short-term monetary position, although practically it might not be attained since the values of many debt and preferred stocks are not related to the promised future nominal payouts since they are convertible, which might reduce the effective maturity. Therefore, a joint test for SMP and LMP to examine whether long-term monetary position has a stronger effect than short-term monetary position is shown as equation (5.15).

$$\begin{aligned} R_{it} &= a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 SMP_{it} P_t^u \\ &+ b_3 LMP_{it} P_t^u + v_i + v_t + \varepsilon_{it} \end{aligned} \tag{5.15}$$

Because SMP and LMP are highly correlated in our sample period, we use the following method to control for the multicollinearity. The residual from the equation (5.16) is used as the proxy for SMP.

$$SMP_{it} = cLMP_{it} + \varepsilon_{it} \tag{5.16}$$

Therefore after Ad-SMP is applied on equation (5.15) to control for multicollinearity, the testable model for Ad-SMP and LMP is shown in equation (5.17).

$$\begin{aligned}R_{it} &= a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 Ad-SMP_{it} P_t^u \\ &+ b_3 LMP_{it} P_t^u + v_i + v_t + \varepsilon_{it}\end{aligned} \quad (5.17)$$

Since NMP, SMP and LMP are defined in terms of nominal assets, according to the nominal contracting hypothesis, for equations (5.12), (5.13) and (5.14), we test for the effect of net monetary position, short-term monetary position or long-term monetary position on the sensitivity of stock returns to unexpected inflation, against the null hypothesis: $b_2= 0$, coefficient, b_2 is expected to be negative, which is associated with firm holding positive net monetary contracts, short-term net monetary contracts or long-term net monetary contracts will lose from unexpected inflation. Using equation (5.17), we test for the effect of adjusted short-term monetary position and long-term monetary position on the sensitivity of stock returns to unexpected inflation, against the null hypothesis H_1: $b_2= 0$, coefficient, b_2 is expected to be negative, which is associated with firms that have positive short-term net monetary contracts and will therefore lose from unexpected inflation, against the null hypothesis H_2: $b_3= 0$, negative estimates of b_3 are associated with firms that have positive long-term net monetary contracts and will therefore lose from unexpected inflation. According to French et al (1983), LMP with a longer maturity would have a stronger effect on stock returns than SMP with shorter maturity, therefore, we expected $b_2 > b_3$.

Depreciation tax shield is introduced as a nominal variable by French et al. (1983), because the depreciation tax expenses can be treated as the nominal contract with the government to reduce the firm's tax payments. Unexpected inflation reduces the real value of tax shields and redistributes the wealth from firms to the government. Therefore, firms that have more depreciation tax shield will lose from unexpected inflation and vice versa. However, the measurement of the depreciation tax shield has a limitation, since it needs to consider the marginal corporate tax rate which varies in different year, for different sizes of firms or in different countries. Thus a general measurement of the marginal corporate tax rate for all UK firms in every year might reduce the precision of the test. However, since it is hard to observe the accurate marginal tax rate for each firm, we still follow French et al. (1983) to evaluate the depreciation tax shield.

According to the nominal contracting hypothesis, for the testable model of depreciation tax shield (TAX) which is defined in terms of nominal assets, as given by equation (5.18), we test for the effect of TAX on the sensitivity to unexpected inflation, against the null hypothesis: $b_2 = 0$, coefficient, b_2 is expected to be negative, which is associated with firms that have positive depreciation tax shield and will therefore lose from unexpected inflation.

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u + v_i + v_t + \varepsilon_{it} \qquad (5.18)$$

Pearce and Roley (1988) suggest that a firm's debt-to-equity ratio is particularly important in determining the response of stock returns to unexpected inflation. Although we have included the SMP and LMP these two variables which measure the debt levels of a firm, considering that there is no correlation between DE and SMP or LMP shown in table 5.5, debt to equity ratio defined in terms of nominal liability is chosen as a firm level variable in testing the nominal contracting hypothesis.

The testable model for DE is shown in equation (5.19). According to the nominal contracting hypothesis, for equation (5.19), we test for the effect of debt-to-equity ratio on the sensitivity of stock returns to unexpected inflation, against the null hypothesis: $b_2 = 0$, coefficient, b_2 is expected to be positive, which is associated with firms that have debts and will therefore gain from unexpected inflation.

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 DE_{it} P_t^u + v_i + v_t + \varepsilon_{it} \qquad (5.19)$$

Although the stock returns might differently react to the unexpected inflation related to different nominal contracting variables, SMP, LMP, TAX and DE, the joint effect of these variables might differ substantially. Therefore, we follow the idea of French et al. (1983) who suggest equation (5.20) to jointly test net monetary position and depreciation tax shield.

$$\begin{aligned} R_{it} &= a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 SMP_{it} P_t^u + b_3 LMP_{it} P_t^u \\ &+ b_4 TAX_{it} P_t^u + v_i + v_t + \varepsilon_{it} \end{aligned} \qquad (5.20)$$

However, since SMP, LMP and TAX are found to be highly correlated in previous tests, we control for the multicollinearity using equations (5.21) and (5.22). The residual from equation (5.21) is used as the proxy for SMP and the residual from equation (5.22) is used as the proxy for LMP.

$$SMP_{i,t} = c_1 LMP_{it} + c_2 TAX_{it} + \varepsilon_{it} \tag{5.21}$$

$$LMP_{i,t} = c_1 SMP_{it} + c_2 TAX_{it} + \varepsilon_{it} \tag{5.22}$$

Therefore the Ad-SMP and Ad-LMP controlling for multicollinearity as proxy for SMP original and LMP original is applied in the model depicted by equation (5.20). Thus equation (5.23) is the testable model to examine the joint effect of Ad-SMP, Ad-LMP and TAX. According to the nominal contracting hypothesis, for equation (5.23), we test for the effect of adjusted-SMP, adjusted-LMP and TAX on the sensitivity of stock returns to unexpected inflation, against the null hypothesis H_1: b_2= 0, H_2:b_3= 0 and H_3:b_4= 0, coefficient, b_2, b_3 and b_4 are expected to be negative, and this is associated with firms that have positive short-term net monetary contracts, positive long-term net monetary contracts and positive depreciation tax shield and will therefore lose from unexpected inflation.

$$\begin{aligned} R_{it} = {} & a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_1 P_t^e + b_1 P_t^u + b_2 Ad-SMP_{it} P_t^u + b_3 Ad-LMP_{it} P_t^u \\ & + b_4 TAX_{it} P_t^u + v_i + v_t + \varepsilon_{it} \end{aligned} \tag{5.23}$$

We also jointly test the effect of TAX on the sensitivity of stock returns to unexpected inflation using equation (5.24), against the null hypothesis H_1: b_2= 0, coefficient, b_2 is expected to be negative, which is associated with firm holding positive depreciation tax shield and will therefore lose from unexpected inflation, also against the null hypothesis H_3: b_3=0, positive estimates of b_3 are associated with firms that have debts and will therefore gain from unexpected inflation.

$$\begin{aligned} R_{it} = {} & a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_1 P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u \\ & + b_3 DE_{it} P_t^u + v_i + v_t + \varepsilon_{it} \end{aligned} \tag{5.24}$$

Since not only the nominal contracts but also other sources might be associated with stock returns and unexpected inflation, Dokko (1989) suggest that the nominal contracting hypothesis and the nominal capital gains tax effect of inflation can be jointly tested by including PP, IN, short-term debt and long-term debt in equation (5.25) because all of them relate to the wealth redistribution effect due to unexpected inflation in two different paths: tax or interest rate. Therefore, in order to provide detailed evidence of the nominal contracting hypothesis as well as the capital gains tax effect of inflation, the firm characteristic variables, NMP, PP and IN, are included in our models. According to Feldstein (1980), firms that have real assets, such as PP and IN, should benefit during inflationary periods.

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 PP_{it} P_t^u + b_3 IN_{it} P_t^u + b_4 NMP_{it} P_t^u + v_i + v_t + \varepsilon_{it} \quad (5.25)$$

However, since PP, IN and NMP were found to be highly correlated in previous tests, we control for the multicollinearity using equations (5.26) and (5.27). The residual from equation (5.26) is used as the proxy for PP and the residual from equation (5.27) is used as the proxy for IN.

$$PP_{i,t} = c_1 IN_{it} + c_2 NMP_{it} + \varepsilon_{it} \quad (5.26)$$

$$IN_{i,t} = c_1 PP_{it} + c_2 NMP_{it} + \varepsilon_{it} \quad (5.27)$$

Therefore the Ad-PP and Ad-IN controlling for multicollinearity as proxy for PP original and IN original is applied on our model (5.25). Thus the testable model is shown as equation (5.28) to jointly examine the nominal contracting hypothesis and the nominal capital gains tax effect of inflation. For equation (5.28) we test for the effect of the NMP, Ad-PP and Ad-IN on the sensitivity of stock returns to unexpected inflation 1) against the null hypothesis H_1: b_2= 0, negative estimates imply the nominal capital gains tax effect of inflation on adjusted PP do exist; 2) against H_2:b_3=0, coefficient, b_3 is expected to be negative, which is associated with firms that are only allowed to use in FIFO on adjusted IN and will therefore lose from unexpected inflation; 3) against the null hypothesis H_3: b_4=0, coefficient, b_4 is expected to be negative, and this is associated with firms with positive net monetary contracts which will consequently lose when higher-than-expected inflation occurs.

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 Ad - PP_{it} P_t^u + b_3 Ad - IN_{it} P_t^u + b_4 NMP_{it} P_t^u + v_i + v_t + \varepsilon_{it} \quad (5.28)$$

According to the nominal contracting hypothesis, the magnitude of the impact of nominal contracts on the sensitivity of stock returns to unexpected inflation should depend on the magnitude of a firms' nominal contracts, thus, we will test this implication of nominal contracting hypothesis by grouping firms into different portfolios depending on the values of net monetary position to find out whether firms that have more debts gain more from higher-than-expected inflation than firms that have less debts.

The full market will be grouped into nine portfolios depending on the values of NMP, one portfolio is for firms have the negative NMP and the rest of the eight portfolios are for the firms that have positive NMP from the lowest to the highest. Then we test them using equation (5.29), against the null hypothesis H_1: $b_1 = 0$, to see whether or not unexpected inflation has any effect on the stocks. Moreover, according to the nominal contacting hypothesis, firms that have more net monetary assets will lose more during inflationary period, b_1 will drop when the NMP value is higher, thus, the coefficient, b_1 for Portfolio 1, is expected to be higher than b_1 for Portfolio 9.

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + v_i + v_t + \varepsilon_{it} \quad (5.29)$$

TAX is included in equation (5.30), both TAX and DE are included in equation (5.31). Hypothesis and expectations for unexpected inflation are the same as those of equation (5.29).

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u + v_i + v_t + \varepsilon_{it} \quad (5.30)$$

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u + b_3 DE_{it} P_t^u + v_i + v_t + \varepsilon_{it} \quad (5.31)$$

5.5 Results

Using the linear dynamic panel data model and a two-step GMM-SYS method, we empirically examine the effect of nominal contracts on the sensitivity of stock returns to unexpected inflation suggested by the nominal contracting hypothesis, for the UK aggregate market and eight none-financial and none-utility industries, Oil and gases, Basic materials, Industrials, Consumer goods, Healthcare, Consumer services, Telecoms and Information technologies in the following order.[16] [17] Firstly, the effect of net monetary position and its two sub-categories: short-term or long-term monetary position is estimated, respectively. And then the effects of adjusted short-term monetary position and long-term monetary position are jointly estimated while controlling for multicollinearity. Secondly, in a similar fashion, the effect depreciation tax shield is estimated. Thirdly, the impact of debt-to-equity ratio is estimated. Fourthly, the impact of adjusted short-term monetary position, adjusted long-term monetary position and depreciation tax shield are jointly estimated while controlling for multicollinearity, and the effects of depreciation tax shield and debt-to-equity ratio are also jointly estimated to find whether a firms' characteristics jointly affect the sensitivity of stock returns to unexpected inflation. Fifthly, the nominal contracting hypothesis and the nominal capital gains tax effect of inflation are jointly tested by including adjusted-net property, plant and equipment, adjusted inventories and net monetary position in the same model. Sixthly, whether or not the magnitude of the impact on stock returns depends on the magnitude of net monetary position is examined. Results of estimating models containing Sargan's test of the validity of the instruments, the auto correlation tests for the residuals, the three Wald (df) tests for the coefficients and the R^2 are reported and explained as follows.[18]

[16] Results reported in the tables present that the coefficients of lagged y for aggregate and industries are always significant, which suggests that the dynamic model allowing the lagged y as an explanatory variable is a valid model to examine the nominal contracting hypothesis.

[17] The test results for the TM might not be reliable, since a two-step GMM estimation can be a poor guide for hypothesis testing in typical small sample size and in this case, inference based on asymptotic standard errors for the on-step estimators would be more reliable (Arellano and Bond, 1991 and Blundell and Bond, 1998). TM which has only 25 firms with a total number of observations at 203 might suffer from this problem. However, in order to show the comparable results for different industries, we report the results estimated from the models using a two-step GMM-SYS for full market and all the industries including TM.

[18] We also estimate the linear model version without including the lag independent variable as explanatory variable and different components of residuals using OLS (pooled). The results of OLS are mainly consistent with the results of GMM-SYS, both methods show the similar significant coefficients for the independent variables. Moreover, the GMM-SYS estimation always provides a higher R^2 than the OLS for the equations we test. Thus, it implies that GMM-SYS is a better estimation method for our tests.

We also investigate the expected inflation effect on stock returns related to the nominal contracting variables with GMM-SYS. If the market is efficient, the effect of expected inflation on the nominal contracts will be impounded in stock prices. However, our results show that this effect still exists, which means that the market is inefficient.

In order to see whether the nominal contracting variables we selected individually affect the stock returns, we put them as explanatory variables for the stock returns, shown in following

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + \sum_{k=2} b_k X_{k-1,i,t} + v_i + v_t + \varepsilon_{it}$$

GMM-SYS is also applied to the models and our results show that nominal contracting variables have effects on stock returns.

5.5.1 Effects of Net Monetary Position

The effect of net monetary position and its two sub-categories: short- and long-term monetary position on the sensitivity of stock returns to unexpected inflation is examined in this section to find out whether the response of stock returns to unexpected inflation is related to net monetary position. Table 5.6 reports the coefficients b_2 of NMP for the aggregate market and the eight industries from the estimating linear dynamic panel data model (5.12) using a two-step GMM-SYS. According to the nominal contracting hypothesis, b_2 is expected to be negative. The results in Table 5.6 show that for the aggregate market, the t-test rejects the null hypothesis of H_1: b_2=0 at 0.01% level, and suggests a significant negative coefficient b_2, -0.176. Similarly, all industries with one exception, Oil and gases, have significant and lower-than-zero coefficient b_2 varying from a low of -2.490 for information technology to a high of -0.042 for Telecoms. Thus, net monetary position is found to significantly and negatively affect the sensitively of stock returns to unexpected inflation, consistent with the prediction of the nominal contracting hypothesis. Therefore, stockholders of firms with positive net nominal assets will lose from unexpected inflation.

The effect of short-term monetary position on the sensitivity of stock returns to unexpected inflation is examined using equation (5.13). Table 5.7 shows estimates of the coefficients b_2 for the SMP. For aggregate market, the t-test suggests a significant negative coefficient, -0.519, which suggests that firms with short-term monetary assets should lose from unexpected inflation. Five out of eight industries display similar significantly negative coefficients for SMP varying from a low of -0.722 for Basic materials to a high of 0.117 for Consumer goods.

The impact of long-term monetary position on the sensitivity of stock returns to unexpected inflation is also examined by equation (5.14). Table 5.8 contains estimates of the coefficients b_2 for the long-term monetary position for the estimating model. The aggregate market and six out of eight industries show significantly negative coefficients, -0.243 for the aggregate and varying from a low of -9.257 for Information technologies to a high of 0.090 for Consumer goods. There are two exceptions, Oil and gases show positive coefficients and Healthcares has no effect.

Therefore, both tables show that stock returns are negatively affected by the unexpected inflation related to the SMP and LMP.

Because SMP and LMP are highly correlated, we test the effect of the adjusted-SMP and LMP on the sensitivity of stock returns to unexpected inflation while controlling for multicollinearity using the linear dynamic panel data model given by equation (5.17). Table 5.9 displays the estimates of b_2 and b_3 for the adjusted-short-term monetary position and the long-term monetary position for the aggregate market and the 8 industries. For the aggregate market, the p-value suggests significant negative coefficients b_2 and b_3, -1.02 and -0.248, which means firms with either short-term monetary assets or long-term monetary assets should lose from unexpected inflation by rejecting the null hypothesis of H_1: $b_2=0$ and H_2: $b_3=0$ at lower than 0.01% level. Similarly, four industries display significantly negative coefficients for adjusted-SMP and five industries show significantly negative coefficients for LMP. This is consistent with what was expected, i.e. both short-term monetary position and the long-term monetary position negatively affect the sensitivity of stock returns to unexpected inflation.

Tables 5.7, 5.8 and 5.9 also report the coefficients for SMP are larger than LMP in most cases. Table 5.9 shows that the aggregate market coefficient for SMP is about four times larger than the coefficient for LMP. Similar results for SMP and LMP can be found in Tables 5.7 and 5.8. Both aggregate and industries show larger coefficients for SMP than LMP in which significant coefficients are recorded. Therefore, the magnitude of the SMP effect is more likely to be larger than the LMP effect.

Therefore, net monetary position and its two sub-categories: short- and long-term monetary position is found to negatively affect the sensitivity of stock returns to unexpected inflation. This uncovered negative relation provides strong support for the nominal contracting hypothesis, consistent with the findings of Bernard (1986), Pearce and Roley (1988) and Dokko (1989) which show that the nominal monetary position has a strong effect on the response of stock returns to unexpected inflation, but inconsistent with previous studies such as French et al (1983) which show the wealth effect of the monetary position goes in the opposite direction against the nominal contracting hypothesis.

Moreover it is found, in this section that the magnitude of the SMP effect is more likely to be larger than the LMP effect, suggesting that although both short- and long-term monetary position have a strong impact effect on sensitivity of the market returns to unexpected inflation, SMP has a stronger impact than LMP. This finding is in direct contradiction to what we expected. As French et al. (1983) suggested, we expected to see the difference in the magnitude of the impact between the short- and long-term monetary position, LMP with a longer maturity would have a greater effect on sensitivity of stock returns to unexpected inflation than SMP with shorter maturity. However, since French et al. (1983) failed to find any evidence of the effect of short- and long-term monetary positions, they actually do not find any evidence to support or reject the predicted magnitude of the impact between short- and long-term monetary positions. Evidence in other papers varies. Pearce and Roley (1988) show that the short-term monetary variable has only a small effect compared with the long-term one, thus only long-term monetary positions provide strong evidence of the nominal contracting hypothesis. However, Bernard (1986) shows that short-term monetary position has stronger effect with a correspondingly larger coefficient and higher significant level than the long-term monetary position. Similarly, Dokko (1989) shows that short- and long-term monetary position both have strong effect, and the magnitude of the impact of short-term monetary position is larger than the long-term monetary position. Thus, our results find no empirical evidence of differing impact magnitudes between short- and long-term monetary positions in agreement with Bernard (1986) and Dokko (1989).

One possible explanation for the failure of capturing the magnitude effect is the problem of measuring LMP. As French et al. (1983) mention that the measure of LMP has the limitation that the many debts and preferred stocks are convertible into common stock, of which values are not related to the future nominal payouts, which therefore reduces the effect of maturity or even the effect of LMP.

5.5.2 Effects of Depreciation Tax Shield

In this section, the impact of depreciation tax shield on the sensitivity of stock returns to unexpected inflation is examined to find out whether or not the response of stock returns to unexpected inflation is related to the depreciation tax shield. Table 5.10 reports the coefficients b_2 for the depreciation tax shield of the estimating linear dynamic panel data of equation (5.18). The results in Table 4.10 show that, for the aggregate market, the t-test rejects the null hypothesis: b_2=0 at 0.01% level, and suggests a significantly positive coefficient b_2. Similarly, six out of eight industries display significant higher than zero coefficients for TAX varying from a low of 0.105 for Basic materials to a high of 1.761 for Information technologies. There are two exceptions, Healthcare which shows an insignificant coefficient and Oil and gases which display a significantly negative coefficient. Therefore, depreciation tax shields are found to positively affect the sensitivity of stock returns to unexpected inflation, which implies that stockholders of firms with depreciation tax shield benefit from unexpected inflation. This positive effect contradicts what we expect. The interpretation of the nominal contracting hypothesis suggests that firms with nominal assets such as depreciation tax shield should lose from unexpected inflation. Thus, we expected a negative effect of depreciation tax shield. On the contrary, our finding provides the evidence that wealth effect of TAX go in the opposite direction against the nominal contracting hypothesis.

Our results are inconsistent with Bernard (1986) who finds a strong negative effect of TAX and Pearce and Roley (1988) who shows a weak negative effect of TAX. French et al. (1983) show mixed results for TAX, which could be either significantly negative or significantly positive or insignificant, which cannot provide any conclusive evidence for the effect of depreciation tax shield on the sensitivity of stock returns to unexpected inflation.

Tax-augmented hypothesis suggested by Anari and Kolar (2001) and Luintel and Paudyal (2006) might be one possible explanation for this reverse evidence of TAX. Anari and Kolar (2001) and Luintel and Paudyal (2006) support the tax-version of Fisher hypothesis which means that nominal stock returns must exceed inflation to compensate tax-paying investors, hence, the long-run relations between stock returns and inflation are positive. Firms might use the depreciation tax shield to address the tax purpose, therefore, firms' stock prices will rise to compensate tax-paying investors in the long run.

5.5.3 Effects of Debt-to-Equity Ratio

Whether or not the response of stock returns to unexpected inflation is related to debt-to-equity ratio is examined in this section. Table 5.11 reports the coefficients b_2 for the debt-to-equity ratio of estimating linear dynamic panel data given by equation (5.19). Results in Table 5.11 display that Basic materials and Healthcare, show significantly positive coefficients for DE, consistent with the prediction of nominal contracting hypothesis. It implies that firms in these two industries with debts will gain from unexpected inflation. However, neither the aggregate market nor the rest of the six industries show any effect of DE on sensitivity of stock returns to unexpected inflation. Thus, our finding shows that debt-to-equity ratio has little impact on the response of stock returns to unexpected inflation, which is inconsistent with what we expected. We expected to find out debt-to-equity ratio positively affects the sensitivity of stock returns to unexpected inflation. Therefore, our results are inconsistent with Pearce and Roley (1988) which suggests a strong nominal contracting effect for DE.

5.5.4 Joint Effects of Nominal Contracts

Because short-term, long-term monetary position and depreciation tax shield are highly correlated to each other, we examine the joint effect of adjusted-SMP, adjusted-LMP and TAX on the sensitivity of stock returns to unexpected inflation while controlling for multicollinearity. Table 5.12 reports the results of estimating equation (5.23). It presents estimates of the coefficients b_2, b_3 and b_4 for the joint test of: Ad-SMP, Ad-LMP and TAX. For the aggregate market, the t-test rejects the null hypothesis of H_1: b_2=0, H_2: b_3=0, and H_4: b_4=0 at 5% level, and suggests significantly negative coefficients for b_2 and b_3, -1.448 and -0.482, respectively, but significantly positive coefficient for b_4, 0.119. Similarly, five out of eight industries, Industrials, Consumer goods, Consumer services, Telecoms and Information technologies, show significantly negative coefficients for Ad-SMP, varying from a low of -8.68 for Consumer services to a high of -3.37 for Information technologies while the remaining three display no significant effect. Three industries show significantly negative coefficients for Ad-LMP, while Oil and gases shows a significantly positive coefficient and the remaining four all show no significant effect. Five industries, Basic materials Industrials, Consumer goods, Consumer services and Information technologies, display significantly positive coefficients for TAX while Oil and gases display a significant negative coefficient and the remaining two have no effect. Therefore, our findings suggest that short- and long-term monetary position negatively affects the response of stock returns to unexpected inflation, which is consistent with the interpretation of the nominal contracting hypothesis, while a depreciation tax shield shows a positive effect contrary to the nominal contracting hypothesis. We expected to find a negative effect for all these three variables. However, the joint test for Ad-SMP, Ad-LMP and TAX provides mixed evidence for the nominal contracting hypothesis.

The results we got in this section are consistent with results in previous sections which show that both SMP and LMP have significantly negative effect while TAX on the other hand has positive effect. Our findings for SMP, LMP and TAX are partly consistent with Bernard (1986) which shows the significantly negative coefficients for all these three variables. Again, the tax-augmented hypothesis suggested by Anari and Kolar (2001) and Luintel and Paudyal (2006) might be possible explanation for the adverse results for TAX.

The joint effect of the depreciation tax shield and debt-to-equity ratio on the sensitivity of stock returns to unexpected inflation is examined using equation (5.24). Table 5.13 contains estimates of the coefficients b_2, and b_3 for the joint test of nominal contracting variables for the aggregate market and the eight industries. The aggregate market and four out of eight industries show significantly positive coefficients for TAX while the rest display insignificant coefficients for TAX. Only industry Healthcare show a positive coefficient for DE while neither the aggregate market nor the remaining seven industries show any effect of DE. Thus our results suggest that depreciation tax shield adversely affects the response of stock returns to unexpected inflation and debt-to-equity ratio has little impact, which stands in contradiction with the interpretation of the nominal contracting hypothesis.

5.5.5 The Nominal Contracting Effect and the Nominal Capital Gains Tax Effect of Inflation

Since net property, plant and equipment, inventories and net monetary position are all high correlated, we examine the joint effect of adjusted-PP, adjusted-IN and TAX on the sensitivity of stock returns to unexpected inflation while controlling for multicollinearity using equation (5.28). Table 5.14 contains estimates of the coefficients b_2, b_3 and b_4 for the joint test of nominal capital gains tax effect of inflation and the nominal contracting effects as related to the nominal contracting variables: Ad-PP, Ad-IN and NMP for the aggregate market and the eight industries. According to the nominal capital gains tax effect of inflation and nominal contracting hypothesis, we expect to find a negative effect from Ad-PP, Ad-IN and NMP. The aggregate market shows significantly negative coefficients for Ad-PP, Ad-IN and NMP are -0.68, -1.675 and -0.159, respectively. Similarly, all industries with one exception (Information technologies) show significantly negative coefficients for NMP. However, only two industries, Consumer goods and Industrials display significantly negative coefficients for Ad-PP, and only two industries, Consumer goods and Oil and gases display significantly negative coefficients for Ad-IN, while others show no effect. Thus there might be an accumulative effect for the significant coefficient found for the aggregate market. Therefore, our findings suggest net property, plant and equipment, inventories and net monetary position all negatively affect the sensitivity of stock returns to unexpected inflation, in agreement with what we expected. Moreover, it implies that stockholders of firms that have net property, plant and equipment, inventories and positive net monetary contracts will lose from unexpected inflation, which agrees with the interpretation of nominal capital gains tax effect of inflation and the nominal contracting hypothesis.

The results provide strong support for the nominal contracting hypothesis, consistent with Bernard (1986). The evidence of the prediction of the nominal capital gains tax effect of inflation is consistent with Dokko (1989) which shows strong negative coefficients for both PP and IN, and also consistent with Pearce and Roley (1988) which shows strong negative effect of IN when the FIFO accounting method are applied, whereas our results are inconsistent with Wei and Wong (1992) who show no nominal capital gains tax effect of inflation for IN.

Moreover, since companies use PP and IN to meet their tax purpose, it is very likely that they also use the depreciation tax yield for tax purpose. Thus, the positive coefficients for TAX shown in our results are possibly relative to the tax-augmented hypothesis (Anari and Kolar, 2001 and Luintel and Paudyal 2006).

5.5.6 Magnitude of Nominal Contracting Effects

In this subsection, we investigate whether or not the magnitude of the impact of nominal contracts on sensitivity of stock returns depends on the magnitude of a firms' nominal contracts .We do so by grouping firms into different portfolios depending on the values of net monetary position.

Table 5.15 reports results of estimating equation (5.29) and contains estimates of the coefficients b_1 for 9 portfolios based on NMP. We expected to find that firms that have more net monetary assets will lose more from higher-than-expected inflation, b_1 will drop when NMP value is higher, thus, b_1 for Portfolio 1 is higher than b_1 for Portfolio 9.

Significantly negative coefficients are found for unexpected inflation in six portfolios, 1 to 5 and 7, varying from a low of Portfolio 7 at -0.128 to a high of Portfolio 1 at -0.007, whereas unexpected inflation of the other three portfolios has insignificant coefficients. Therefore, we find that different stock's responses to the unexpected inflation related to the net monetary assets vary considerably across firms and firms that have more net monetary assets lose more from inflation surprise than firms that have less or even negative net monetary assets in agreement with expectations.

Table 5.16 reports results of estimating equation (5.30) and contains estimates of the coefficients b_1 and b_2 for 9 portfolios based on NMP. significantly negative coefficients are found for unexpected inflation in five portfolios 1, 2, 4, 5 and 8, varying from a low of Portfolio 8 at -0.103 to a high of Portfolio 1 at -0.009, whereas the other four portfolios have insignificant coefficients. Therefore, our findings are also consistent with the magnitude prediction of nominal contracting hypothesis.

Table 5.17 reports results of estimating equation (5.30) and contains estimates of the coefficients b_1, b_2 and b_3 for 9 portfolios sorted on NMP. Results in Table 4.17 show that significantly negative coefficients are found for unexpected inflation in four portfolios, 1, 2, 4, 5and 6, varying from a low of Portfolio 6 at -0.064 to a high of Portfolio 1 at -0.008, whereas others have insignificant coefficients. Therefore, our findings are weakly consistent with the magnitude impact predicted by the nominal contracting hypothesis.

In conclusion, the empirical results suggest that net monetary position and its two sub-categories: short- and long-term monetary position strongly and negatively affects the sensitivity of stock returns to unexpected inflation, which implies that debtor firms gain while creditor firms lose from unexpected inflation, and vice versa, which is wholly consistent with the prediction of the nominal contracting hypothesis. It also reveals that net monetary position plays an important role in determining the response of stock returns to unexpected inflation, consistent with previous studies which suggest the nominal contracting effect. Moreover, the magnitude of the impact suggested by the nominal contracting hypothesis which assumes that firms that have more net monetary assets will lose more or firms that have more debts gain more from higher-than-expected inflation is also supported by these results. Therefore, the results are generally consistent with Bernard (1986), Pearce and Roley (1988) and Dokko (1989) who provide evidence of the nominal contracting hypothesis, but contrary to French et al. (1983) and Wei and Wong (1992) who show no evidence of the nominal contracting hypothesis.

Our findings also suggest that depreciation tax shield plays an opposite role in determining the response of stock returns on unexpected inflation, thus, provide contrary evidence of the depreciation tax shield effect on the sensitivity of stock returns on unexpected inflation. This finding is consistent with French et al. (1983), but contrary to Bernard (1986) and Pearce and Roley (1988).

In addition, we find that net property, plant and equipment and inventories also negatively affect the sensitivity of stock returns to unexpected inflation, which implies that firms that have real assets gain from unexpected inflation in agreement with the nominal capital gains tax effect of inflation, weakly supporting Dokko (1989).

Moreover, we find evidence of a negative relationship between the difference of magnitude impact between short- and long-term monetary position. Similarly LMP with a longer maturity would have more of an effect on the sensitivity of stock returns to unexpected inflation than SMP with shorter maturity magnitude. This was suggested by French et al (1983). Our results suggest that although both short- and long-term monetary positions have strong impact effect on sensitivity of the market returns to unexpected inflation, SMP has stronger impact than LMP.

5.6 Summary

Numerous studies empirically examine the puzzle of whether common stocks are a good hedge against inflation and present many explanations for the mixed evidence found. In contrast to the theories that attempted to explain the empirically mixed results at macroeconomics level, the nominal contracting hypothesis (Kessel, 1956) focuses on the inflation risk that the firm faced and provides an explanation for the empirical relationship between inflation and stock returns at the microeconomic level. However, in the last fifty years, only a limited number of studies have empirically examined the nominal contracting hypothesis and results are mixed and conflicting. Aiming to find out whether nominal contracting hypothesis can explain the empirical relationship between inflation and stock returns, this chapter extends models suggested by previous studies to the linear dynamic panel data model with an estimation method of two-step GMM-SYS and empirically examines the effect of nominal contracts on the sensitivity of stock returns related to unexpected inflation using five variables of nominal contracts: net monetary position, its two sub-categories: short-term monetary position and long-term monetary position, depreciation tax shield and debt-to-equity ratio, and the nominal capital gains tax effect of inflation using variables of real assets: net property, plant and equipment and inventories.

The results presented in this chapter are consistent with the nominal contracting hypothesis and previous studies which show evidence of the nominal contracting effect. Net monetary position and its two sub-categories: short- and long-term monetary positions, defined in terms of nominal assets, are found to have strong negative effect on the sensitivity of stock returns to unexpected inflation. Although debt-to-equity ratio, defined in terms of nominal liabilities, is found to have little nominal contracting effect, its weak positive effect on the sensitivity of stock returns to unexpected inflation is also consistent with the nominal contracting hypothesis. Therefore our findings suggest that biased estimates of future nominal interest rates due to the unexpected inflation will cause the value of the nominal contract to be lower or higher than the primary value of the nominal contracts agreed by the parties involved, thus, debtor firms gain while creditor firms lose from higher-than-expected inflation. Moreover, we find that firms that have more net monetary assets lose more while firms that have more debts gain more from higher-than-expected inflation. This result agrees with the magnitude of the impact suggested by the nominal contracting hypothesis.

Our results also indicate that firms have a lot of short-term debts gain more than the firms that have a lot of long-term debts. This is inconsistent with the difference of magnitude impact between short- and long-term monetary positions suggested by French et al (1983). Long-term monetary positions with a longer maturity would have more effect on sensitivity of stock returns to unexpected inflation than short-term monetary position with shorter maturity magnitude. However our finding is consistent with previous studies which provide either mixed evidence or contradictory evidence of the magnitude impact due to maturity magnitude.

However, the depreciation tax shield, which is assumed to have a negative effect in determining the response of stock returns on unexpected inflation, is found to have a positive effect on the sensitivity of stock returns to unexpected inflation. This is inconsistent with the nominal contracting hypothesis. However, it might be explained by the tax augmented hypothesis which suggests that firms might use the depreciation tax shield to address the tax purpose, therefore, firms' stock prices will rise to compensate tax-paying investors in the long run.

Finally, the results are also consistent with previous studies suggesting the nominal capital gains tax effect of inflation. The net property, plant and equipment and inventories are found to negatively affect the sensitivity of stock returns to unexpected inflation, which implies that due to the accounting methods applied on the calculation of real assets, firms that have real assets will lose from higher-than-expected inflation.

In conclusion, our results confirm the nominal contracting effect and suggest that nominal contracts due to unexpected inflation will cause the wealth redistribution from creditors to debtors. Therefore the mixed results found for the relationship between inflation and stock returns might be explained by the nominal contracting hypothesis: since net debtor firms benefit from unexpected inflation while the net creditor firms lose from unexpected inflation, an industry or an aggregate market at a negative net nominal position (holding more nominal liabilities than assets) will gain from unexpected inflation, consequently, there will be a positive relationship between unexpected inflation and stock returns of the aggregate market at negative net nominal position, and vice versa.

Table 5. 1: The Unbiasedness Test

$P_t = a + \beta P_t^e + \varepsilon_t$

α	0.000018 (0.00013)[0.893]
β	**1.0186***** (0.0270)[0.000]
R^2	0.826
Durbin-Watson Test	1.95
F-test: (α, β)=(0,1)	0.4989[0.6076]
Breusch-Godfrey LM(12)	1.653*[0.077]

Note: Standard errors are shown in parentheses and p-values are shown in square brackets
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 2: The Weak-Form Test of Efficiency

$P_t - P_t^e = a + \beta_1 P_{t-1} + ... + \beta_{12} P_{t-12} + e_t$

α	-5.36e-5 (0.0002)[0.8154]
β_1	0.0228 (0.0271)[0.4008]
β_2	-0.0216 (0.0274)[0.4319]
β_3	-0.0083 (0.0274)[0.7636]
β_4	0.0068 (0.0273)[0.8047]
β_5	0.0377 (0.0273)[0.1692]
β_6	0.0169 (0.0274)[0.5372]
β_7	-0.0057 (0.0274)[0.8345]
β_8	-0.0188 (0.0267)[0.4834]
β_9	-0.0314 (0.0267)[0.2407]
β_{10}	0.0289 (0.0268)[0.2806]
β_{11}	-0.0245 (0.0267)[0.3602]
β_{12}	0.0511 (0.0263)[0.0534]*
R^2	0.0552
Durbin-Watson Test	2.0
Breusch-Godfrey LM(12)	0.9101[0.5372]
F-test:(β_i)=(0)	1.3447[0.1929]

Note: Standard errors are shown in parentheses and p-values are shown in square brackets
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 3: Structure of the Panel Data

All non-financial and non-utility UK domestic firms (dead or alive) which are listed on London Stock Exchange from 1982 to 2006 and have at least three continual annual data available on all of the accounting variables are included in the sample. All the in-sample firms are divided into eight industries named Oil and gases (OI), Basic materials (BM), Industrials (ID), Consumer goods (CG), Healthcare (HL), Consumer services (CS), Telecoms (TM) and Information technologies (TO) on the basis of its industry categories. Therefore the total number of non-financial and non-utility firms is at 2110, the total number of observation is 23549 from 1982 to 2006. All the data are constructed as the unbalanced panel data set. Two sections for the aggregate market (ALL) and eight industries (BM, CG, CS, HL, ID, OI, IT and TM) in the tables shown in following.

Panel A: Number of firms										Panel B: Number of observations									
n(years)	ALL	OI	BM	ID	CG	HL	CS	TM	IT	Years	ALL	OI	BM	ID	CG	HL	CS	TM	IT
3	120	6	13	27	11	11	40	1	11	1982	215	6	18	90	45	7	46	1	2
4	135	7	15	34	12	7	40	5	15	1983	226	7	17	93	45	9	51	1	3
5	172	6	4	53	18	11	58	5	17	1984	307	9	23	124	61	10	76	1	3
6	194	6	8	33	17	19	64	2	45	1985	364	10	28	146	72	10	89	2	7
7	112	3	6	30	12	7	35	4	15	1986	397	13	28	159	77	11	99	2	8
8	139	4	6	37	20	8	46	1	17	1987	679	16	41	266	150	18	158	2	28
9	123	7	10	42	11	6	32	2	13	1988	907	20	49	360	192	28	207	3	48
10	155	4	12	52	23	7	34	1	22	1989	1021	24	57	404	210	33	234	4	55
11	133	8	6	42	21	15	30	0	11	1990	1081	27	59	424	218	33	254	4	62
12	86	0	8	27	18	2	18	0	13	1991	1096	23	60	427	219	34	264	5	64
13	77	2	8	20	11	6	24	0	6	1992	1078	23	60	414	213	32	268	4	64
14	63	2	2	20	11	3	22	1	2	1993	1085	24	59	412	218	33	272	4	63
15	55	0	1	18	19	0	11	0	6	1994	1096	23	63	414	217	39	268	4	68
16	48	0	3	19	9	1	12	0	4	1995	1114	23	62	413	221	39	274	5	77
17	69	3	4	30	13	0	13	0	6	1996	1202	30	77	430	223	52	293	6	91
18	80	3	3	35	17	5	13	1	3	1997	1281	31	77	438	226	60	325	12	112
19	96	1	4	35	22	6	21	0	7	1998	1271	31	71	422	215	66	327	16	123
20	86	2	2	36	11	2	24	0	9	1999	1188	32	59	384	187	66	313	17	130
21	23	0	0	10	3	1	7	0	2	2000	1128	30	50	363	170	60	301	19	135
22	23	0	0	10	5	0	6	1	1	2001	1211	34	54	363	154	75	331	19	181
23	29	1	2	15	4	0	7	0	0	2002	1216	33	54	372	146	80	332	19	180
24	12	0	1	4	2	1	3	0	1	2003	1190	38	63	371	131	80	315	17	175
25	80	1	8	36	18	1	14	1	1	2004	1157	40	70	360	123	81	305	15	163
										2005	1066	38	69	330	112	79	269	12	157
										2006	973	37	64	301	102	71	243	9	146
Total	**2110**	**66**	**126**	**665**	**309**	**119**	**574**	**25**	**227**	**Total**	**23549**	**622**	**1332**	**8280**	**3947**	**1106**	**5914**	**203**	**2145**

Table 5. 4: Summary Statistics

Summary statistics of the variables in analysis for the aggregate market are shown in this table. The total number of firms is 2110. Ri is the first difference of logs of stock prices; Rm is the natural logarithmic of FTSE All Share Index; P^e, P^u is the expected and unexpected changes in the Retail Price Index (RPI) inflation; Net property, plant and equipment (PP) is defined as PP= (net property, plant and equipment-average PP)/market value; Inventories (IV) are defined as IN= (inventories-average IN)/market value; Net monetary position (NMP) is defined as NMP= (cash and equivalents - net receivables - current liabilities - long term debt - Preferred stocks-average NMP)/market value; Short-term monetary position (SMP) is defined as SMP = (cash and equivalents - net receivables - current liabilities - average SMP)/market value; Long-term monetary position (LMP) is defined as LMP = [- (long term debt - Preferred stocks)-average NMP)]/market value; Depreciation tax shield (TAX) is defined as TAX = (net property, plant and equipment - 3* deferred tax - average TAX)/ market value; Debt to equity ratio (DE) is defined as DE= ratio of total debt to common equity- average DE. Medi, Max, Min, S-d, and Skew refer to Median, Maximum, Minimum, Standard Deviation and Skewness, respectively

	Ri	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Mean	-0.0089	0.0719	0.0333	0.0015	-26.4441	-6.2344	16.4111	5.2137	11.1569	-21.7544	0.0042
Medi	0.0760	0.1235	0.0329	0.0028	-5.8369	-1.3739	3.2818	0.9827	2.2674	-4.5399	-0.1401
S-d	0.6095	0.1468	0.0170	0.0062	80.5346	18.6655	55.2198	18.6342	36.8305	64.6668	9.0910
Kurtosis	7.6960	2.9645	4.4792	3.2613	246.2517	232.2136	292.7488	318.7689	280.2345	208.0390	3332.3280
Skew	-0.7403	-1.0631	1.2323	-0.8557	-12.2215	-11.8592	13.3336	13.4879	13.0775	-11.1980	-13.9146
Min	-6.3910	-0.2872	0.0047	-0.0137	-2805.225	-595.4199	-355.3868	-238.1261	-312.9791	-2143.880	-761.8455
Max	4.2500	0.2625	0.0814	0.0124	131.9753	12.9043	2129.1320	775.2987	1349.8530	196.0902	596.3143

Table 5. 5: Correlation Matrix

Panel A: All

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.1113	1.0000								
P^u	-0.2988	0.0852	1.0000							
PP	0.1383	-0.0062	-0.3021	1.0000						
INV	0.1266	-0.0263	-0.3108	**0.9812**	1.0000					
NMP	-0.1427	-0.0097	0.2580	-0.9856	-0.9561	1.0000				
SMP	-0.1462	-0.0203	0.2275	-0.9492	-0.8929	0.9799	1.0000			
LMP	-0.1394	-0.0047	0.2696	-0.9890	-0.9731	0.9951	0.9553	1.0000		
TAX	0.1499	-0.0006	-0.3129	0.9926	0.9680	-0.9689	-0.9336	-0.9719	1.0000	
DE	-0.0047	-0.0009	0.0091	0.0126	0.0114	-0.0124	-0.0160	-0.0104	0.0129	1.0000

Panel B: OI

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.1558	1.0000								
P^u	-0.3081	0.0467	1.0000							
PP	0.1260	0.0050	-0.2700	1.0000						
INV	0.1367	0.0058	-0.2688	0.9574	1.0000					
NMP	-0.1600	-0.0193	0.2861	-0.9770	-0.9323	1.0000				
SMP	-0.2337	-0.0603	0.2591	-0.7801	-0.8063	0.8705	1.0000			
LMP	-0.0997	0.0043	0.2677	-0.9780	-0.8981	0.9601	0.6981	1.0000		
TAX	0.1099	0.0030	-0.2692	0.9909	0.9224	-0.9663	-0.7255	-0.9935	1.0000	
DE	-0.0016	0.0050	0.0252	-0.3504	-0.3075	0.2939	0.1463	0.3452	-0.3674	1.0000

Panel C: BM

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.1110	1.0000								
P^u	-0.2944	0.0529	1.0000							
PP	0.1667	0.0583	-0.1569	1.0000						
INV	0.1618	0.0381	-0.2194	0.9666	1.0000					
NMP	-0.1707	-0.0618	0.1372	-0.9973	-0.9571	1.0000				
SMP	-0.1739	-0.0715	0.0813	-0.9589	-0.8775	0.9743	1.0000			
LMP	-0.1674	-0.0580	0.1625	-0.9979	-0.9777	0.9952	0.9483	1.0000		
TAX	0.1703	0.0635	-0.1544	0.9981	0.9712	-0.9946	-0.9489	-0.9975	1.0000	
DE	0.0018	0.0007	-0.0117	0.0300	0.0512	-0.0247	-0.0120	-0.0327	0.0272	1.0000

Panel D: ID

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.0854	1.0000								
P^u	-0.2967	0.1021	1.0000							
PP	0.1475	-0.0147	-0.3497	1.0000						
INV	0.1369	-0.0613	-0.3771	0.9702	1.0000					
NMP	-0.1472	-0.0007	0.2994	-0.9730	-0.9144	1.0000				
SMP	-0.1830	-0.0075	0.3202	-0.9470	-0.9236	0.9445	1.0000			
LMP	-0.1417	0.0003	0.2930	-0.9646	-0.8986	0.9970	0.9186	1.0000		
TAX	0.1555	-0.0143	-0.3440	0.9963	0.9641	-0.9665	-0.9496	-0.9564	1.0000	
DE	-0.0006	0.0004	-0.0017	0.0163	0.0169	-0.0118	-0.0147	-0.0103	0.0168	1.0000

See Table 5.3 and 5.4 for definition of variables

Table 5.5: Correlation Matrix (continued)

Panel E: CG

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.0551	1.0000								
P^u	-0.2896	0.1151	1.0000							
PP	0.1424	-0.0308	-0.3181	1.0000						
INV	0.1167	0.0029	-0.2349	0.9404	1.0000					
NMP	-0.1389	-0.0214	0.2083	-0.9159	-0.9878	1.0000				
SMP	-0.1318	-0.0266	0.1940	-0.8981	-0.9848	0.9974	1.0000			
LMP	-0.1401	-0.0168	0.2175	-0.9255	-0.9895	0.9990	0.9933	1.0000		
TAX	0.1572	-0.0147	-0.3107	0.9904	0.9103	-0.8926	-0.8725	-0.9028	1.0000	
DE	0.0011	-0.0040	-0.0003	0.0170	0.0166	-0.0161	-0.0172	-0.0154	0.0171	1.0000

Panel F: HL

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.1997	1.0000								
P^u	-0.2839	0.0522	1.0000							
PP	0.1627	-0.0207	-0.3557	1.0000						
INV	0.1630	-0.0451	-0.3707	0.9913	1.0000					
NMP	-0.1399	0.0721	0.3206	-0.9307	-0.9372	1.0000				
SMP	-0.0490	-0.0030	-0.0496	-0.1355	-0.1669	0.4322	1.0000			
LMP	-0.1342	0.0820	0.3768	-0.9724	-0.9666	0.9238	0.0540	1.0000		
TAX	0.1440	0.0056	-0.3509	0.9852	0.9636	-0.8817	-0.0291	-0.9633	1.0000	
DE	0.0023	-0.0058	-0.0053	-0.0242	-0.0071	0.0077	-0.0156	0.0157	-0.0170	1.0000

Panel G: CS

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.1414	1.0000								
P^u	-0.3027	0.0665	1.0000							
PP	0.1166	-0.0134	-0.2705	1.0000						
INV	0.1215	-0.0229	-0.3012	0.9895	1.0000					
NMP	-0.1113	0.0036	0.2377	-0.9911	-0.9681	1.0000				
SMP	-0.1233	0.0042	0.2389	-0.9815	-0.9626	0.9925	1.0000			
LMP	-0.1044	0.0025	0.2341	-0.9897	-0.9642	0.9981	0.9830	1.0000		
TAX	0.1236	-0.0011	-0.2715	0.9971	0.9874	-0.9846	-0.9747	-0.9833	1.0000	
DE	-0.0030	-0.0031	0.0031	0.0112	0.0121	-0.0102	-0.0114	-0.0095	0.0112	1.0000

Panel H: TM

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.2700	1.0000								
P^u	-0.3168	-0.0394	1.0000							
PP	0.1068	0.0200	-0.3344	1.0000						
INV	0.1265	0.0188	-0.3160	0.9922	1.0000					
NMP	-0.0635	0.0051	0.2195	-0.8852	-0.9196	1.0000				
SMP	-0.0110	0.0244	0.1832	-0.8103	-0.8467	0.9823	1.0000			
LMP	-0.1013	-0.0088	0.2411	-0.9207	-0.9528	0.9900	0.9464	1.0000		
TAX	0.1335	0.0441	-0.3646	0.9277	0.8890	-0.6517	-0.5418	-0.7200	1.0000	
DE	0.0067	0.0171	0.0090	-0.2120	-0.1928	0.0642	0.0295	0.0883	-0.2835	1.0000

See Table 5.3 and 5.4 for definition of variables

Table 5.5: Correlation Matrix (continued)

Panel I: TO

	Rm	P^e	P^u	PP	INV	NMP	SMP	LMP	TAX	DE
Rm	1.0000									
P^e	0.2165	1.0000								
P^u	-0.2811	0.0885	1.0000							
PP	0.1184	-0.1455	-0.4218	1.0000						
INV	0.1125	-0.1806	-0.4165	0.9585	1.0000					
NMP	-0.1403	-0.0252	0.0134	-0.2309	-0.0503	1.0000				
SMP	0.0115	-0.0098	-0.3581	0.6777	0.6775	0.3130	1.0000			
LMP	-0.1428	-0.0168	0.2684	-0.7053	-0.5322	0.7360	-0.4126	1.0000		
TAX	0.1275	-0.1100	-0.4045	0.9636	0.8664	-0.3748	0.5959	-0.7850	1.0000	
DE	-0.0019	0.0000	-0.0012	0.0053	0.0052	-0.0121	0.0004	-0.0119	0.0057	1.0000

See Table 5.3 and 5.4 for definition of variables.

Table 5. 6: Effects of Net Monetary Position on the Sensitivity of Stock Returns to Unexpected Inflation

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 NMP_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1420*** **	**0.1535*** **	**0.1516*** **	**0.1391*** **	**0.0874** **	**0.1720*** **	**0.1466*** **	-0.1159	0.0427
	(0.0162)	(0.0631)	(0.0483)	(0.0221)	(0.0383)	(0.053)	(0.0328)	(0.4259)	(0.0424)
	[0.000]	[0.015]	[0.002]	[0.000]	[0.022]	[0.001]	[0.000]	[0.786]	[0.314]
R_m	**0.6428*** **	**1.1951** **	**0.5092*** **	**0.6803*** **	**0.5191*** **	**0.5853** **	**0.3121** **	-2.6242	3.6659
	(0.0582)	(0.5665)	(0.1326)	(0.0741)	(0.1095)	(0.2661)	(0.1497)	(3.927)	(9.621)
	[0.000]	[0.035]	[0.000]	[0.000]	[0.000]	[0.028]	[0.037]	[0.505]	[0.703]
P^e	**0.0603*** **	0.1709	**0.0495* **	**0.0711*** **	**0.04951*** **	0.0240	-0.0104	0.5439	0.5849
	(0.0112)	(0.1064)	(0.0263)	(0.0143)	(0.0205)	(0.0535)	(0.029)	(0.4156)	(1.87)
	[0.000]	[0.109]	[0.060]	[0.000]	[0.016]	[0.654]	[0.721]	[0.193]	[0.754]
P^u	**-0.0103*** **	-0.0149	**-0.0098*** **	**-0.0112*** **	**-0.0111*** **	-0.0053	**-0.0056** **	-0.0369	-0.0553
	(0.001)	(0.0099)	(0.0025)	(0.0013)	(0.0021)	(0.0042)	(0.0022)	(0.042)	(0.1179)
	[0.000]	[0.134]	[0.000]	[0.000]	[0.000]	[0.210]	[0.011]	[0.381]	[0.639]
NMP	**-0.1755*** **	0.0215	**-0.1858*** **	**-0.2114*** **	**-0.0698* **	**-0.3335* **	**-0.2032*** **	**-0.0414** **	**-2.4891* **
	(0.0233)	(0.0608)	(0.0252)	(0.0761)	(0.0393)	(0.1972)	(0.0478)	(0.0161)	(1.411)
	[0.000]	[0.724]	[0.000]	[0.005]	[0.075]	[0.091]	[0.000]	[0.011]	[0.078]
AR(1)	-21.65***	-4.151***	-5.744***	-12.19***	-8.933***	-5.439***	-10.87***	-1.555	-6.497***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.120]	[0.000]
AR(2)	-0.4742	0.1119	-1.029	-1.484	1.624	-1.203	0.3205	-1.171	-0.7677
	[0.635]	[0.911]	[0.304]	[0.138]	[0.104]	[0.229]	[0.749]	[0.241]	[0.443]
Sargan Test (df)	515.0*** (233) [0.000]	37.82 (41) [0.613]	91.04 (91) [0.479]	188.8 (210) [0.850]	174.4 (162) [0.239]	60.44 (91) [0.994]	149.0 (141) [0.305]	5.247 (66) [1.000]	100.8 (91) [0.227]
Wald (joint)(df)	832.2*** (5)[0.000]	19.65*** (5)[0.000]	187.4*** (5)[0.000]	394.3*** (5)[0.000]	106.4*** (5)[0.000]	118.8*** (5)[0.000]	232.8*** (5)[0.000]	13.88*** (5)[0.016]	202.8*** (5)[0.000]
Wald (dum)(df)	1687. *** (24)[0.000]	384.9*** (24)[0.000]	339.6*** (24)[0.000]	755.9*** (24)[0.000]	364.8*** (24)[0.000]	349.1*** (24)[0.000]	524.5*** (24)[0.000]	162.5*** (24)[0.000]	329.8*** (24)[0.000]
Wald (time)(df)	1475. *** (23)[0.000]	283.9*** (23)[0.000]	251.8*** (23)[0.000]	666.8*** (23)[0.000]	327.7*** (23)[0.000]	318.5*** (23)[0.000]	451.1*** (23)[0.000]	162.5*** (23)[0.000]	325.2*** (23)[0.000]
R^2	0.1384	0.2218	0.1711	0.1247	0.1400	0.1908	0.1434	<1	0.2947
Instruments	Ri(2,2); Rm,Pe,Pu, NMP(1,1); △Ri (1,1); △Rm,Pe,Pu NMP(0,0).	Ri(2,2); △Ri(1,1).	Ri(2,2); △Ri(1,1); △Pu, NMP(0,0).	Ri(2,2); Rm,Pe, Pu(1,1); △Ri(1,1); △Rm, Pe,Pu, NMP (0,0).	Ri(2,2); Pu, NMP(1,1); △Ri(1,1); △Pe,Pu, NMP(0,0).	Ri(2,2); △Ri(1,1); △Pu, NMP(0,0).	Ri(2,2); △Ri(1,1); △Rm, Pe,Pu, NMP(0,0).	Ri(2,2); △Ri(1,1); △NMP(0,0).	Ri(2,2); △Ri(1,1); △Pu, NMP(0,0).
Firms/Obs	2110/21317	66/556	126/1203	665/7581	308/3604	119/982	574/5300	25/178	227/1913

Notes: See Table 5.3 and 5.4 for definition of variables; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 7: Effects of Short-Term Monetary Position on the Sensitivity of Stock Returns to Unexpected Inflation

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 SMP_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	0.1376***	0.1564**	0.1333***	0.1274***	0.0710**	0.1231**	0.1429***	-0.2018	0.0689*
	(0.016)	(0.0668)	(0.0487)	(0.0220)	(0.0317)	(0.0550)	(0.0323)	(0.2808)	(0.0383)
	[0.000]	[0.020]	[0.006]	[0.000]	[0.025]	[0.026]	[0.000]	[0.474]	[0.072]
R_m	0.6389***	1.1219**	0.5403***	0.6723***	0.5093***	0.6768***	0.3195**	2.4007**	4.0539
	(0.0571)	(0.4912)	(0.1174)	(0.0732)	(0.1069)	(0.242)	(0.1477)	(1.127)	(5.491)
	[0.000]	[0.023]	[0.000]	[0.000]	[0.000]	[0.005]	[0.031]	[0.035]	[0.46]
P^e	0.0589***	0.1571*	0.0603***	0.0686***	0.0481**	0.0488	-0.0079	-0.4082	0.6627
	(0.011)	(0.0912)	(0.0229)	(0.0140)	(0.0205)	(0.0492)	(0.0286)	(0.7037)	(1.069)
	[0.000]	[0.086]	[0.009]	[0.000]	[0.019]	[0.321]	[0.783]	[0.563]	[0.535]
P^u	-0.0106***	-0.0131	-0.0109***	-0.0117***	-0.0110***	-0.0074*	-0.0058***	-0.8957	-0.0617
	(0.001)	(0.0087)	(0.0024)	(0.0012)	(0.0020)	(0.0039)	(0.0022)	(0.6135)	(0.0675)
	[0.000]	[0.136]	[0.000]	[0.000]	[0.000]	[0.063]	[0.009]	[0.146]	[0.361]
SMP	-0.5186***	0.0356	-0.7223***	-0.6210*	-0.1171*	-2.5272	-0.6294***	-0.1382*	-1.6699
	(0.0616)	(0.1574)	(0.0678)	(0.341)	(0.0709)	(2.381)	(0.1365)	(0.0766)	(1.919)
	[0.000]	[0.821]	[0.000]	[0.069]	[0.099]	[0.289]	[0.000]	[0.073]	[0.384]
AR(1)	-21.85***	-4.113***	-5.549***	-12.22***	-9.382***	-5.398***	-10.92***	-0.2933	-6.637***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.769]	[0.000]
AR(2)	-0.6317	0.09989	-1.157	-1.679	1.447	-1.273	0.2257	-2.109	-0.4196
	[0.528]	[0.920]	[0.247]	[0.093]	[0.148]	[0.203]	[0.821]	[0.035]	[0.675]
Sargan Test (df)	505.4*** (233) [0.000]	37.90 (66) [0.998]	100.8 (89) [0.185]	180.6 (210) [0.930]	145.7 (135) [0.249]	42.15 (41) [0.421]	142.7 (141) [0.445]	7.645 (66) [1.000]	138.3 (135) [0.406]
Wald (joint)(df)	875.5*** (5) [0.000]	19.81*** (5)[0.001]	243.1*** (5)[0.000]	367.2*** (5)[0.000]	127.6*** (5)[0.000]	104.9*** (5)[0.000]	235.9*** (5)[0.000]	7.974 (5)[0.158]	178.3*** (5)[0.000]
Wald (dum)(df)	1737. *** (24)[0.000]	398.8*** (24)[0.000]	344.5*** (24)[0.000]	800.6*** (24)[0.00]	406.2 *** (24)[0.000]	404.0*** (24)[0.000]	532.4*** (24)[0.000]	168.4*** (24)[0.000]	333.0*** (24)[0.000]
Wald (time)(df)	1516. *** (23)[0.000]	282.7*** (23)[0.000]	291.6*** (23)[0.000]	717.0*** (23)[0.000]	382.5*** (23)[0.000]	344.0*** (23)[0.000]	464.0*** (23)[0.000]	167.7*** (23)[0.000]	329.3*** (23)[0.000]
R^2	0.1404	0.2124	0.1709	0.1248	0.1382	0.1892	0.1455	<1	0.2915
Instru-ments	Ri(2,2); Rm,Pe,Pu, SMP(1,1); △Ri (1,1); △Rm, Pe,Pu SMP(0,0)	Ri(2,2); △Ri(1,1); △Rm(0,0)	Ri(2,2); SMP(1,1); △Ri(1,1); △SMP(0,0)	Ri(2,2); Rm,Pe, Pu(1,1); △Ri(1,1); △Rm, Pe,Pu, SMP (0,0)	Ri,SMP(2,2); Pu(1,1); △Ri, SMP(1,1); △Pu(0,0)	Ri(2,2); △Ri(1,1)	Ri(2,2); △Ri(1,1); △Rm,Pe, Pu,SMP (0,0)	Ri(2,2); △Ri(1,1); △SMP(0,0)	Ri,Pu(2,2); SMP(1,1); △Ri, Pu(1,1); △SMP (0,0)
Firms/Obs	2110/21317	66/556	126/1203	665/7581	308/3604	119/982	574/5300	25/178	227/1913

Notes: See Table 5.3 and 5.4 for definition of variables; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start fonn lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 8: Effects of Long-Term Monetary Position on the Sensitivity of Stock Returns to Unexpected Inflation

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 LMP_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1467*****	**0.1832*****	**0.1534*****	**0.1414*****	**0.0574***	**0.1731*****	**0.1489*****	-0.0809	0.0027
	(0.0164)	(0.0654)	(0.0476)	(0.0225)	(0.0327)	(0.0535)	(0.0333)	(0.4236)	(0.0423)
	[0.000]	[0.005]	[0.001]	[0.000]	[0.079]	[0.001]	[0.000]	[0.849]	[0.948]
R_m	**0.6439*****	**1.2438***	**0.5056*****	**0.6848*****	**0.5242*****	**0.6039****	**0.3080****	-3.5770	-9.3778
	(0.0583)	(0.7393)	(0.1318)	(0.0771)	(0.1073)	(0.2568)	(0.151)	(4.613)	(18.03)
	[0.000]	[0.093]	[0.000]	[0.000]	[0.000]	[0.019]	[0.041]	[0.439]	[0.603]
P^e	**0.0600*****	0.1809	**0.04886***	**0.0716*****	**0.0508****	0.0269	-0.0119	0.4166	-1.9440
	(0.0112)	(0.1423)	(0.0262)	(0.0149)	(0.0205)	(0.052)	(0.0292)	(0.4531)	(3.509)
	[0.000]	[0.204]	[0.062]	[0.000]	[0.013]	[0.605]	[0.683]	[0.359]	[0.58]
P^u	**-0.0105*****	-0.0164	**-0.0094*****	**-0.0110*****	**-0.0117*****	-0.0056	**-0.0057****	-0.0019	0.1104
	(0.001)	(0.0101)	(0.0025)	(0.0013)	(0.002)	(0.0043)	(0.0022)	(0.0229)	(0.2202)
	[0.000]	[0.105]	[0.000]	[0.000]	[0.000]	[0.189]	[0.011]	[0.934]	[0.616]
LMP	**-0.2433*****	**0.0731*****	**-0.2639*****	**-0.2834*****	**-0.0902***	-0.2806	**-0.2972*****	**-0.0651****	**-9.2574***
	(0.0385)	(0.0159)	(0.0354)	(0.0965)	(0.0462)	(0.2795)	(0.0734)	(0.0287)	(5.101)
	[0.000]	[0.000]	[0.000]	[0.003]	[0.051]	[0.316]	[0.000]	[0.024]	[0.070]
AR(1)	-21.57***	-4.217***	-5.734***	-12.07***	-9.199***	-5.413***	-10.84***	-1.458	-6.743***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.145]	[0.000]
AR(2)	-0.3334	0.2913	-1.012	-1.500	1.200	-1.214	0.3806	-1.139	-1.027
	[0.739]	[0.771]	[0.311]	[0.134]	[0.230]	[0.225]	[0.703]	[0.255]	[0.305]
Sargan Test (df)	528.0***	42.49	91.10	191.2	144.9	58.65	152.7	6.406	52.89
	(233)	(66)	(91)	(210)	(135)	(66)	(141)	(66)	(41)
	[0.000]	[0.989]	[0.477]	[0.820]	[0.264]	[0.728]	[0.237]	[1.000]	[0.101]
Wald (joint)(df)	830.2***	58.63***	195.0***	381.1***	128.9***	104.8***	232.2***	11.16**	242.1***
	(5)[0.000]	(5)[0.000]	(5)[0.000]	(5)[0.000]	(5)[0.000]	(5)[0.000]	(5)[0.000]	(5)[0.048]	(5)[0.000]
Wald (dum)(df)	1687. ***	175.3***	324.7***	761.9***	411.1***	354.4***	524.0***	176.7***	372.6***
	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24) [0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]
Wald (time)(df)	1478. ***	165.9***	249.2***	662.0***	387.2***	322.3***	444.7***	181.0***	364.1***
	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]
R^2	0.1369	0.2272	0.1717	0.1242	0.1379	0.1900	0.1424	<1	0.2203
Instru-ments	Ri(2,2); Rm,Pe,Pu, LMP(1,1); △Ri (1,1); △Rm,Pe, Pu LMP(0,0)	Ri(2,2); △Ri(1,1); △LMP (0,0)	Ri(2,2); △Ri(1,1); △Pu, LMP(0,0)	Ri(2,2); Rm,Pe, Pu(1,1); △Ri(1,1); △Rm,Pe, Pu,LMP (0,0)	Ri,LMP(2,2); Pu(1,1); △Ri, LMP(1,1); △Pu(0,0)	Ri(2,2); △Ri(1,1); △LMP(0,0)	Ri(2,2); △Ri(1,1); △Rm,Pe, Pu,LMP (0,0)	Ri(2,2); △Ri(1,1); △LMP(0,0)	Ri(2,2); △Ri(1,1)
Firms/Obs	2110/21317	66/556	126/1203	665/7581	308/3604	119/982	574/5300	25/178	227/1913

Notes: See Table 5.3 and 5.4 for definition of variables; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals.

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 9: Comparison of the Impact of Short and Long-Term Monetary Position

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 Ad - SMP_{it} P_t^u + b_3 LMP_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1368***	**0.1619**	**0.1826***	**0.1480***	**0.0810**	**0.1688***	**0.1380***	-0.1754	0.0458
	(0.016)	(0.0781)	(0.0527)	(0.0226)	(0.0365)	(0.0527)	(0.0323)	(0.1502)	(0.0433)
	[0.000]	[0.039]	[0.001]	[0.000]	[0.027]	[0.001]	[0.000]	[0.245]	[0.292]
R_m	**0.6339***	0.9595	**0.5231***	**0.6693***	**0.5408***	**0.6152**	**0.2955**	**-7.0688***	1.5179
	(0.0516)	(0.7537)	(0.131)	(0.0823)	(0.1014)	(0.2564)	(0.1503)	(3.969)	(1.644)
	[0.000]	[0.204]	[0.000]	[0.000]	[0.000]	[0.017]	[0.049]	[0.077]	[0.356]
P^e	**0.0581***	0.1292	**0.04957***	**0.0691***	**0.0503***	0.0312	-0.0111	**-2.8402**	0.1672
	(0.009)	(0.1438)	(0.0258)	(0.0158)	(0.0190)	(0.0517)	(0.0291)	(1.403)	(0.321)
	[0.000]	[0.370]	[0.055]	[0.000]	[0.008]	[0.546]	[0.704]	[0.045]	[0.603]
P^u	**-0.0102***	-0.0128	**-0.0102***	**-0.0108***	**-0.0111***	-0.0058	**-0.0055**	**-2.1227***	-0.0333
	(0.0009)	(0.0098)	(0.0025)	(0.0013)	(0.0019)	(0.0042)	(0.0022)	(1.118)	(0.0216)
	[0.000]	[0.196]	[0.000]	[0.000]	[0.000]	[0.169]	[0.016]	[0.060]	[0.124]
Ad-SMP	**-1.0205***	**-0.14613***	-0.0232	0.5568	**-0.7688**	-0.3740	**-5.5085**	0.2250	**-5.82267***
	(0.2414)	(0.0828)	(0.2832)	(0.5727)	(0.3405)	(1.466)	(2.187)	(0.2239)	(3.534)
	[0.000]	[0.078]	[0.935]	[0.331]	[0.024]	[0.799]	[0.012]	[0.317]	[0.099]
LMP	**-0.2477***	**0.0600***	**-0.2533***	**-0.2852***	**-0.1256**	-0.3128	**-0.3266***	**-0.1367***	-1.3152
	(0.0405)	(0.0181)	(0.0303)	(0.0912)	(0.0526)	(0.3593)	(0.0779)	(0.0785)	(1.984)
	[0.000]	[0.001]	[0.000]	[0.002]	[0.017]	[0.384]	[0.000]	[0.084]	[0.507]
AR(1)	-21.29***	-3.909***	-5.577***	-11.92***	-8.854***	-5.363***	-11.04***	-3.652***	-6.259***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-0.7192	0.1557	-0.8254	-1.337	1.582	-1.213	-0.4995	-2.815	-0.8030
	[0.472]	[0.876]	[0.409]	[0.181]	[0.114]	[0.225]	[0.617]	[0.005]	[0.422]
Sargan Test (df)	587.6***	41.64	103.6	213.2	216.6	59.41	153.8	6.441	138.9
	(280)	(65)	(90)	(234)	(207)	(65)	(140)	(65)	(134)
	[0.000]	[0.989]	[0.154]	[0.832]	[0.310]	[0.672]	[0.201]	[1.000]	[0.368]
Wald (joint)(df)	855.7***	131.8***	230.5***	377.7***	144.1***	112.3***	256.9***	11.36*	202.3***
	(6)[0.000]	(6)[0.000]	(6)[0.000]	(6) [0.000]	(6) [0.000]	(6)[0.000]	(6)[0.000]	(6) [0.078]	(6)[0.000]
Wald (dum)(df)	1668. ***	221.5***	231.4 ***	789.9***	412.5***	341.0***	490.7***	166.1***	403.6***
	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24) [0.000]	(24) [0.000]	(24) [0.000]	(24)[0.000]
Wald (time)(df)	1442. ***	208.1***	198.2***	680.5***	379.5***	314.6***	375.9***	208.7***	400.8***
	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]
R^2	0.1411	0.2425	0.1676	0.1234	0.1433	0.1916	0.1293	<1	0.2947
Instru-ments	Ri(2,2); Rm,Pe, Pu,SMP LMP(1,1); ΔRi, (1,1); ΔRm,Pe, Pu,SMP, LMP(0,0)	Ri(2,2); ΔRi(1,1); ΔSMP(0,0)	Ri(2,2); SMP(1,1); ΔRi(1,1); ΔSMP, LMP(0,0)	Ri(2,2); Rm,Pe, Pu(1,1); ΔRi(1,1); ΔRm,Pe, Pu,SMP, LMP (0,0)	Ri,LMP(2,2); Rm, SMP(1,1); ΔRi, LMP(1,1); ΔRm,,Pu, SMP(0,0)	Ri(2,2); ΔRi(1,1); ΔLMP(0,0)	Ri(2,2); ΔRi(1,1); ΔRm,Pe, Pu,LMP(0,0)	Ri(2,2); ΔRi(1,1); ΔSMP(0,0)	Ri,Pu(2,2); LMP(1,1); ΔRi, Pu(1,1); ΔLMP(0,0)
Firms/Obs	2110/21317	66/556	126/1203	665/7581	308/3604	119/982	574/5300	25/178	227/1913

Notes: See Table 5.3 and 5.4 for definition of variables; Ad-SMP is the adjusted SMP to control multicollinearity with LMP. Standard errors are shown in parentheses and p-values are shown in square brackets; Sargan Test is test of the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 10: Effects of Depreciation Tax Shield on the Sensitivity of Stock Returns to Unexpected Inflation

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1522*** **	**0.1911*** **	**0.1586*** **	**0.1613*** **	**0.0764** **	**0.1568*** **	**0.1902*** **	-0.3044	**0.0844** **
	(0.0177)	(0.0703)	(0.0516)	(0.0254)	(0.0371)	(0.0545)	(0.0354)	(0.2431)	(0.0431)
	[0.000]	[0.007]	[0.002]	[0.000]	[0.040]	[0.004]	[0.000]	[0.212]	[0.050]
R_m	**0.6026*** **	1.0995	**0.5927*** **	**0.6713*** **	**0.3713*** **	**0.7589** **	**0.4665*** **	-0.3370	0.2542
	(0.0632)	(1.664)	(0.1464)	(0.0849)	(0.1158)	(0.3187)	(0.1171)	(0.9906)	(5.209)
	[0.000]	[0.509]	[0.000]	[0.000]	[0.001]	[0.017]	[0.000]	[0.734]	[0.961]
P^e	**0.0496*** **	0.1431	**0.06292** **	**0.0658*** **	0.0280	0.0592	0.0196	0.3379	-0.0927
	(0.0123)	(0.33)	(0.0292)	(0.0164)	(0.0225)	(0.065)	(0.023)	(0.4255)	(1.005)
	[0.000]	[0.665]	[0.032]	[0.000]	[0.214]	[0.363]	[0.393]	[0.428]	[0.927]
P^u	**-0.0102*** **	-0.0097	**-0.0111*** **	**-0.0110*** **	**-0.0066*** **	-0.0056	**-0.0069*** **	**0.0385** **	-0.0819
	(0.0011)	(0.0255)	(0.0026)	(0.0014)	(0.0025)	(0.0045)	(0.0019)	(0.0161)	(0.1285)
	[0.000]	[0.703]	[0.000]	[0.000]	[0.008]	[0.206]	[0.000]	[0.018]	[0.524]
TAX	**0.1259*** **	**-0.0163*** **	**0.1054*** **	**0.13058** **	**0.34961** **	0.0931	**0.1920*** **	**0.1166** **	**1.7605** **
	(0.0322)	(0.0051)	(0.014)	(0.0708)	(0.1733)	(0.1113)	(0.0696)	(0.0483)	(0.9608)
	[0.000]	[0.001]	[0.000]	[0.065]	[0.044]	[0.403]	[0.006]	[0.017]	[0.067]
AR(1)	-20.58***	-4.150***	-5.572***	-11.73***	-9.216***	-5.298***	-10.78***	-0.4843	-3.974***
	[0.000]	[0.000	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.628]	[0.000]
AR(2)	-0.01107	0.3889	-1.048	-0.8538	1.590	-1.259	0.8711	-0.9180	0.3238
	[0.991]	[0.697]	[0.295]	[0.393]	[0.112]	[0.208]	[0.384]	[0.359]	[0.746]
Sargan Test (df)	497.8***	44.58	97.93	178.8	76.91	54.96	138.6	7.087	99.35
	(233)	(66)	(91)	(210)	(66)	(66)	(141)	(63)	(91)
	[0.000]	[0.980]	[0.291]	[0.942]	[0.169]	[0.832]	[0.542]	[1.000]	[0.258]
Wald (joint)(df)	807.2***	45.91***	186.5***	358.1***	112.9***	100.1***	257.6***	17.50***	223.1***
	(5)[0.000]	(5) [0.000]	(5)[0.000]	(5) [0.000]	(5)[0.000]	(5)[0.000]	(5)[0.000]	(5)[0.004]	(5)[0.000]
Wald (dum)(df)	1626***	169.3***	284.7***	776.1***	421.0***	354.1***	561.4***	654.3***	328.2***
	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24) [0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]	(23)[0.000]	(24)[0.000]
Wald (time)(df)	1476***	158.0***	261.5***	709.9***	382.2***	318.9***	490.4***	2371. ***	327.3***
	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23) [0.000]	(22)[0.000]	(23)[0.000]
R^2	0.1348	0.2156	0.1723	0.1177	0.1269	0.1916	0.1379	<0	0.2404
Instru-ments	Ri(2,2); Rm,Pe, Pu,TAX(1,1); △Ri(1,1); △Rm,Pe, Pu TAX(0,0)	Ri(2,2); △Ri(1,1); △TAX(0,0)	Ri(2,2); △Ri(1,1); △Pu, TAX(0,0)	Ri(2,2); Rm,Pe, Pu,(1,1); △Ri(1,1); △Rm,Pe, Pu,TAX(0,0)	Ri(2,2); △Ri(1,1); △Pu(0,0)	Ri(2,2); △Ri(1,1); △TAX(0,0)	Ri(2,2); △Ri(1,1); △Rm,Pe, Pu,TAX(0,0)	Ri(2,2); △Ri(1,1); △TAX(0,0)	Ri(2,2); △Ri(1,1); △Pu, TAX(0,0)
Firms/Obs	2110/20479	66/533	126/1159	665/7237	308/3434	119/953	574/5114	25/172	227/1877

Notes: See Table 5.3 and 5.4 for definition of variables; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 11: Effects of Debt-to-Equity Ratio on the Sensitivity of Stock Returns on Unexpected Inflation

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 DE_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1086*** **	**0.1352***	**0.2056*** **	**0.1160*** **	**0.0973*** **	**0.1236** **	**0.1034*** **	-0.2038	0.0140
	(0.0148)	(0.0727)	(0.0603)	(0.0200)	(0.0351)	(0.0556)	(0.0307)	(0.1241)	(0.0383)
	[0.000]	[0.063]	[0.001]	[0.000]	[0.005]	[0.026]	[0.001]	[0.103]	[0.716]
R_m	**0.6694*** **	**1.1421***	**0.5556*** **	**0.6967*** **	**0.4797*** **	**0.6491** **	**0.3576** **	**2.0772** **	-10.6775
	(0.0556)	(0.5918)	(0.121)	(0.0678)	(0.1291)	(0.3118)	(0.1477)	(1.013)	(18.03)
	[0.000]	[0.054]	[0.000]	[0.000]	[0.000]	[0.038]	[0.015]	[0.042]	[0.554]
P^e	**0.0619*** **	0.1665	**0.0501** **	**0.0725*** **	**0.0417***	0.0314	-0.0035	-0.3556	-2.2030
	(0.0107)	(0.1103)	(0.0247)	(0.0131)	(0.0246)	(0.0619)	(0.0285)	(0.3109)	(3.508)
	[0.000]	[0.132]	[0.043]	[0.000]	[0.090]	[0.611]	[0.902]	[0.255]	[0.530]
P^u	**-0.0121*** **	**-0.0140***	**-0.0109*** **	**-0.0121*** **	**-0.0110*** **	**-0.0090** **	**-0.0075*** **	-0.5343	0.1200
	(0.0009)	(0.0085)	(0.0028)	(0.0012)	(0.0023)	(0.0044)	(0.0023)	(0.3725)	(0.2205)
	[0.000]	[0.098]	[0.000]	[0.000]	[0.000]	[0.038]	[0.001]	[0.154]	[0.586]
DE	0.0064	5.7085	**3.2151** **	0.2026	-0.7261	**2.4633*** **	0.0222	-6.1674	-0.0455
	(0.0981)	(5.183)	(1.497)	(0.5718)	(0.7901)	(0.309)	(0.1151)	(10.26)	(0.2344)
	[0.948]	[0.271]	[0.032]	[0.723]	[0.358]	[0.000]	[0.847]	[0.549]	[0.846]
AR(1)	-22.04***	-3.969***	-5.378***	-12.48***	-9.234***	-5.161***	-10.98***	-0.4142	-6.583***
	[0.000]	[0.000]	[0.000]	[0.000	[0.000]	[0.000]	[0.000]	[0.679]	[0.000]
AR(2)	-1.606	0.09320	-0.8552	-1.927	1.832	-1.483	-0.2424	-1.527	-1.251
	[0.108]	[0.926]	[0.392]	[0.054]	[0.067]	[0.138]	[0.808]	[0.127]	[0.211]
Sargan Test (df)	315.2***	43.22	104.6	166.0	140.2	62.35	109.8	7.612	75.43
	(233)	(66)	(114)	(160)	(135)	(66)	(116)	(66)	(66)
	[0.000]	[0.987]	[0.724]]	[0.356]	[0.361]	[0.605]	[0.644]	[1.000]	[0.200]
Wald (joint)(df)	914.3***	24.24***	69.28***	376.3***	103.1***	169.1***	211.5***	10.48*	258.7***
	(5)[0.000]	(5)[0.000]	(5)[0.000]	(5) [0.000]	(5) [0.000]	(5) [0.000]	(5)[0.000]	(5)[0.063]	(5)[0.000]
Wald (dum)(df)	2028***	304.0***	238.2***	930.2***	472.6***	253.4***	597.0***	139.2***	421.1***
	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24) [0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]	(24)[0.000]
Wald (time)(df)	1880. ***	262.3***	203.7***	829.7***	444.1***	234.2***	516.3***	140.2***	416.4***
	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]	(23)[0.000]
R^2	0.1351	0.2124	0.1287	0.1253	0.1258	0.2082	0.1364	<0	0.2295
Instru-ments	Ri(2,2); Rm,Pe, Pu,DE(1,1); ΔRi(1,1); ΔRm,Pe, Pu DE(0,0)	Ri(2,2); ΔRi(1,1); ΔDE(0,0)	Ri(2,2); Pu(1,1); ΔRi(1,1); ΔPu, DE(0,0)	Ri,DE(2,2); Pu(1,1); ΔRi,DE(1,1); ΔPe,Pu(0,0)	Ri,DE(2,2); Pu(1,1); ΔRi,DE(1,1); ΔPu(0,0)	Ri(2,2); ΔRi(1,1); ΔDE(0,0)	Ri(2,2); ΔRi(1,1); ΔPe,Pu, DE(0,0)	Ri(2,2); ΔRi(1,1); ΔDE(0,0)	Ri(2,2); ΔRi(1,1); ΔDE(0,0)
Firms/Obs	2110/21317	66/556	126/1203	665/7591	308/3605	119/985	574/5304	25/178	227/1915

Notes: See Table 5.3 and 5.4 for definition of variables; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 12: Joint Effects of Short-Term Monetary Position, Long-Term Monetary Position and Depreciation Tax Shield

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 Ad-SMP_{it} P_t^u + b_3 Ad-LMP_{it} P_t^u + b_4 TAX_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1402*** **	**0.1473** **	**0.1203** **	**0.1613*** **	**0.0626* **	**0.1606*** **	**0.1545*** **	**-0.3373* **	**0.1038*** **
	(0.0171)	(0.0639)	(0.0549)	(0.0257)	(0.0356)	(0.06)	(0.0345)	(0.1881)	(0.0389)
	[0.000]	[0.022]	[0.029]	[0.000]	[0.079]	[0.008]	[0.000]	[0.075]	[0.008]
R_m	**0.6175*** **	2.2916	**0.5118*** **	**0.6481*** **	**0.3446*** **	**0.7492** **	**0.4606*** **	-3.1991	3.4378
	(0.0636)	(1.627)	(0.1273)	(0.0869)	(0.129)	(0.2996)	(0.1183)	(5.409)	(3.103)
	[0.000]	[0.160]	[0.000]	[0.000]	[0.008]	[0.013]	[0.000]	[0.555]	[0.268]
P^e	**0.0526*** **	0.3801	**0.0591** **	**0.0612*** **	0.0100	0.0608	0.0235	1.5064	0.5444
	(0.0123)	(0.3248)	(0.025)	(0.0169)	(0.0253)	(0.0603)	(0.0232)	(1.775)	(0.6001)
	[0.000]	[0.242]	[0.018]	[0.000]	[0.693]	[0.314]	[0.311]	[0.398]	[0.364]
P^u	**-0.0106*** **	-0.0281	**-0.0095*** **	**-0.0114*** **	**-0.0088*** **	-0.0057	**-0.0071*** **	0.0236	-0.0497
	(0.001)	(0.0253)	(0.0033)	(0.0014)	(0.0022)	(0.0046)	(0.0019)	(0.5311)	(0.0488)
	[0.000]	[0.267]	[0.003]	[0.000]	[0.000]	[0.221]	[0.000]	[0.965]	[0.309]
Ad-SMP	**-1.4475*** **	-0.1256	-0.7105	**-4.8029** **	**-7.6528*** **	-0.3829	**-8.6802*** **	**-6.4600* **	**-3.3690** **
	(0.3286)	(0.0857)	(0.502)	(2.061)	(2.832)	(1.429)	(2.195)	(3.839)	(1.619)
	[0.000]	[0.143]	[0.157]	[0.020]	[0.007]	[0.789]	[0.000]	[0.095]	[0.038]
Ad-LMP	**-0.4823** **	**0.6726** **	0.7691	**-1.4311*** **	**-5.6365** **	-0.5713	-0.7239	-3.3857	**-4.1152** **
	(0.2306)	(0.3398)	(1.944)	(0.3836)	(2.619)	(0.8764)	(0.8103)	(2.283)	(1.889)
	[0.036]	[0.048]	[0.692]	[0.000]	[0.031]	[0.515]	[0.372]	[0.140]	[0.030]
TAX	**0.1191*** **	**-0.0160** **	**0.1910*** **	**0.0963* **	**0.1407** **	0.1382	**0.2136*** **	0.1453	**1.6798** **
	(0.0187)	(0.0063)	(0.0457)	(0.0569)	(0.0567)	(0.1404)	(0.0634)	(0.2198)	(0.8492)
	[0.000]	[0.011]	[0.000]	[0.090]	[0.013]	[0.325]	[0.001]	[0.510]	[0.048]
AR(1)	-20.04***	-3.990***	-5.200***	-12.24***	-8.591***	-5.272***	-10.97***	-0.4007	-6.712***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.689]	[0.000]
AR(2)	-0.5729	0.1659	-1.063	-1.234	1.407	-1.209	-0.7163	-1.385	0.0300
	[0.567]	[0.868]	[0.288]	[0.217]	[0.159]	[0.227]	[0.474]	[0.166]	[0.976]
Sargan Test (df)	627.5*** (327) [0.000]	42.00 (64) [0.985]	92.71 (89) [0.373]	181.1 (208) [0.911]	234.8 (231) [0.419]	53.73 (64) [0.816]	131.4 (114) [0.126]	2.594 (87) [1.000]	137.8 (162) [0.916]
Wald (joint)(df)	842.5*** (7)[0.000]	106.1*** (7)[0.000]	105.5*** (7)[0.000]	382.0*** (7) [0.000]	166.8*** (7)[0.000]	113.3*** (7)[0.000]	293.6*** (7)[0.000]	31.94*** (7)[0.001]	218.6*** (7) [0.000]
Wald (dum)(df)	1615*** (24)[0.000]	157.5*** (24)[0.000]	263.6*** (24)[0.000]	778.4*** (24)[0.000]	382.5*** (24) [0.000]	331.8*** (24)[0.000]	526.7*** (24)[0.000]	165.6*** (23)[0.000]	402.0*** (24)[0.000]
Wald (time)(df)	1454. *** (23)[0.000]	144.8*** (23)[0.000]	227.5*** (23)[0.000]	705.9*** (23) [0.000]	366.1*** (23) [0.000]	289.9*** (23)[0.000]	424.0*** (23)[0.000]	165.3*** (22)[0.000]	400.3*** (23)[0.000]
R^2	0.1408	0.2268	0.1469	0.1157	0.1417	0.1932	0.1000	<0	0.2871
Instruments	Ri(2,2); Rm,Pe,Pu, SMP,LMP, TAX(1,1); △Ri(1,1); △Rm,Pe, Pu,TAX, SMP, LMP(0,0)	Ri(2,2); △Ri(1,1); △TAX(0,0)	Ri(2,2); △Ri(1,1); △Pu, LMP(0,0)	Ri(2,2); Rm,Pe, Pu(1,1); △Ri(1,1); △Rm,Pe, Pu,TAX(0,0)	Ri,TAX(2,2); Pu,SMP, LMP(1,1); △Ri, TAX(1,1) ; △Rm, Pu,SMP, LMP(0,0)	Ri(2,2); △Ri(1,1); △LMP(0,0)	Ri(2,2); △Ri(1,1); △Pe,Pu, TAX(0,0)	Ri(2,2); Rm(1,1); △Ri(1,1); △Rm(0,0)	Ri(2,2); Pu (1,1); △Ri(1,1); △Pu, SMP,LMP, TAX(0,0)
Firms/Obs	2110/20460	66/533	126/1159	665/7227	308/3433	119/950	574/5111	25/172	227/1875

Notes: See Table 5.3 and 5.4 for definition of variables; Ad-SMP is the adjusted SMP to control multicollinearity with LMP and TAX; Ad-LMP is the adjusted LMP to control multicollinearity with SMP and TAX; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 13: Joint Effects of Depreciation Tax Shield and Debt-to-Equity Ratio

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u + b_3 DE_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1513*** **	**0.1911*** **	**0.1133** **	**0.1303*** **	**0.0738** **	**0.1720*** **	**0.1876*** **	**-0.3106*** **	**0.0707* **
	(0.0174)	(0.0688)	(0.0536)	(0.0266)	(0.0362)	(0.0536)	(0.0336)	(0.1098)	(0.0395)
	[0.000]	[0.006]	[0.035]	[0.000]	[0.041]	[0.001]	[0.000]	[0.005]	[0.073]
R_m	**0.5868*** **	1.7226	**0.5567*** **	**0.6464*** **	**0.3688*** **	**0.7145** **	**0.4905*** **	3.5090	1.5520
	(0.062)	(1.55)	(0.1243)	(0.0926)	(0.1139)	(0.3466)	(0.126)	(2.501)	(3.935)
	[0.000]	[0.267]	[0.000]	[0.000]	[0.001]	[0.039]	[0.000]	[0.163]	[0.693]
P^e	**0.0468*** **	0.2670	**0.0586** **	**0.0627*** **	0.0281	0.0438	0.0234	-0.1400	0.1781
	(0.012)	(0.3094)	(0.0236)	(0.0179)	(0.0221)	(0.071)	(0.025)	(0.603)	(0.7654)
	[0.000]	[0.389]	[0.013]	[0.000]	[0.204]	[0.537]	[0.348]	[0.817]	[0.816]
P^u	**-0.0099*** **	-0.0193	**-0.0101*** **	**-0.0112*** **	**-0.0065*** **	-0.0065	**-0.0072*** **	-0.7183	-0.0273
	(0.001)	(0.0239)	(0.0023)	(0.0017)	(0.0025)	(0.0049)	(0.0019)	(0.9028)	(0.0501)
	[0.000]	[0.420]	[0.000]	[0.000]	[0.009]	[0.180]	[0.000]	[0.428]	[0.586]
TAX	**0.1249*** **	**-0.0189** **	**0.1182*** **	0.0471	**0.3433* **	0.0799	**0.1850*** **	-0.1628	0.9843
	(0.0326)	(0.0084)	(0.0141)	(0.0824)	(0.1757)	(0.1045)	(0.0686)	(0.1705)	(0.992)
	[0.000]	[0.024]	[0.000]	[0.568]	[0.051]	[0.444]	[0.007]	[0.341]	[0.321]
DE	0.0970	-4.0216	0.1247	-0.0514	2.4354	**2.5846*** **	-0.0158	-15.1466	0.5933
	(0.2056)	(5.241)	(2.612)	(0.5024)	(3.489)	(0.3624)	(0.1112)	(10.73)	(1.79)
	[0.637]	[0.443]	[0.962]	[0.919]	[0.485]	[0.000]	[0.887]	[0.160]	[0.740]
AR(1)	-20.41***	-4.069***	-5.283***	-11.19***	-9.285***	-5.443***	-10.62***	-0.3605	-6.703***
	[0.000]	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.718]	[0.000]
AR(2)	-0.0214	0.3704	-1.345	-1.322	1.443	-1.136	0.8279	-0.7300	-0.3716
	[0.983]	[0.711]	[0.179]	[0.186]	[0.149]	[0.256]	[0.408]	[0.465]	[0.710]
Sargan Test (df)	528.8*** (280) [0.001]	40.66 (65) [0.992]	108.6 (113) [0.598]	281.2 (280) [0.469]	76.00 (65) [0.165]	74.69 (90) [0.878]	159.8 (140) [0.121]	5.126 (40) [1.000]	130.3 (136) [0.621]
Wald (joint)(df)	826.4*** (6)[0.000]	66.38*** (6)[0.000]	164.5*** (6) [0.000]	270.4*** (6)[0.000]	116.0*** (6)[0.000]	146.1*** (6)[0.000]	279.3*** (6) [0.000]	16.92*** (6)[0.010]	184.1*** (6)[0.000]
Wald (dum)(df)	1629. *** (24)[0.000]	171.1*** (24)[0.000]	304.1*** (24)[0.000]	698.5*** (24)[0.000]	424.9*** (24)[0.000]	247.4*** (24)[0.000]	531.7*** (24)[0.000]	136.9 (23)[0.844]	341.3*** (24)[0.000]
Wald (time)(df)	1470. *** (23)[0.000]	155.5*** (23)[0.000]	264.4*** (23)[0.000]	638.6*** (23)[0.000]	384.7*** (23)[0.000]	233.7*** (23)[0.000]	489.4*** (23) [0.000]	137.4 (22)[0.803]	339.3*** (23)[0.000]
R^2	0.1349	0.2110	0.1803	0.1216	0.1165	0.2046	0.1390	<0	0.2905
Instruments	Ri(2,2); Rm,Pe, Pu,TAX, DE(1,1); ΔRi(1,1); ΔRm,Pe, Pu TAX, DE(0,0)	Ri(2,2); ΔRi(1,1); ΔTAX(0,0)	Ri(2,2); DE(1,1); ΔRi,(1,1); ΔDE, TAX(0,0)	Ri(2,2); Rm,Pe, Pu,TAX, DE(1,1); ΔRi(1,1); ΔRm,Pe, Pu,TAX, DE(0,0)	Ri(2,2); ΔRi,(1,1); ΔPu(0,0)	Ri(2,2); ΔRi(1,1); ΔTAX, DE(0,0)	Ri(2,2); ΔRi(1,1); ΔPe,Pu, TAX,DE(0,0)	Ri(2,2); ΔRi(1;1); ΔPu(0,0)	Ri(2,2); Pu,TAX(1,1); ΔRi(1,1); ΔPu, TAX(0,0)
Firms/Obs	2110/20479	66/533	126/1159	665/7237	308/3434	119/953	574/5114	25/172	227/1877

Notes: See Table 5.3 and 5.4 for definition of variables; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 14: Joint Tests of the Nominal Contracting Hypothesis and the Nominal Capital Gains Tax Effect of Inflation

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 Ad - PP_{it} P_t^u + b_3 Ad - IN_{it} P_t^u + b_4 NMP_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	ALL	OI	BM	ID	CG	HL	CS	TM	IT
$R_{i,t-1}$	**0.1417***** (0.0166) [0.000]	**0.1390*** (0.084) [0.098]	**0.2090***** (0.0519) [0.000]	**0.1356***** (0.0224) [0.000]	**0.0958**** (0.0373) [0.010]	**0.1492***** (0.0568) [0.009]	**0.1293***** (0.032) [0.000]	-0.3393 (0.6235) [0.587]	**0.0451** (0.042) [0.282]
R_m	**0.5903***** (0.0559) [0.000]	**1.0650*** (0.6315) [0.092]	**0.5412***** (0.1209) [0.000]	**0.7001***** (0.0719) [0.000]	**0.4527***** (0.1266) [0.000]	**0.5980**** (0.2874) [0.038]	**0.3163*** (0.1627) [0.052]	-1.3083 (4.489) [0.771]	1.5017 (4.21) [0.721]
P^e	**0.0484***** (0.0108) [0.000]	0.1501 (0.1209) [0.215]	**0.0506**** (0.0242) [0.037]	**0.0744***** (0.014) [0.000]	0.0380 (0.0241) [0.115]	0.0367 (0.0581) [0.527]	-0.0116 (0.032) [0.718]	0.9199 (0.5842) [0.117]	0.1660 (0.8176) [0.839]
P^u	**-0.0102***** (0.001) [0.000]	-0.0140 (0.0093) [0.133]	**-0.0099***** (0.0025) [0.000]	**-0.0121***** (0.0013) [0.000]	**-0.0107***** (0.0022) [0.000]	-0.0055 (0.0047) [0.248]	**-0.0058**** (0.0026) [0.024]	-0.0988 (0.1598) [0.537]	-0.0294 (0.052) [0.572]
Ad-PP	**-0.6800**** (0.3121) [0.029]	-0.0694 (0.0573) [0.227]	0.3756 (0.4231) [0.375]	**-1.9616***** (0.6661) [0.003]	**-0.1692*** (0.1027) [0.099]	-1.7094 (6.437) [0.791]	-0.9713 (2.383) [0.684]	-5.7842 (11.96) [0.629]	-4.9798 (26.45) [0.851]
Ad-IN	**-1.6750***** (0.6224) [0.007]	**-0.4046*** (0.2316) [0.081]	-0.0250 (0.2663) [0.925]	-1.1772 (1.231) [0.339]	**-0.8841*** (0.5269) [0.093]	-5.0335 (16.85) [0.765]	-4.4511 (8.065) [0.581]	-382.730 (761.2) [0.616]	-4.1212 (22.68) [0.856]
NMP	**-0.1588***** (0.0227) [0.000]	**0.0471**** (0.0223) [0.035]	**-0.1733***** (0.0205) [0.000]	**-0.1701***** (0.0446) [0.000]	**-0.1153***** (0.037) [0.002]	**-0.7725*** (0.3954) [0.051]	**-0.2188***** (0.074) [0.003]	**-0.0348**** (0.0161) [0.032]	-1.7090 (2.242) [0.446]
AR(1)	-20.89*** [0.000]	-3.868*** [0.000]	-5.739*** [0.000]	-12.22*** [0.000]	-9.116*** [0.000]	-5.364*** [0.000]	-10.76*** [0.000]	-0.1374 [0.891]	-6.491*** [0.000]
AR(2)	-0.6482 [0.517]	0.05521 [0.956]	-0.6671 [0.505]	-1.888* [0.059]	1.756* [0.079]	-1.189 [0.234]	-0.0574 [0.954]	-0.8379 [0.402]	-0.6127 [0.540]
Sargan Test (df)	685.0*** (327) [0.000]	44.72 (112) [0.999]	105.5 (114) [0.703]	214.2 (233) [0.807]	155.1 (139) [0.166]	56.72 (64) [0.729]	126.5 (114) [0.200]	4.191 (64) [1.000]	135.9 (133) [0.413]
Wald (joint)(df)	832.1*** (7)[0.000]	131.3*** (7)[0.000]	230.1*** (7)[0.000]	512.6*** (7)[0.000]	120.0*** (7)[0.000]	94.49*** (7)[0.000]	243.0*** (7)[0.000]	24.13*** (7)[0.001]	186.8*** (7)[0.000]
Wald (dum)(df)	1608. *** (24)[0.000]	153.6*** (24)[0.253]	277.6*** (24)[0.000]	789.9*** (24)[0.000]	397.3*** (24)[0.000]	299.2*** (24)[0.000]	560.6*** (24)[0.000]	93.94*** (24)[0.048]	375.2*** (24)[0.000]
Wald (time)(df)	1413. *** (23)[0.000]	106.7*** (23)[0.210]	248.1*** (23)[0.000]	712.4*** (23)[0.000]	360.9*** (23)[0.000]	270.5*** (23)[0.000]	470.2*** (23)[0.000]	94.13** (23)[0.036]	358.6*** (23) [0.000]
R^2	0.1403	0.2361	0.1630	0.1293	0.1447	0.1912	0.1449	<1	0.3008
Instru-ments	Ri(2,2); Rm,Pe, Pu,PP, IN,NMP(1,1); ΔRi(1,1); Δ Rm,Pe, Pu, PP, IN,NMP(0,0)	Ri(2,2); IN(1,1); ΔRi(1,1); ΔPP,IN(0,0)	Ri(2,2); ΔRi(1,1); ΔPP,IN, NMP(0,0)	Ri(2,2); Rm,Pe, Pu,(1,1) ΔRi(1,1); ΔRm,Pe, Pu,IN, NMP(0,0)	Ri(2,2); ΔRi(1,1); ΔRm, Pu,PP, NMP(0,0)	Ri(2,2); ΔRi(1,1); ΔIN(0,0)	Ri(2,2); ΔRi(1,1); ΔPe,Pu, PP(0,0)	Ri(2,2); ΔRi(1,1); ΔNMP(0,0)	Ri(2,2); Pu,NMP(1,1); ΔRi(1,1); ΔPu, NMP(0,0)
Firms/Obs	2110/21298	66/556	126/1203	665/7218	308/3604	119/950	574/5296	25/172	227/1913

Notes: See Table 5.3 and 5.4 for definition of variables; Ad-PP is the adjusted PP to control multicollinearity with IN and NMP; Ad-IN is the adjusted IN to control multicollinearity with PP and NMP; Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test a is test for the validity of instruments; Instruments used for the model start form lag (t-2); AR(1) and AR(2) are the first and second order autocorrelation of residuals
*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 15: Magnitude Tests of Net Monetary Position

$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + v_i + v_t + \varepsilon_{it}$

	P1	P2	P3	P4	P5	P6	P7	P8	P9
$R_{i,t-1}$	0.0996**	0.0613*	0.10054**	0.0959***	0.1211***	0.1793***	0.0244	0.0916**	0.0661
	(0.0426)	(0.0325)	(0.0447)	(0.0362)	(0.0392)	(0.0406)	(0.0341)	(0.0396)	(0.0465)
	[0.020]	[0.059]	[0.025]	[0.008]	[0.002]	[0.000]	[0.475]	[0.021]	[0.155]
R_m	0.5114***	0.5008***	0.4380***	0.7804***	0.5666***	0.6022	18.3112*	0.6192**	5.8169
	(0.1175)	(0.0741)	(0.1587)	(0.1713)	(0.1657)	(2.878)	(10.23)	(0.301)	(5.773)
	[0.000]	[0.000]	[0.006]	[0.000]	[0.001]	[0.834]	[0.074]	[0.040]	[0.314]
P^e	0.0382*	0.0378***	0.0351	0.0823**	0.0377	0.0385	3.4726*	0.0728	1.1630
	(0.022)	(0.0144)	(0.0303)	(0.0322)	(0.0324)	(0.5588)	(1.989)	(0.0516)	(1.224)
	[0.082]	[0.009]	[0.248]	[0.011]	[0.244]	[0.945]	[0.081]	[0.158]	[0.342]
P^u	-0.0065***	-0.0094***	-0.0073***	-0.0150***	-0.0105***	-0.0100	-0.1284*	0.1112	-0.2773
	(0.002)	(0.0013)	(0.0023)	(0.0028)	(0.0022)	(0.0337)	(0.0733)	(0.4011)	(0.3077)
	[0.001]	[0.000]	[0.001]	[0.000]	[0.000]	[0.767]	[0.080]	[0.782]	[0.368]
AR(1)	-6.242***	-9.316***	-7.411***	-8.243***	-7.801***	-6.247***	-4.927***	-1.548	-1.391
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.122]	[0.164]
AR(2)	-0.3723	-0.1432	0.7907	-0.7678	-1.629	-1.121	0.0730	0.0062	-0.7577
	[0.710]	[0.886]	[0.429]	[0.443]	[0.103]	[0.262]	[0.942]	[0.995]	[0.449]
Sargan Test (df)	80.01 (117)[0.996]	40.69 (42)[0.528]	98.67 (88) [0.205]	86.05 (88) [0.539]	95.41 (90)[0.328]	85.14 (90)[0.625]	57.11 (67)[0.800]	58.54 (67)[0.760]	52.14 (67)[0.909]
Wald (joint)(df)	68.80*** (4) [0.000]	170.5*** (4)[0.000]	85.26*** (4)[0.000]	125.8*** (4) [0.000]	87.91*** (4)[0.000]	149.5*** (4)[0.000]	125.3*** (4) [0.000]	148.5*** (4)[0.000]	59.11*** (4) [0.000]
Wald (dum)(df)	442.7*** (24) [0.000]	747.2*** (24)[0.000]	412.6*** (24)[0.000]	448.6*** (24)[0.000]	213.8*** (24)[0.000]	354.2*** (24)[0.000]	338.4*** (24)[0.000]	407.1*** (24)[0.000]	334.5*** (24)[0.000]
Wald (time)(df)	254.3*** (23) [0.000]	446.6*** (23)[0.000]	309.2*** (23)[0.000]	325.6*** (23)[0.000]	212.3*** (23)[0.000]	352.8*** (23)[0.000]	334.0*** (23)[0.000]	407.1*** (23)[0.000]	334.2*** (23)[0.000]
R^2	0.1436	0.1589	0.1266	0.1692	0.1401	0.1305	<0	0.0600	<0
Instru-ments	Ri(2,2); ΔRi(1,1); ΔRm,Pu, Pe(0,0)	Ri(2,2); ΔRi(1,1)	Ri,Pu(2,2); ΔRi,Pu(1,1)	Ri,Pu(2,2); ΔRi,Pu(1,1)	Ri(2,2); Pu(1,1); ΔRi,(1,1); ΔPu(0,0)	Ri(2,2); Pu(1,1); ΔRi,(1,1); ΔPu(0,0)	Ri(2,2); ΔRi(1,1); ΔPu(0,0)	Ri(2,2); ΔRi(1,1); ΔPe(0,0)	Ri(2,2); ΔRi(1,1); ΔPe(0,0)
Firms/Obs	167/2515	243/3076	243/2663	243/2549	243/2234	243/2204	243/2154	243/2120	242/1848

Notes: P1, P2, P3, P4, P5, P6, P7, P8, and P9 are portfolios formed by the rank of net monetary position (NMP). Stocks have negative net monetary position are sorted in portfolio 1 and the rest are sorted from the lowest to the highest into portfolio 2, 3...9 respectively. Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2). AR (1) and AR (2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 16: Magnitude Tests of Net Monetary Position with Depreciation Tax Shield

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	P1	P2	P3	P4	P5	P6	P7	P8	P9
$R_{i,t-1}$	**0.1026***	**0.1613*****	**0.1018****	**0.0758****	**0.2495*****	**0.1893*****	**0.1701*****	**0.0860****	**0.1178***
	(0.0622)	(0.044)	(0.0479)	(0.0355)	(0.0407)	(0.0408)	(0.0439)	(0.0432)	(0.0622)
	[0.100]	[0.000]	[0.034]	[0.033]	[0.000]	[0.000]	[0.000]	[0.046]	[0.100]
R_m	**0.6418*****	**0.4943*****	**0.2533***	**0.7772*****	**0.7426*****	1.0741	3.1645	**2.3533***	**0.3849*****
	(0.0968)	(0.0817)	(0.1467)	(0.133)	(0.1476)	(1.474)	(6.105)	(1.398)	(0.14)
	[0.000]	[0.000]	[0.084]	[0.000]	[0.000]	[0.466]	[0.604]	[0.092]	[0.006]
P^e	**0.0618*****	**0.0328****	-0.0062	**0.0906*****	**0.0654****	0.1249	0.8436	-0.1000	0.0063
	(0.0188)	(0.016)	(0.0299)	(0.0245)	(0.0272)	(0.2871)	(1.878)	(0.0932)	(0.0243)
	[0.001]	[0.040]	[0.835]	[0.000]	[0.016]	[0.664]	[0.653]	[0.283]	[0.795]
P^u	**-0.0088*****	**-0.0096*****	-0.0047	**-0.0103***	**-0.0149*****	-0.0144	0.3384	**-0.1028***	-0.0009
	(0.0018)	(0.0016)	(0.0049)	(0.0055)	(0.0034)	(0.0203)	(0.7564)	(0.0624)	(0.0045)
	[0.000]	[0.000]	[0.339]	[0.059]	[0.000]	[0.476]	[0.655]	[0.099]	[0.836]
TAX	**0.6839*****	-2.0451	0.5594	1.0016	-0.0711	-0.0956	0.0262	-0.2970	**0.1502*****
	(0.2495)	(1.954)	(2.102)	(1.172)	(0.331)	(0.3096)	(0.1303)	(0.2832)	(0.0192)
	[0.006]	[0.295]	[0.79]	[0.393]	[0.83]	[0.758]	[0.841]	[0.294]	[0.000]
AR(1)	-5.230***	-8.311***	-7.263***	-8.103***	-8.166***	-6.126***	-6.859***	-7.302***	-6.687***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-0.4508	1.054	0.5232	-0.8889	-0.3377	-0.7707	1.643	-1.389	0.5212
	[0.653]	[0.292]	[0.601]	[0.374]	[0.736]	[0.441]	[0.100]	[0.165]	[0.602]
Sargan Test (df)	105.5 (141)[0.989]	95.38 (91)[0.356]	73.20 (66)[0.254]	92.46 (89)[0.380]	170.3 (162)[0.312]	159.6 (162)[0.538]	151.3 (131)[0.108]	62.14 (63)[0.507]	111.8 (114)[0.540]
Wald (joint)(df)	111.1*** (5)[0.000]	158.8*** (5)[0.000]	98.30*** (5)[0.000]	140.7*** (5)[0.000]	147.9*** (5)[0.000]	146.5*** (5)[0.000]	85.57*** (5) [0.000]	90.81*** (5)[0.000]	124.8*** (5)[0.000]
Wald (dum)(df)	473.2*** (24)[0.000]	584.9*** (24)[0.000]	498.9*** (24)[0.000]	431.6*** (24)[0.000]	229.7*** (24)[0.000]	323.9*** (24)[0.000]	235.1*** (22) [0.000]	247.6*** (21)[0.000]	228.3*** (23)[0.000]
Wald (time)(df)	311.9*** (23) [0.000]	433.1*** (23)[0.000]	310.9*** (23)[0.000]	289.4*** (23)[0.000]	223.0*** (23)[0.000]	320.7*** (23)[0.000]	234.9*** (21)[0.000]	213.0*** (20)[0.000]	228.3*** (22) [0.000]
R^2	0.1592	0.1529	0.1292	0.1827	0.1209	0.1289	0.1411	0.1137	0.1722
Instru-ments	Ri(2,2); ΔRi(1,1); ΔRm, Pe,Pu, TAX(0,0)	Ri(2,2); ΔRi(1,1); ΔPu, TAX(0,0)	Ri(2,2); ΔRi (1,1); ΔPu(0,0)	Ri (2,2); Pu(1,1); ΔRi(1,1); ΔPu(0,0)	Ri(2,2); Pu,TAX(1,1); ΔRi(1,1); ΔPe,Pu, TAX(0,0)	Ri(2,2); u,TAX(1,1); ΔRi(1,1) ; ΔPe,Pu, TAX(0,0)	Ri,Pu(2,2); ΔRi,Pu(1,1); ΔPe, TAX(0,0)	Ri(2,2); ΔRi(1,1); ΔRm(0,0)	Ri(2,2); Pu(1,1); ΔRi(1,1); ΔPu, TAX(0,0)
Firms/Obs	167/2262	243/2815	243/2558	243/2452	243/2180	243/2180	243/2133	243/2092	242/1807

Notes: P1, P2, P3, P4, P5, P6, P7, P8, and P9 are portfolios formed by the rank of net monetary position (NMP). Stocks have negative net monetary position are sorted in portfolio 1 and the rest are sorted from the lowest to the highest into portfolio 2, 3…9 respectively. Standard errors are shown in parentheses and p-values are shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2). AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Table 5. 17: Magnitude Tests of Net Monetary Position with Depreciation Tax Shield and Debt-to-Equity ratio

$$R_{it} = a_i + \gamma_i R_{i,t-1} + \beta_i R_{mt} + \lambda_i P_t^e + b_1 P_t^u + b_2 TAX_{it} P_t^u + b_3 DE_{it} P_t^u + v_i + v_t + \varepsilon_{it}$$

	P1	P2	P3	P4	P5	P6	P7	P8	P9
$R_{i,t-1}$	0.0968	**0.1611*** **	**0.1213** **	**0.0790** **	**0.2538*** **	**0.1679*** **	**0.1690*** **	0.0585	0.0715
	(0.0631)	(0.04756)	(0.05014)	(0.03547)	(0.04244)	(0.03725)	(0.04434)	(0.03825)	(0.04889)
	[0.125]	[0.001]	[0.016]	[0.026]	[0.000]	[0.000]	[0.000]	[0.127]	[0.144]
R_m	**0.5986*** **	**0.4903*** **	0.1775	**0.7806*** **	**0.6489*** **	3.9876	3.0455	**5.25541* **	0.4278
	(0.0933)	(0.09051)	(0.1739)	(0.1328)	(0.1308)	(2.517)	(6.113)	(3.174)	(0.3168)
	[0.000]	[0.000]	[0.307]	[0.000]	[0.000]	[0.113]	[0.618]	[0.098]	[0.177]
P^e	**0.0516*** **	0.0290	-0.0179	**0.0899*** **	0.0342	0.6818	0.8084	0.3013	0.0171
	(0.0185)	(0.01778)	(0.03224)	(0.02405)	(0.0239)	(0.489)	(1.881)	(0.2171)	(0.05023)
	[0.005]	[0.103]	[0.578]	[0.000]	[0.152]	[0.163]	[0.667]	[0.165]	[0.734]
P^u	**-0.0079*** **	**-0.0091*** **	0.0022	**-0.0100* **	**-0.0141*** **	**-0.0636** **	0.3243	-0.2130	-0.0002
	(0.0018)	(0.001807)	(0.008614)	(0.005383)	(0.003575)	(0.03235)	(0.7573)	(0.131)	(0.01287)
	[0.000]	[0.000]	[0.798]	[0.062]	[0.000]	[0.049]	[0.669]	[0.104]	[0.985]
TAX	**0.7267*** **	-1.9387	3.4741	1.0250	-0.1423	**-0.8747* **	0.0453	-0.0776	**0.1801** **
	(0.2535)	(1.84)	(3.647)	(1.135)	(0.3142)	(0.5123)	(0.1402)	(0.3428)	(0.0836)
	[0.004]	[0.292]	[0.341]	[0.367]	[0.651]	[0.088]	[0.747]	[0.821]	[0.031]
DE	**-1.0855*** **	1.1976	**0.1311*** **	-3.1222	**1.3213** **	**0.1096* **	4.1010	0.2341	-5.0425
	(0.3705)	(0.8085)	(0.04409)	(4.982)	(0.6663)	(0.05997)	(12.68)	(0.669)	(4.49)
	[0.003]	[0.139]	[0.003]	[0.531]	[0.047]	[0.068]	[0.746]	[0.726]	[0.262]
AR(1)	-5.444***	-7.925***	-6.973***	-8.133***	-8.173***	-6.159***	-6.725***	-7.707***	-6.749***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-0.8507	0.9547	0.7996	-0.8996	-0.2781	-0.9252	1.399	-1.342	-0.2248
	[0.391]	[0.340]	[0.424]	[0.368]	[0.781]	[0.355]	[0.162]	[0.180]	[0.822]
Sargan Test (df)	122.6 (165)[0.994]	125.2 (115)[0.242]	108.2 (115)[0.660]	91.04 (88)[0.391]	167.1 (163)[0.397]	110.5 (113)[0.549]	150.5 (130)[0.106]	70.27 (80)[0.773]	58.09 (65)[0.716]
Wald (Joint)(df)	135.8*** (6) [0.000]	146.1*** (6) [0.000]	111.1*** (6) [0.000]	145.3*** (6)[0.000]	128.6*** (6)[0.000]	137.7*** (6)[0.000]	83.54*** (6)[0.000]	147.8*** (6)[0.000]	62.92*** (6) [0.000]
Wald (dum)(df)	457.2*** (24) [0.000]	488.5*** (24) [0.000]	395.8*** (24)[0.000]	384.2 *** (24)[0.000]	210.9*** (24) [0.000]	329.2*** (24) [0.000]	231.3*** (22)[0.000]	282.1*** (21)[0.000]	219.8*** (23)[0.000]
Wald (time)(df)	297.8*** (23) [0.000]	346.9 *** (23) [0.000]	292.0*** (23)[0.000]	238.0*** (23)[0.000]	203.9*** (23) [0.000]	325.8*** (23)[0.000]	230.7*** (21) [0.000]	267.7*** (20)[0.000]	219.8*** (22)[0.000]
R^2	0.1592	0.1379	0.1263	0.1825	0.1165	0.1029	0.1395	0.1190	0.1516
Instru-ments	Ri(2,2); ΔRi(1,1); ΔRm,Pe, Pu,TAX, DE(0,0)	Ri(2,2); Pu(1,1); ΔRi(1,1); ΔPu,TAX, DE(0,0)	Ri(2,2); Pu(1,1); ΔRi(1,1); ΔPe,Pu, DE(0,0)	Ri(2,2); Pu(1,1); ΔRi(1,1); ΔPu(0,0)	Ri(2,2); TAX(1,1); ΔRi(1,1); ΔPe,Pu, TAX,DE(0,0)	Ri(2,2); ΔRi(1,1); ΔPu, DE(0,0)	Ri,Pu(2,2); ΔRi,Pu(1,1); ΔPe, TAX(0,0)	Ri,DE(2,2); ΔRi, DE(1,1)	Ri(2,2); ΔRi(1,1); ΔPe(0,0)
Firms/Obs	167/2262	243/2815	243/ 2558	243/2452	243/ 2180	243/ 2180	243/ 2133	243/ 2092	242/1807

Notes: P1, P2, P3, P4, P5, P6, P7, P8, and P9 are portfolios formed by the rank of net monetary position (NMP). Stocks have negative net monetary position are sorted in portfolio 1 and the rest are sorted from the lowest to the highest into portfolio 2, 3...9 respectively. Standard errors are shown in parentheses and p-value is shown in square brackets; The Sargan Test is a test for the validity of instruments; Instruments used for the model start form lag (t-2). AR(1) and AR(2) are the first and second order autocorrelation of residuals

*, **, ***Significant at 10%, 5% and 1% level, respectively.

Chapter 6 Summary and Conclusion

6.1 Overview and Contributions

The interaction between monetary policy, inflation and stock returns has attracted major attention from economists for a long time. Previous research uncovers that the interaction between monetary policy, inflation and stock returns is mixed, and is more complicated than what theories imply. Monetary economists, such as Rozeff (1974) and Mishkin (2007, 155-156), have provided theoretically insights into the relationship between monetary policy and stock returns. Similarly, financial economists, such as Bodie (1976), have also considered whether or not stocks should hedge against inflation due to the Fisher hypothesis (1930) and have provided many theoretical approaches in order to explain the empirical evidence for the relationship between inflation and stock returns. Among the existing explanations focusing on the aggregate market, the nominal contracting hypothesis (Kessel, 1956) explaining the relationship between inflation and stock returns at a micro-firm level by focusing on the inflation exposure that any given firm is faced with is one of the most influential. However, empirical results regarding the nominal contracting hypothesis are also mixed. This reflects the state of the research in this field that, for such a critical issue, the existing literature has yet to provide some convincing theoretical explanations and the empirical evidence is far from conclusive.

Despite the accumulation of hundreds of studies that have investigated the response of stock returns to monetary policy and inflation, the current state of the literature show that the response has proved to be more complicated than what the theories have indicated, thus, it demands further research, with wider coverage of the countries and new investigation techniques, to achieve a better understanding of such a vital issue of the economy. The empirical findings show mixed evidence in the field and studies are mostly concerned with the US market. The UK, which differs from the US, has a distinctive monetary policymaking process and a low inflation target. The Bank of England has more obligations for the price stability, as compared to its US counterpart the US Federal Reserve System. Therefore the US experience in the field could not be applied in the UK market and investigating the UK case could add international evidence to current literature. This thesis chooses the UK market as the research object to empirically examine the interaction between monetary policy, inflation and stock returns with special emphasises on the effect monetary policy announcements have on the level of stock returns and stock market volatility, and the relationship between inflation and stock returns over a range of time horizons and across different inflationary economies and regimes, and the effect of nominal contracts on the sensitivity of stock returns to unexpected inflation suggested by the nominal contracting hypothesis.

This study of the UK adds the following contributions to the current literature. 1) It uses the hand-collected inflation announcement data back to 1962 to test the response of stock returns to the inflation announcements and that provides the evidence of the announcements effect of inflation on stock returns for the UK back to 60s. This sample period is far longer than most studies which sample period only cover 10-20 years back to 80s.

2) This study has examined the impact of monetary policy on both the level of stock returns and the stock market volatility. There has been a lack of evidence of the response of the stock market volatility to the monetary announcements for the UK. Covering a wider area of monetary policy than previous studies do, this study provides evidence of the impact of the Bank of England official bank rate and broad money supply announcements on stock returns. It has also compared the impact of monetary policy announcements on the stock returns before and after May 1997, when the Bank of England was granted independence. To the best of the author's knowledge, there is lack of study that considers this difference for the announcement effect of monetary policy on stock returns.

3) Differing from previous studies, this study has investigated the relationship between inflation and stock returns in short, medium and long-term at a variety of time horizons and under different inflationary economies and regimes in the context of the UK. Horizon sensitivity, inflationary economies and regimes are found to significantly affect this relationship.

4) As far as the author knows, this study has been the first to provide empirical evidence of the nominal contracting hypothesis on a non-US market and provides more up-to-date evidence in this field. There has been lack of evidence of the nominal contracting hypothesis for the non-US case. Differing from previous studies which focus on only some specific firm characteristics, this study also provides empirical evidence of as many pertinent nominal contracting variables as possible. Moreover, this study also has made an important extension of previous techniques by applying a new method, the linear dynamic panel data model with an estimation method of two-step system-generalised method of moments (GMM-SYS), to test the nominal contracting effect.

6.2 Summary

This thesis reviews the literature first, in chapter 2, then empirically examines the impact of monetary policy announcements on stock returns in chapter 3, and continues to investigate the relationship between inflation and short returns in chapter 4 and then tests how the nominal contracting hypothesis is related to corporate financing mix and inflation exposure in chapter 5.

Chapter 2 reviews the literature on the interaction between monetary policy, inflation and stock return, with a special emphasis on the impact of monetary policy announcements on stock returns, the relationship between inflation and stock returns, and the nominal contracting hypothesis. The review shows that previous studies find mixed results for the effect of monetary policy announcements on the level of stock returns and the stock market volatility. Similarly, empirical evidence indicates that the relationship between inflation and stock returns is mixed and it could be positive, negative or insignificant; or it may vary with different time horizons, inflationary economies and regimes. It suggests that this relationship is more complicated than what the Fisher's hypothesis (1930) implies, which suggests that common stocks should be a good hedge against inflation. Moreover, among the existing theoretical approaches attempting to explain the empirical mixture of results for the relationship between inflation and stock returns, the nominal contracting hypothesis which provides a micro-firm level explanation focusing on the corporate financing mix, the inflation risk that the corporations are faced with and the wealth redistribution caused by the nominal contracts due to the unexpected inflation is one of the most influential of existing explanations. However, literature shows that the empirical findings for the nominal contracting hypothesis are mixed and conflicting. This reflects that the interaction between monetary policy, inflation and stock returns is such a critical issue and the existing literature has not provided conclusive theoretical explanations to explain existing empirical evidence.

Chapter 3 empirically examines the effect of monetary policy announcements on the level of stock returns and stock market volatility for the aggregate market and industries, attempting to find out whether the monetary policy affects the stock returns and stock market volatility and whether the independence of the Bank of England affects the responses of the stock market. The evidence of the impact of the Bank of England official bank rate and broad money supply announcements on stock returns is ascertained. The results found in this chapter are consistent with most former studies, which confirm that the monetary policy announcements negatively affect the stock returns and significantly affect the stock market volatility. Stock returns are found to significantly and negatively respond to announcements of both changes in interest rate and changes in money supply. The unexpected changes in monetary policy contribute to the negative effect while the expected change in the policy has little impact, consistent with the efficient market hypothesis. Unexpected changes in interest rate also affect the stock market volatility, which is consistent with most literature that provides support for the effect of monetary policy announcements. Overall, the results suggest that the announcements of tightening monetary policy will be the bad news for the stock while the announcements of loosening monetary policy will on the contrary be the good news.

In addition, the chapter also reveals that the responses of stock returns or stock market volatility to unexpected changes in interest rate are different before or after May 1997 when the Bank of England was made independent. Before May 1997, the unexpected changes in interest rate affected the level of stock returns and the stock market volatility on the announcement day. Since May 1997, they only affect the level of stock returns before the announcement day and have little impact on the stock market volatility. Before May 1997, the Chancellor of Exchequer and the governor of the Bank of England jointly decided the UK monetary policy and only generally indicated the decision of monetary policy to the markets by changing the rate at which it conducted its daily money market operations. After May 1997 when the Bank of England gained independence, the Bank of England Monetary Policy Committee (MPC) began having regular meetings to independently decide the monetary policy that would meet the inflation target. The regular meeting date is set in advance and published on the website of the Bank of England and the official bank rates set by the MPC are announced regularly to the public on schedule. It suggests that this system changes results based on the different responses of the stock market to monetary policy. Our findings suggests that before the Bank of England gained independence, the stock market participants could not fully anticipate the changes in interest rates, so the stock prices reflected the unexpected changes in interest rate around the days of the announcement. However, after the independence of the Bank, the market participants could fully anticipate the changes in interest rate. As a result, stock prices reflected this information in advance and consequently have little effect on the announcement day, consistent with the efficient market hypothesis.

Chapter 4 empirically tests the relationship between inflation and stock returns at the aggregate and sectoral level at a variety of time horizons: announcements, short horizon and long term cointegration analysis and across different inflationary economies and regimes, aiming to find out whether the relationship varies across different time horizons or if it depends on different inflationary economies and regimes. The results are consistent with most previous studies which suggest that the relationship between inflation and stock returns has horizon sensitivity. We find that unexpected inflation announcements negatively and slowly affect stock returns while expected inflation has little impact in the announcement study. A positive relationship between expected inflation and stock returns and a negative relationship between unexpected inflation and stock returns is found in the short-horizon study. A positive and greater than unity long-term relationship is documented in the long-term cointegration analysis. Therefore, the results are for the most part consistent with studies which show that the relationship between inflation and stock returns is negative in the announcements studies, could be either positive or negative in the short-horizon studies, and positive in the in the long-horizon or long-term cointegration studies, which suggests that the UK stock market provides a good hedge against inflation in the long run but fails to hedge against inflation in the short run.

This chapter also provides weak evidence of the preannouncement effect and the delay effect because results show that unexpected inflation affects the stock market only slowly. No evidence of directional asymmetry effect is found in this chapter. This suggests that investors have no preference for bad or good news of inflation. Furthermore, although two important shifts in January 1975 and October 1987 significantly affect the stock returns but they do not affect the relationship between inflation and stock returns in the short-horizon study. Similarly, in the long-term cointegration analysis, these two events along with other structure breaks and seasonality do not affect the long-run relationship between stock prices and Retail Price Index.

In addition, it is revealed that the relationship between inflation and stock returns varies across different inflationary economies and regimes. Inflation news is found to negatively affect the aggregate stock returns in the low inflation economy but to have no impact in the high inflation economy. Similarly, in the short-horizon study, the expected inflation was found to positively affect the aggregate stock returns in the high inflation economy but to have no effect in the low inflation economy. On the contrary, unexpected inflation is found to have a strong negative impact on the aggregate stock returns in the low inflation economy but to have no discernible impact in the high inflation economy. In the short-horizon study, inflation, either expected or unexpected, significantly affects stock returns only in the high inflationary regime but not in the low inflationary regime. This suggests that the relationship between inflation, whether expected or unexpected, and stock returns varies across different inflationary regimes.

Chapter 5 uses the linear dynamic panel data model with an estimation method of two-step GMM-SYS to empirically examine the nominal contracting hypothesis and the nominal capital gains tax effect of inflation with net monetary position, short- and long-term monetary position, depreciation tax shield, debt-to-equity ratio, inventories and net property, plant and equipment. It attempts to find out whether nominal contracting effect exists and to ascertain whether or not nominal contracting hypothesis can explain the empirical mixture of the results found to exist in the relationship between inflation and stock returns. The results present in this chapter are consistent with the nominal contracting hypothesis and previous studies. Net monetary position and its two sub-categories: short- and long-term monetary position, defined in terms of nominal assets, is found to have a strong negative effect on the sensitivity of stock returns to unexpected inflation. Although debt-to-equity ratio, defined in terms of nominal liabilities, is found to have little nominal contracting effect, it is found to have a weak positive effect on the sensitivity of stock returns to unexpected inflation and this is consistent with the nominal contracting hypothesis. Although the depreciation tax shield is found to have a positive effect, inconsistent with the nominal contracting hypothesis, it does not affect the basic evidence found for nominal contracting hypothesis. It is also confirmed that with higher-than-expected inflation, the more net monetary assets a firm has, the more it loses. On the other hand, firms that have more debts can gain more, consistent with the magnitude impact suggested by the nominal contracting hypothesis.

In addition, the results also show that firms with a lot of short-term debts gain more than firms with a lot of long-term debts, which is found to be inconsistent with the difference of magnitude impact between short- and long-term monetary position. The nominal hypothesis suggests that long-term debts with a longer maturity will have a more effects on sensitivity of stock returns to unexpected inflation than short-term debts with shorter maturity magnitude. However, the empirical findings in this chapter are consistent with previous studies which either provides mixed results or evidence in direct opposition to the magnitude impact due to maturity magnitude. Supporting evidence for nominal capital gains tax effect of inflation is also found.

6.3 The Implications of Findings

We find evidence that the announcement effect of monetary policy, the relationship between inflation and stock returns and the nominal contracting hypothesis related to corporate financing mix and the inflation exposure in this thesis has some implications for market participants, managers and policy markers.

Investors

Investors who watch carefully the central banks' monetary policy announcements benefit from the evidence that monetary announcements negatively affect both level of stock returns and stock market volatility. It implies that investors who do a short-term investment in the stock market will lose from the tightening monetary policy but gain from loosening monetary policy. Thus, before investing in stock market, investors need to consider what monetary policy the central bank will conduct and over what investment period.

Investors also have been interested in ascertaining whether or not common stock is a good hedge against inflation over years. The finding that the relationship between inflation and stock returns varies in different time horizon: negative in the announcement study, mixed in the short-horizon study and positive and over unity in the long-term cointegration analysis, provides the insight that changing the holding period of stocks is likely to be a way to control the inflation risk since in the short run, stocks fail to hedge against inflation but in the long run, provides a good hedge against inflation.

Managers

Inflation risk is one of the biggest risks that managers need to take into account. Managers who need to make decisions of the firms' debt ratio, wage budget, pension plans or other financial plans want to know whether nominal contracts would cause their firms to lose or gain from unexpected inflation. This thesis provides support for the nominal contracting hypothesis which suggests that debtor firms gain and creditor firm lose from higher than expected inflation which gives managers the suggestive idea that adjusting the financial plans and debt structures is likely to be a way to control the inflation exposure that firms are faced with. If inflation is expected to be higher in the future, manager could raise the debt ratio, consequently, the firm would benefit from rising inflation.

In addition, the evidence that firms with a lot of short-term debts gain more than firms with a lot of long-term debts implies that managers might increase the proportion of short-term debts and reduce long-term debts. Consequently, as surmised above, firms benefit more from rising inflation.

Policymakers

This thesis also provides insights for the policymaker. Policymakers are highly concerned with controlling inflation using monetary policy and the effect of policy decisions due to the importance of the inflation stability for the sustainable output growth and employment leading to economic stability. The evidence that announcements of interest rate and money supply negatively affect stock returns implies that the interest rate and money supply are likely to be good tools to effectively affect the stock market in the short-run.

The evidence also shows that changes in the decision-markers themselves, such as the independence of the Bank of England and the introduced Monetary Policy Committee (MPC)) influence the response of the stock market to the monetary policy. It provides insights for the policymakers who care about the monetary policy decision making process. In contrast to the US, the Bank of England has more obligations for the inflation stability since the inflation target required to be met by monetary policy is set by the Chancellor of the Exchequer. Policymakers could compare its policy effect before and after the independence of the Bank or with the monetary policy effect of other countries and reconsider whether the decision-making process is suitable for the UK.

6.4 Future Research

Given the two-way causation of monetary policy, inflation and stock returns, this thesis focuses on investigating the response of stock market to monetary policy and inflation. Thus it might be interpreted with cautions. Given the potential limitation, there are some issues that could be addressed in further research on the interaction between monetary policy, inflation and stock returns.

Firstly, the interaction could be modeled as a two-way system to further understand the relationship. As literature indicated, monetary policy, inflation and stock returns might affect each other, generally investigating the interaction between monetary policy, inflation and stock returns can provide a more complete picture of the channels through which monetary policy, inflation and stock markets interact.

Secondly, future research could provide the interpretations for the announcement effect of monetary policy found in this thesis. This thesis has empirically examined the announcement effect of monetary policy without further investigation on by which path that monetary policy affects the stock returns: expected dividends, the discount rate or the equity premium.

Thirdly, future research could focus on the nominal contracting hypothesis in other countries. This thesis has empirically examined the relationship between inflation and stock returns at all horizons and provided support for the nominal contracting hypothesis, which suggests that nominal contracting hypothesis is likely to be an explanation for the empirical mixture of results found for the relationship between inflation and stock returns. Only a limited number of studies have examined the nominal contracting hypothesis and the non-US evidence is, as far as I know, first presented in this thesis. More evidence from non-US markets, where the regulatory provisions and governance are different, is sorely needed.

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